GOVERNMENT OF KARNATAKA

DEPARTMENT OF SCHOOL EDUCATION AND LITERACY

Learning outcomes Based Assessment (LBA) Question Bank

2026-27

MATHEMATICS

10

TENTH STANDARD

ENGLISH MEDIUM

DEPARTMENT OF STATE EDUCATIONAL RESEARCH AND TRAINING
BANASHANKARI 3rd STAGE, BENAGALURU-560085
AND
DISTRICT INSTITUTE OF EDUCATION AND TRAINING
CHITRADURGA

ಪರಿಕಲ್ಪನೆ ಮತ್ತು ಮಾರ್ಗದರ್ಶನ / Concept and Guidance

ಶ್ರೀಮತಿ ರಶ್ಮಿ ಮಹೇಶ್.ವಿ, ಭಾ.ಆ.ಸೇ
ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು,
ಶಾಲಾ ಶಿಕ್ಷಣ ಮತ್ತು ಸಾಕ್ಷರತಾ ಇಲಾಖೆ

ಶ್ರೀಮತಿ. ಡಾ. ಕೆ. ವಿದ್ಯಾಕುಮಾರಿ, ಭಾ.ಆ.ಸೇ ರಾಜ್ಯ ಯೋಜನಾ ನಿರ್ದೇಶಕರು, ಸಮಗ್ರ ಶಿಕ್ಷಣ ಇಲಾಖೆ, ಬೆಂಗಳೂರು	**ಶ್ರೀಮತಿ ಅನಿತಾ ನಾಜರೆ** ನಿರ್ದೇಶಕರು, DSERT, ಬೆಂಗಳೂರು

ಡಯಟ್ ಸಹಕಾರ / DIET CO-OPERATION

ಶ್ರೀ ನಾಗಭೂಷಣ ಎಸ್ **ಪ್ರಾಂಶುಪಾಲರು** ಡಯಟ್, ಚಿತ್ರದುರ್ಗ	**ಶ್ರೀಮತಿ ಮಂಜುಳ ಬಿ** **ನೋಡಲ್ ಅಧಿಕಾರಿ** ಡಯಟ್, ಚಿತ್ರದುರ್ಗ

ಸಂಯೋಜನೆ / CO-ORDINATION

ಶ್ರೀಮತಿ ರಾಧಾ **P**
ಹಿರಿಯ ಸಹಾಯಕ ನಿರ್ದೇಶಕರು,
DSERT, ಬೆಂಗಳೂರು

ರಚನಾ ಸಂಪನ್ಮೂಲ ತಂಡ	ಪರಿಷ್ಕರಣಾ ಸಂಪನ್ಮೂಲ ತಂಡ
1. **ಶ್ರೀ ರಂಗನಾಥ್ ಜಿ.** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಎನ್ ದೇವರಹಳ್ಳಿ, ಚಳ್ಳಕೆರೆ ತಾ. 2. **ಶ್ರೀಮತಿ ಅರುಣ ಬಿ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಚವಳಿಹಳ್ಳಿ ಗೊಲ್ಲರಹಟ್ಟಿ, ಚಿತ್ರದುರ್ಗ ತಾ. 3. **ಶ್ರೀ ಪ್ರಕಾಶ್ ಎಲ್** ಸ.ಶಿ ಸ.ಪ.ಪೂ.ಕಾಲೇಜು (ಪ್ರೌ.ಶಾ.ವಿಭಾಗ) ವಿ.ವಿ.ಪುರ ಹಿರಿಯೂರು ತಾ. 4. **ಶ್ರೀ ವಾದಿರಾಜ ಪಿ.ವಿ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಕೋಟೆ, ಚಿತ್ರದುರ್ಗ 5. **ಶ್ರೀ ಮಂಜುನಾಥ್ ಜಿ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ, ಆಲೂರು, ಹಿರಿಯೂರು ತಾ. 6. **ಶ್ರೀಮತಿ ಸಲ್ಮಾತಬಸ್ಸುಂ** ಸ.ಶಿ ಕೆ.ಪಿ.ಎಸ್ ಅನ್ನೇಹಾಳ್ ಜಂಪಯ್ಯನಹಟ್ಟಿ, ಚಿತ್ರದುರ್ಗ ತಾ. 7. **ಶ್ರೀ ವೀರಭದ್ರಪ್ಪ ಜಿ.ಎಂ** ಸ.ಶಿ ಆದರ್ಶ ವಿದ್ಯಾಲಯ ಚಳ್ಳಕೆರೆ 8. **ಶ್ರೀ ರಮೇಶ್ ಎಂ.ಎಸ್** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ನಾಗತಿಹಳ್ಳಿ ಹೊಸದುರ್ಗ ತಾ. 9. **ಶ್ರೀ ತಿಮ್ಮೇಶ್ ವಿ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ವಸಂತ ನಗರ, ಹಿರಿಯೂರು ತಾ. 10. **ಶ್ರೀ ಜಹೀರ್ ಅಹ್ಮದ್** ಸ.ಶಿ ಸ.ಪ.ಪೂ.ಕಾಲೇಜು (ಪ್ರೌ.ಶಾ.ವಿಭಾಗ) ಚಿತ್ರುದುರ್ಗ 11. **ಶ್ರೀಮತಿ ತಾರಾಕುಮಾರಿ ಕೆ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಸಿದ್ದೇಶ್ವರನದುರ್ಗ ಚಳ್ಳಕೆರೆ ತಾ. 12. **ಶ್ರೀ ಬಸವಂತಕುಮಾರ್ ಎಂ.ಟಿ** ಪ್ರಾಂಶುಪಾಲರು, ಅನುಪಮಾ ವಿದ್ಯಾಸಂಸ್ಥೆ, ಚಿತ್ರದುರ್ಗ 13. **ಶ್ರೀ ಲೋಕೇಶ್** ಸ.ಶಿ ವಿಶ್ವಮಾನವ ಪ್ರೌ.ಶಾಲೆ ಸೀಬಾರ, ಚಿತ್ರದುರ್ಗ ತಾ. 14. **ಶ್ರೀಮತಿ ರಶ್ಮಿ ಹೆಚ್.ಕೆ** ಸ.ಶಿ ಚಿಂತಾಮಣೇಶ್ವರ ಪ್ರೌ.ಶಾಲೆ, ಹಿರೇಹಳ್ಳಿ, ಚಳ್ಳಕೆರೆ ತಾ.	1. **ಶ್ರೀ ರಂಗನಾಥ್ ಜಿ.** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಎನ್ ದೇವರಹಳ್ಳಿ, ಚಳ್ಳಕೆರೆ ತಾ. 2. **ಶ್ರೀ ವಾದಿರಾಜ ಪಿ.ವಿ** ಸ.ಶಿ ಸ.ಪ್ರೌ.ಶಾಲೆ ಕೋಟೆ, ಚಿತ್ರದುರ್ಗ ತಾ 3. **ಶ್ರೀ ಬಸವಂತಕುಮಾರ್ ಎಂ.ಟಿ** ಪ್ರಾಂಶುಪಾಲರು, ಅನುಪಮಾ ವಿದ್ಯಾಸಂಸ್ಥೆ, ಚಿತ್ರದುರ್ಗ

ಮಾರ್ಗದರ್ಶಕರು / MENTORS	ಪರಿಶೀಲಕರು/ REVIEWERS
ಶ್ರೀ ಹರಿಪ್ರಸಾದ್ ಜಿ.ವಿ. ಉಪನಿರ್ದೇಶಕರು , DSERT, ಬೆಂಗಳೂರು **ಶ್ರೀ ರಾಘವೇಂದ್ರ ಟಿ.ಕೆ.** ನಿವೃತ್ತ ಹಿರಿಯ ಉಪನ್ಯಾಸಕರು ಡಯಟ್ , ಕೋಲಾರ	**ಶ್ರೀಮತಿ ಶಾರದ ಹೆಚ್.ಎಸ್** ಸಹ ಶಿಕ್ಷಕರು, ಸರ್ಕಾರಿ ಪ್ರೌಢಶಾಲೆ, ಎಂ.ಸಿ ತಳಲು, ಹೆಗ್ಗಡದೇವನಕೋಟೆ ತಾ||, ಮೈಸೂರು **ಶ್ರೀ ಅನಿಲ್ ಕುಮಾರ್ ಸಿ.ಎನ್** ಸಹ ಶಿಕ್ಷಕರು ಸರ್ಕಾರಿ ಪ್ರೌಢಶಾಲೆ, ಅರಳಾಳುಸಂದ್ರ, ರಾಮನಗರ ತಾ|| ಬೆಂಗಳೂರು ದಕ್ಷಿಣ **ಶ್ರೀ ಗುರುರಾಜ್ ಹೊಸೂರಕರ್** ಸ.ಶಿ., KPS, ಹೆಗ್ಗನಹಳ್ಳಿ, ಬೆಂಗಳೂರು ಉತ್ತ ರ ವಲಯ-1

ಮುನ್ನುಡಿ

ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ತರಗತಿ ನಿರ್ದಿಷ್ಟ ಕಲಿಕಾಫಲ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಉಂಟುಮಾಡಲು ಹಾಗೂ ರಾಷ್ಟ್ರ, ಮತ್ತು ರಾಜ್ಯ ಮಟ್ಟದ ಸಾಧನಾ ಸಮೀಕ್ಷೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಕಲಿಕಾ ಸಾಧನೆಯನ್ನು ಉತ್ತಮಪಡಿಸುವ ಮೂಲಕ ಶಾಲಾ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಯನ್ನು ಬಲಪಡಿಸಲು ಹಾಗೂ ಕಲಿಕಾಫಲ ಆಧಾರಿತ ತರಗತಿ ಪ್ರಕ್ರಿಯೆಗಳನ್ನು ಪರಿಣಾಮಕಾರಿಗೊಳಿಸಲು ರಾಜ್ಯಮಟ್ಟದಲ್ಲಿ ಹಲವಾರು ಉಪಕ್ರಮಗಳನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ತರಗತಿ ಪ್ರಕ್ರಿಯೆ, ಮೌಲ್ಯಾಂಕನ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ಪ್ರಕ್ರಿಯೆಗಳನ್ನು ಸಾಮರ್ಥ್ಯಾಧಾರಿತ, ಕಲಿಕಾ ಫಲ ಆಧಾರಿತವಾಗಿ ನಿರ್ವಹಿಸಲು ಹಾಗೂ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ನಿರೀಕ್ಷಿತ ಕಲಿಕಾ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಬೆಳೆಸಲು ರಾಜ್ಯ ಶೈಕ್ಷಣಿಕ ಸಂಶೋಧನೆ ಮತ್ತು ತರಬೇತಿ ಇಲಾಖೆ (DSERT) ಯಿಂದ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳಲಾಗುತ್ತಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ 2026–27ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿಗೆ ಒಂದನೇ ತರಗತಿಯಿಂದ ಹತ್ತನೇ ತರಗತಿಯವರೆಗೆ 'ಗಣಿತ' ವಿಷಯದಲ್ಲಿ ಕಲಿಕಾಫಲ ಆಧಾರಿತ ಮೌಲ್ಯಾಂಕನ ಪ್ರಶ್ನಕೋಠಿಯನ್ನು (LBA) ರೂಪಿಸಲಾಗಿದೆ.

ಪ್ರತಿ ತರಗತಿಗೆ ಸಂಬಂಧಿಸಿದ ಕಲಿಕಾ ವಿಷಯಗಳಲ್ಲಿ, ಕಲಿಕಾ ಸಾಮರ್ಥ್ಯಗಳು ಹಾಗೂ ಕಲಿಕಾ ಫಲಗಳ ಆಧಾರದಲ್ಲಿ ಪ್ರಶ್ನೆಗಳನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಗಣಿತ ವಿಷಯದಲ್ಲಿ ಪರಿಕಲ್ಪನಾತ್ಮಕ ಜ್ಞಾನ, ತಿಳಿವಳಿಕೆ, ಕೌಶಲ, ಅನ್ವಯ, ಸಮಸ್ಯಾ ಪರಿಹಾರ ಕೌಶಲಗಳು, ಗಣಿತೀಯ ಅನ್ವಯನ, ಸೃಜನೆ ಹಾಗೂ ಉನ್ನತ ಮಟ್ಟದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಕಲಿಕೆಯನ್ನು ಮೌಲ್ಯಾಂಕನ ಮಾಡುವ ಉದ್ದೇಶದಿಂದ ವಸ್ತುನಿಷ್ಠ, ಸಂಕ್ಷಿಪ್ತ, ವಿವರಣಾತ್ಮಕ, ಅನ್ವಯಿಕ, ಕೌಶಲಾಧಾರಿತದಂತಹ ವಿವಿಧ ಸ್ವರೂಪದ ಪ್ರಶ್ನೆಗಳನ್ನು ರಚಿಸಲಾಗಿದೆ. ಇವು ಕಲಿಕಾರ್ಥಿಗಳಲ್ಲಿ ಉನ್ನತ ಮಟ್ಟದ ಚಿಂತನಾ ಕೌಶಲಗಳನ್ನು ಮೂಡಿಸಲು ಉಪಯುಕ್ತವಾಗಿವೆ.

ಕಲಿಕಾ ಫಲ / ಸಾಮರ್ಥ್ಯ ಆಧಾರಿತ ಮೌಲ್ಯಾಂಕನವು ಕೇವಲ ವಿದ್ಯಾರ್ಥಿಗಳ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯನ್ನು ಅಳೆಯುವ ಸಾಧನವಲ್ಲ; ಬದಲಾಗಿ ಕಲಿಕೆಯ ಗುಣಮಟ್ಟವನ್ನು ವೃದ್ಧಿಸುವ, ಬೋಧನಾ ಪ್ರಕ್ರಿಯೆಯನ್ನು ಪರಿಣಾಮಕಾರಿಯಾಗಿಸುವ ಹಾಗೂ ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿಯ ಕಲಿಕಾ ಪ್ರಗತಿಯನ್ನು ನಿರಂತರವಾಗಿ ಗುರುತಿಸಿ, ಅಗತ್ಯ ಶೈಕ್ಷಣಿಕ ಬೆಂಬಲ ಒದಗಿಸುವ ಪ್ರಮುಖ ಶೈಕ್ಷಣಿಕ ಸಾಧನವಾಗಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ **ಶಿಕ್ಷಕರು ಸದರಿ ಪ್ರಶ್ನೆಕೋಠಿಯನ್ನು ತರಗತಿ ಪ್ರಕ್ರಿಯೆ, ಮೌಲ್ಯಾಂಕನ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ಪ್ರಕ್ರಿಯೆಗಳಲ್ಲಿ ನಿರಂತರವಾಗಿ (CCE) ಬಳಸುವುದು ಅತ್ಯವಶ್ಯಕವಾಗಿದೆ.**

ರಾಜ್ಯದ ಎಲ್ಲಾ ಶಾಲೆಗಳಲ್ಲಿ ಗಣಿತ ಬೋಧನಾ–ಕಲಿಕಾ ಪ್ರಕ್ರಿಯೆಯನ್ನು ಮತ್ತಷ್ಟು ಉತ್ತಮಗೊಳಿಸುವಲ್ಲಿ ಹಾಗೂ ವಿದ್ಯಾರ್ಥಿಗಳ ಕಲಿಕಾಫಲ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಉನ್ನತೀಕರಿಸುವಲ್ಲಿ ಈ **ಕಲಿಕಾಫಲ ಆಧಾರಿತ** ಮೌಲ್ಯಾಂಕನ ಪ್ರಶ್ನೆಕೋಠಿಯು ಉಪಯುಕ್ತವಾಗಲಿದೆ. ಸದರಿ ಕಾರ್ಯದಲ್ಲಿ ಭಾಗವಹಿಸಿದ ವಿಷಯ ಪರಿಣಿತರು, ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಗಳು, ಶಿಕ್ಷಣ ತಜ್ಞರಿಗೆ ಇಲಾಖೆಯು ಕೃತಜ್ಞತೆಗಳನ್ನು ಸಲ್ಲಿಸುತ್ತದೆ.

ನಿರ್ದೇಶಕರು
ಡಿ.ಎಸ್.ಇ.ಆರ್.ಟಿ, ಬೆಂಗಳೂರು

ಕಲಿಕಾ ಫಲ ಆಧಾರಿತ ಪ್ರಶ್ನೆಕೋಠಿಯನ್ನು ಬಳಸಲು ಶಿಕ್ಷಕರು ಅನುಸರಿಸಬೇಕಾದ ಸೂಚನೆಗಳು

- ಇದು ಕಲಿಕಾ ಫಲ ಆಧಾರಿತ ಪ್ರಶ್ನೆಕೋಠಿಯಾಗಿದ್ದು, ಪ್ರತಿ LO ಗಳಿಗೆ ಸಾಧ್ಯವಿರುವ ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳನ್ನು ಸಿದ್ಧಪಡಿಸಿ ಇದರಲ್ಲಿ ನೀಡಲಾಗಿದೆ.
- ಇದನ್ನು ಶಿಕ್ಷಕರು ತಮ್ಮ ದೈನಂದಿನ ಕಲಿಕಾ ಬೋಧನಾ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಸೂಚಿಸಲಾಗಿದೆ
- ಈ ಪ್ರಶ್ನೆ ಕೋಠಿಯು ಬಹುಆಯ್ಕೆ, ಒಂದು ಅಂಕ, ಎರಡು ಅಂಕ, ಮೂರು ಅಂಕ, ನಾಲ್ಕು ಅಂಕ ಮತ್ತು ಐದು ಅಂಕದ ಪ್ರಶ್ನೆಗಳನ್ನು ಒಳಗೊಡಿದ್ದು, ಪ್ರತಿ LO ಗಳಿಗೆ ಅನ್ವಯಿಸುವಂತೆ ಸಿದ್ಧಪಡಿಸಿದ್ದು, ಅವುಗಳನ್ನು ಅಧ್ಯಾಯವಾರು ನೀಡಲಾಗಿದೆ.
- ಸದರಿ ಪ್ರಶ್ನೆಕೋಠಿಯು LO ಆಧಾರಿತ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಪ್ರತಿ ಪ್ರಶ್ನೆಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಸೂಕ್ತವಾದ ಉತ್ತರವನ್ನು ಸಹ ನೀಡಲಾಗಿದೆ. ಇಲ್ಲಿ ನೀಡಲಾದ ಉತ್ತರವನ್ನು ಹೊರತು ಪಡಿಸಿ ಬೇರೆ ವಿಧಾನದಿಂದಲೂ ಬಿಡಿಸಲು ಸಾಧ್ಯವಿದ್ದರೆ, ಅದನ್ನು ತರಗತಿಯ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಚರ್ಚಿಸಲು ಅವಕಾಶವಿದೆ.
- ಇದನ್ನು ತರಗತಿಯ ಕಲಿಕಾ ಬೋಧನಾ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ನಿರಂತರವಾಗಿ ಮತ್ತು ಸಮಗ್ರವಾಗಿ ಪ್ರತಿ ಮೌಲ್ಯಮಾಪನದ ಸಂದರ್ಭದಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಸೂಚಿಸಲಾಗಿದೆ.
- ಸದರಿ ಸಾಮಗ್ರಿಯನ್ನು ಶಿಕ್ಷಕರು ಒಂದು ಸಂಪನ್ಮೂಲವಾಗಿ ಬಳಸಿಕೊಳ್ಳಲು ಸೂಚಿಸಿದ್ದು, ಇದನ್ನು ಪ್ರತಿ ಮಗುವಿಗೆ ಝರಾಕ್ಸ್ ಮಾಡಿ ನೀಡಲೇ ಬೇಕೆಂದು ತಿಳಿಸಿರುವುದಿಲ್ಲಾ. ಮಕ್ಕಳಿಗೆ LO ಆಧಾರಿತ ಕಲಿಕೆಯು ಖಾತರಿ ಪಡಿಸಿಕೊಳ್ಳಲು ನಡೆಸುವ ನಿರಂತರ ಮತ್ತು ಸಮಗ್ರ ಮೌಲ್ಯಮಾಪನ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಸೂಚಿಸಿದೆ.
- ಇಲಾಖೆಯು ಹಮ್ಮಿಕೊಳ್ಳುವ ಎಲ್ಲಾ ತರಗತಿವಾರು ಮೌಲ್ಯಮಾಪನ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಸದರಿ ಪ್ರಶ್ನೆಕೋಠಿಯಲ್ಲಿ ನೀಡಲಾದ LO ಗಳನ್ನು ಆಧಾರವಾಗಿ ಯೋಜನೆಯನ್ನು ಸಿದ್ಧಪಡಿಸಿ ನಡೆಸಲಾಗುವುದು.

LEARNING OUTCOMES

Subject: Mathematics ***Class: 10***

Curricular Goals ..	*Competencies*	*Learning Outcomes*	*Name of the Chapter*
CG-1- Understands numbers (natural, whole, integer, rational, irrational, and real), ways of representing numbers, relationships amongst numbers, and number sets.	***C-1.1*** *Develops understanding of numbers, including the set of real numbers and its properties.*	1. *Generalize the properties of numbers and relationships studied earlier to develop results such as the Fundamental Theorem of Arithmetic and express the given composite numbers as the product of prime numbers.* 2. *Find HCF, LCM of given numbers and verify the relationship between the product of numbers and the product of their HCF and LCM and apply HCF and LCM to solve problem in real life situations.* 3. *Prove the given irrational numbers as irrational using method of contradiction*	***01. Real Numbers***
CG-2- Builds deductive and inductive logic to prove theorems related to numbers and their relationships (such as 'v2 is an irrational number', recursion relation for Virahanka **numbers, formula for the sum of the first** N **square numbers).**	***C-2.1*** *Extends the understanding of powers (radical powers) and exponents.*		
	C-3.1 *States and motivates/proves the Remainder Theorem, Factor Theorem, and*		

CG-3- Discovers and proves algebraic identities and models real-life situations in the form of equations to solve them.	*Division Algorithm.*		
	C-3.2 *Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables or polynomial equations) and draws conclusions about the situation being modeled.*	*4. Identify the types and degree of polynomials and express them in the standard form; Identify the relationship between degree and zeroes of a polynomial.* *5. Develop the relationship between algebraic and graphical methods for finding the zeroes of a polynomial.* 6. *Find the relationship between the zeroes of the polynomial and the coefficients and form a quadratic polynomial when zeroes/sum/product of zeroes are given*	***02. Polynomials***
		7. Find the solutions of pairs of linear equations in two variables using graphical and different algebraic methods. *8. Find the solutions, graphs of the pair of linear equations by finding the ratio of the coefficients and also infer whether the pair of linear equations in two variables is consistent, inconsistent or dependent.* 9. *Express the given situations as a pair of linear equations and solve various daily life problems of simultaneous linear equations*	***03. Pairs of Linear Equations in Two Variables***

	C-3.3 *Learns Brahmagupta's quadratic formula (in symbolic and poetic forms), its derivation, and applies it to solve Bhaskara's poetic puzzles and modern-day problems.*	*10. Write the standard form of quadratic equation and express the given quadratic equation in the standard form.* *11. Verify whether the given equations are quadratic or not and translate the given statements into quadratic equation.* *12. Demonstrate techniques for finding the roots of a quadratic equation and determine the nature of its roots by finding the discriminant.* 13. *Verify whether the given daily life situations exist and if exist, find the solutions using quadratic equations.*	***04. Quadratic Equations***
CG-4-Analyses characteristics and properties of two-dimensional geometric shapes and develops mathematical arguments to explain geometric relationships	***C-4.1*** *Describes relationships, including congruence of two-dimensional geometric shapes (lines, angles, triangles), to make and test conjectures and solve problems.*	14. *Develop methods to distinguish between congruent figures and similar figures.*	***06. Triangles***
	C-4.2 *Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals and applies them to solve geometric problems.*	*15. Establish the properties of similarity of two triangles using logical reasoning. State and Prove Basic Proportionality Theorem. Prove the*	***07. Triangles***

		theorems related to SSS, AAA, SAS criteria of similar triangles 16. *Solve various geometric problems on similar triangles using basic proportionality theorem, SSS, AAA, SAS, criteria of similar triangles.*	
	C-4.3 *Proves theorems related to circle geometry, including chords, subtended angles, inscribed polygons, and area in terms of π.*	*17. Define tangents and secants and identify them.* *18. Logically prove that the length of tangents drawn from and external point to a circle are equal and apply theorem to solve various problems* 19. *Prove that the radius of a circle is perpendicular to the tangent at the point of contact logically and apply theorem to solve various problems*	***10. Circles***
	C-4.4 *Understands the irrationality of π, historical approximations of π, and Madhava's infinite series formula for π.*		
	C-4.5 *Specifies locations and describes spatial relationships using coordinate geometry, including graphical solutions of equations and area calculations using coordinates.*	*20. Locate coordinates on cartesian plane. Derive formulas to establish relationships related to geometric figures in the coordinate plane, such as distance formula, section formula and midpoint formula.* 21. *Apply distance formula, section formula, midpoint formula to solve various problems.*	***08. Coordinate Geometry***

	C-4.6 *Understands the definitions, history, motivation, and applications of trigonometric functions, including Aryabhata's introduction of sine and cosine functions.*	*22. Determine all trigonometric ratios for a given acute angle in a right-angled triangle and identify the relation between them. Find the value of standard angles for these ratios.* *23. Prove trigonometric identities and use them to prove various trigonometric equations.* 24. *Apply trigonometric ratios and angles to solve problems involving heights and distances in daily-life situations.*	***09. Introduction to Trigonometry*** ***Applications of Trigonometry***
CG-5-Derives and uses formulae to calculate areas of plane figures, and surface areas and volumes of solid objects	***C-5.1*** *Visualizes, represents, and calculates the area of a triangle using Heron's Formula and its extension to cyclic quadrilaterals using Brahmagupta's Formula.*		
	C-5.2 *Visualizes and derives formulae for calculating surface areas and volumes of solid objects such as cubes, cuboids, spheres, hemispheres, cylinders, cones, and their combinations.*	*25. Find the surface area and volume of objects in the surroundings by considering them as combinations of solids such as cylinders, cones, spheres, hemispheres and other composite solids.* 26. *Calculate areas of segments, sectors, and find the length of the arc of a circle in given situations. Solve various problems by applying the formula.*	***11. Surface Areas and Volumes*** ***10. Areas Related to Circles***

CG-6-Analyses and interprets data using statistical concepts (such as measures of central tendency, standard deviations) and probability	***C-6.1*** *Applies measures of central tendency such as mean, median, and mode.*	27. *Calculate mean, median, and mode for different datasets arising from real-life situations.*	***12. Statistics***
	C-6.2 *Applies concepts of probability to solve problems involving the likelihood of everyday events.*	28. *Determine that the probability of an event is always between 0 and 1. Differentiate between Sure event and impossible event.* 29. *Write the sample space for a random event and apply the concept of probability to solve problems encountered in daily life.*	***13. Probability***
CG-7-Begins to perceive and appreciate the axiomatic and deductive structure of Mathematics.	***C-7.1*** *Proves mathematical statements and performs geometric constructions using assumptions, axioms, postulates, definitions, and mathematical vocabulary.*		
	C-7.2 *Visualizes and appreciates geometric proofs for algebraic identities and other "proofs without words."*		
	C-7.3 *Proves theorems using Euclid's axioms and postulates for angles, triangles, quadrilaterals, circles, and area-related theorems involving triangles and parallelograms.*		
	C-7.4 *Constructs geometrical figures such as line segment bisectors, angle bisectors, triangles, and polygons satisfying given constraints.*		
	C-8.1 *Models daily-life phenomena and uses*		

CG-8-Builds skills such as visualisation, optimisation, representation, and mathematical modelling along with their application in daily life.	*graphs, tables, and equations to draw conclusions.*		
	C-8.2 *Uses two-dimensional representations of three-dimensional objects to visualize and solve problems involving surface area and volume.*		
	C-8.3 *Employs optimization strategies to maximize desired quantities (e.g., area, volume, or output) under given constraints.*		
CG-9- Develops computational thinking, i.e., deals with complex problems and is able to break them down into a series of simple problems that can then be solved by suitable procedures/algorithms	***C-9.1*** *Decomposes a problem into smaller sub-problems.*		
	C-9.2 *Describes and analyzes a sequence of instructions being followed.*	30. *Identify patterns in numbers. Develop strategies to derive formula in arithmetic progression and apply the concept of Arithmetic Progression (A.P.) to daily-life situations to solve related problems.*	***05. Arithmetic Progression***
	C-9.3 *Analyzes similarities and differences among problems to develop solutions applicable to multiple situations.*		
	C-9.4 *Engages in algorithmic problem-solving to design effective solutions.*		
CG-10- Knows and appreciates important contributions of	***C-10.1*** *Recognizes the important contributions of Indian and other mathematicians to the development of Mathematics, including*		

mathematicians from India and around the world	*numbers, geometry, and algebra.*		
	C-10.2 *Recognizes modern contributions to Mathematics in India and abroad and understands emerging frontiers and major open questions in the field.*		
CG-11- Explores connections of Mathematics with other subjects	***C-11.1*** *Applies mathematical knowledge and tools to analyze problems and situations across Science, Social Science, Visual Arts, Music, Vocational Education, and Sports.*		*Applies to all lessons*

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UNIT1:REAL NUMBERS

LO's number	LO	Question number
1	Generalize the properties of numbers and relationships studied earlier to develop results such as the Fundamental Theorem of Arithmetic and express the given composite numbers as the product of prime numbers.	1,2,3,4,5,6,7,8,9,10,11,12, 29,30,31,32,33,3436,37 39,41
2	Find HCF, LCM of given numbers and verify the relationship between the product of numbers and the product of their HCF and LCM and apply HCF and LCM to solve problem in real life situations.	13,14,15,16,17,18,19,20,21,22,23,24 ,25,26,27,28,35,38,40,42,60,61,62,63, 64,65,66,67,68,69,70,71,72,73,74,75, 76,77,79,80,84,85,86,87,88,88,90
3	Prove the given irrational numbers as irrational using method of contradiction	43,44,45,46,47,48,49,50,51,52,53,54, 55,56,57,58,81,82,83

Number of questions	**Easy**	**Average**	**Difficult**
90	**29**	**54**	**4**

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. $\sqrt{2}$ is a/an (Easy)
   (A) Rational number (B) Irrational number
   (C) Integer (D) Natural number
2. $5 - \sqrt{3}$is a/an (Easy)
   (A) Irrational number (B) Rational number
   (C) Composite number (D) Prime number
3. Rational number in the following is, (Easy)
   (A) 5 (B) π (C) $\sqrt{3}$ (D) $3\sqrt{3}$
4. Which of the following is not an irrational number? (Easy)
   (A) $\sqrt{2}$ (B) $\sqrt{3}$ (C) $\sqrt{9}$ (D) $\sqrt{5}$
5. Rational number in the following is, (MQP-2025:Easy)
   (A) $\sqrt{3}$ (B) $\sqrt{4}$ (C) $\sqrt{5}$ (D) $\sqrt{7}$
6. πis a/an (Easy)
   (A) Irrational number (B) Rational number
   (C) Prime number (D) Composite number

7. 7×11×13 + 13 is a/an (Aug - 2024 : Easy)
   (A)Prime number (B) composite number
   (C) Irrational number (D) odd number
8. Prime factorization of 91 is, (SLP-2024 : Easy)
   (A) 2×13×7 (B) 13×7 (C) 91×1 (D) 13×7×1
9. The number of primes between 1 and 10 is, (Easy)
   (A) 2 (B) 3 (C) 4 (D) 12

10. Any composite number can be expressed as the product of (Average)
    (A) even numbers (B) odd numbers
    (C) prime numbers (D) square numbers

11. The prime factorization of 120 is, (MQP-2019 : Easy)
    (A) $2^3 \times 3^2 \times 5^1$ (B) $2^2 \times 3^1 \times 5^1$
    (C) $2^3 \times 3^1 \times 5^2$ (D) $2^3 \times 3^1 \times 5^1$
12. The prime factors of 30 is, (Easy)
    (A) 2, 3, 5 (B) 5, 3 (C) 15, 2 (D) 6, 5
13. The L.C.M of 2 and 3 (Easy)
    (A) 2 (B) 3 (C) 5 (D) 6
14. The H.C.F of 3 and 5 is, (SLP-2023 :Easy)
    (A) 1 (B) 3 (C) 5 (D) 15
15. The H.C.F of any two consecutive natural numbers is, (Easy)
    (A) 0 (B) 1 (C) 2 (D) 3
16. The H.C.F of any two prime numbers is, (June-2023 : Easy)
    (A) 0 (B) 2 (C) 1 (D) -1
17. If 'a' and 'b' are co-primes, then their L.C.M is, (Easy)
    (A) 0 (B) a x b (C) 1 (D) a + b

18. The H.C.F of the smallest composite number and the smallest prime number is,
    (September-2020: Average)
    (A) 4 (B) 2 (C) 1 (D) 8
19. For any two positive integers, 'a' and 'b', H.C.F (a, b) × L.C.M (a, b) is equal to
    (April-2019 :Easy)
    (A) (a + b) (B) (a – b) (C) (a × b) (D) (a ÷ b)
20. The H.C.F of (12, 15) is 3. The L.C.M of (12, 15) is, (Average)
    (A) 60 (B) 45 (C) 36 (D) 90
21. The H.C.F of $5^2 \times 2$ and $2^5 \times 5$ is, (MQP-1,2024 : Easy)
    (A) 2×5 (B) $2^5 \times 5$ (C) $5^2 \times 2^6$ (D) $2^5 \times 5^2$

22. Two positive integers a and b are expressed as, a = x^3y^2 and b = x y^3 If x and y are prime numbers, then the H.C.F of (a, b) is, (Average)
    (A) xy (B) x y^2 (C) x^3y^3 (D) x^2y^2
23. The L.C.M of a and 18 is 36 and H.C.F of a and 18 is 2. The value of a is, (Average)
    (A) 2 (B) 3 (C) 4 (D) 1
24. If p and q are co-primes, then the H.C.F of p^2 and q^2 is, (Easy)
    (A) pq (B) 1 (C) p + q (D) p^2q^2
25. If 180 = $2^x \times 3^2 \times 5$ then the value of x is, (SLP-2020 : Difficult)
    (A) 1 (B) 2 (C) 3 (D) 4

26. The product of H.C.F and L.C.M of the numbers15 and 20 is,
    (April-2024 : Average)
    (A) 15 (B) 20 (C) 300 (D) 35
27. 'a' is an odd number and 'b' is a number divisible by 3. If the L.C.M of 'a' and 'b' is 'p' then the L.C.M of 3a and 2b is, (Difficult)
    (A) p^2 (B) 5p (C) 6p (D) 3p
28. The H.C.F and L.C.M of two numbers a and b are 5 and 200, then the product of a and b is,
    (Average)
    (A) 205 (B) 1000 (C) 200 (D) 195

II. Answer the following questions. (1 Mark)

29. Express 140 as the product of prime numbers. (Easy)

30. State the fundamental theorem of arithmetic. (MQP 2024:Easy)

31. If the H.C.F of the numbers 24 and 36 is 12, then find their L.C.M (Easy)

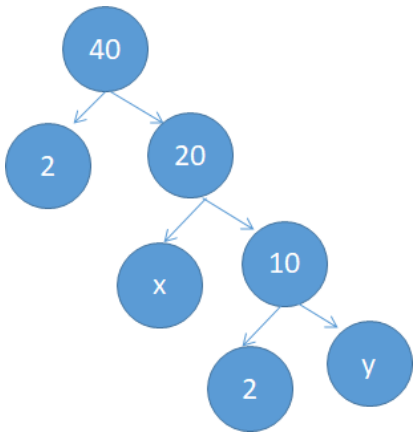
32. Express 96 as its product of prime factors. (June-2019 : Easy)

33. Express 156 as its product of prime factors. (Easy)

34. If 200 = $2^m \times 5^n$, then find the value of m and n. (April-2024 : Difficult)

35. Find the maximum length of the rod which can measure the rods of length 24m and 36m exactly. (Average)
36. Write the smallest number which has only 7 and 3 as its prime factors. (Average)

37. Observe the given factor tree and find the value of x and y. (Easy)



III. Answer the following questions. (2/3Marks)

38. If the H.C.F. of (306, 657)is 9 then find the L.C.M of (306, 657). (Easy)
39. $7 \times 11 \times 13 + 13$ is a composite number. Justify this statement. (Average)
40. If the L.C.M of (91, 26)is 182, then find the H.C.F of (91, 26) (Easy)
41. What is a composite number? Which is the composite number among 23 and 24? (MQP 2024:Easy)
42. Find the largest number that divides 438 and 606 without leaving any reminder. (MTE 2024:Average)
43. Prove that $5 + \sqrt{3}$is an irrational number. (MQP,2024March 2026 : Average)
44. Prove that $2 + \sqrt{5}$ is an irrational number. (April 2018:Average)
45. Prove that $6 + \sqrt{2}$is an irrational number. (June 2025:Average)
46. Prove that $5 - \sqrt{3}$is an irrational number. (Average)
47. Prove that $2 + \sqrt{3}$ is an irrational number. **(**Average)
48. Prove that $3 + \sqrt{2}$ is an irrational number (Average)
49. Prove that $5 + \sqrt{7}$ is an irrational number. (Average)
50. Prove that $5 + \sqrt{2}$ is an irrational number (Average)
51. Prove that $4 + \sqrt{3}$ is an irrational number (Average)
52. . Prove that $6 + \sqrt{11}$ is an irrational number (Average)
53. Prove that $8 + \sqrt{5}$ is an irrational number (Average)
54. Prove that $7 + \sqrt{5}$ is an irrational number (Average)
55. Prove that $2 + \sqrt{7}$ is an irrational number (Average)
56. Prove that $7 + \sqrt{7}$ is an irrational number (Average)
57. Prove that $2 - \sqrt{5}$ is an irrational number (Average)
58. Prove that $8 - \sqrt{3}$ is an irrational number (Average)
59. Prove that $6 - \sqrt{2}$ is an irrational number (Average)
60. If the H.C.F of (120 , 135) is 15, then find the L.C.M of (120 , 135) (Average)

61. If the H.C.F of (88 , 128) is 8, then find the L.C.M of (88 , 128) (Average)
62. If the H.C.F of (136 , 176) is 8, then find the L.C.M of (136, 176) (Average)
63. If the H.C.F of (336, 216) is 24 , then find the L.C.M of (336, 216) (Average)
64. If the L.C.M of (224 ,336) is 672, then find the H.C.F of (224 , 336) (Average)
65. If the L.C.M of (112,144) is 1008, then find the H.C.F of (112,144) (Average)
66. If the L.C.M of (96, 120) is 480, then find the H.C.F of (96, 120) (Average)
67. Find the H.C.F and L.C.M of the numbers 68 and 72 by the method of prime factorization and verify that L.C.M X H.C. F = The product of numbers (Average)
68. Find the H.C.F and L.C.M of the numbers 36 and 63 by the method of prime factorization and verify that L.C.M X H.C. F = The product of numbers (Average)
69. Find the H.C.F and L.C.M of the numbers 38 and57 by the method of prime factorization and verify that L.C.M X H.C. F = The product of numbers (Average)
70. Find the H.C.F and L.C.M of the numbers 66 and 42 by the method of prime factorization and verify that L.C.M X H.C. F = The product of numbers (Average)
71. The lengths of two rectangular tables are 84cm and 126cm respectively and both have a width equal to 42cm. Find the maximum length of a square glass sheet that can exactly fit both the tables. Also, calculate the total number of glass sheets required to fit each table. (MQP 2026 Average)
72. If the product of L.C.M and H.C.F of two numbers is 2366 and their HCF is 13, then find their LCM. If one of the numbers is 91, then find the other number. (MQP 2026 Average)
73. The floor of an auditorium is to be paved completely with square tiles. The length and breadth of the floor are 112 feet and 72 feet respectively. Find the maximum side length of the square tiles which can be used to exactly fit the area of the floor. Also calculate the total number of tiles required for the flooring of the auditorium. (SLP 2026 Average)
74. The product of HCF and LCM of 2 numbers is 2016. If one of the numbers is 42, then find the other number. Also find the HCF of those two numbers by prime factorization method. (MQP 2026 Average)
75. If the L.C.M and H.C.F of 2^m X 3^2 , 3^n X 2^2 and 3^3 X 2 are 3^4 X $2^3$and 3^y X 2^x respectively then, find the values of m , n , x and y (MAY 2026 Average)
76. Two students A and B are preparing rose garlands by using 24 roses and 60 roses respectively for each garland. After making a few garlands the number of flowers used by them are equal. Find the least number of roses equally used by them to make the garlands and find how many such garlands have been prepared by them. (SLP 2026 Average)
77. There is a circular path around a sports field. A takes 18 minutes to drive one round of the field, while B takes 24 minutes for the same. Suppose they both start at the same point and at the

same time, and go in the same direction, after how many minutes will they meet again at the starting point? (Average)

78. According to fundamental theorem of arithmetic, if $40 = x^y z$, then find the value of x, y and z (April 2025:Average)
79. The length and breadth of a rectangular field are 147m and 56m respectively. Calculate the maximum length of a rod that can be used to measure both length and breadth exactly. How many times this rod has to be used to measure the length of the field? (May 2025 Average)
80. A sweet seller has 420 kaju barfis and 130 badam barfis. She wants to stack them in such a way that each stack has the same number of barfis, and they take up the least area of the tray. What is the number of barfis that can be placed in each stack for this purpose? (Average)
81. Prove that $\sqrt{2}$is an irrational number. (Average)
82. Prove that $\sqrt{3}$is an irrational number. (September-2020 : Average)
83. Prove that $\sqrt{5}$is an irrational number. (June-2020 : Average)
84. Find the H.C.F and L.C.M of the numbers 510 and 92 by the method of prime factorization and verify that L.C.M × H.C.F = The product of the numbers (SLP-2024 : Average)
85. Find the H.C.F and L.C.M of the integers 336 and 54 by the method of prime factorization and verify that L.C.M × H.C.F = The product of the integers. (SLP-2024 : Average)
86. Find the H.C.F and L.C.M of 26 and 91 by the method of prime factorization and verify that L.C.M × H.C.F = The product of the numbers (Average)
87. Find the H.C.F of 135 and 75 by prime factorization method and then find the L.C.M of H.C.F(135, 75) and 20. (SLP-2020 ,Difficult)
88. Find the L.C.M and H.C.F of 12, 15 and 21 by prime factorization method. (Average)
89. Find the L.C.M and H.C.F of 6, 72 and 120 by prime factorization method. (Average)
90. An army contingent of 616 members is to march behind an army band of 32 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march? Also find the number of rows of each team. (Difficult)

UNIT 2 : POLYNOMIALS

LO's number	LO	Question number
4	Identify the types and degree of polynomials and express them in the standard form; Identify the relationship between degree and zeroes of a polynomial.	1,2,3,4,5,6,7,8,17,18,22,25,26, 27,28,29,3038,40,41,
5	Develop the relationship between algebraic and graphical methods for finding the zeroes of a polynomial.	9,10,11,1314,21,23,24,39,
6	Find the relationship between the zeroes of the polynomial and the coefficients and form a quadratic polynomial when zeroes/sum/product of zeroes are given	12,15,16,19,20,31,32,33,34, 35,36,37,42,43,44,45,46,47,48,49, 50,51,52,53,54,55,56,57,58,59,60 ,61,62,63,64,65,66,67,68,69,70,71,72, 73,74,75,76,77,

Number of questions	Easy	Average	Difficult
77	32	33	12

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. **(1 Mark)**

1. The degree of a polynomial p(x) = $x^2 - 3x + 4x^3 - 6$ is, [MQP 2018, Easy]
A) 2 B)1 C)3 D)6

2. The degree of a linear polynomial is, [MQP 2019,Easy]
A) 0 B) 1 C) 2 D) 3

3. The degree of a polynomial p(x) = $2x^3 + 3x - 11 + 6$ is, [Easy]
A) 2 B) 6 C) 3 D) 4

4. The degree of a quadratic polynomial is, [Easy]
A) 4 B) 1 C) 3 D) 2

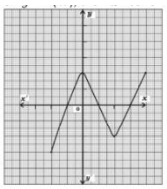
5. The degree of a cubic polynomial is, [MARCH 2020 Easy]
A) 4 B) 1 C) 3 D) 2

6. The maximum number of zeroes of a quadratic polynomial is, [SLP 2024, Easy]
A) 4 B) 1 C) 2 D) 3

7. In the quadratic polynomial f(x) = $x^2 - 9x + 20$ the value of f(0) is, [Easy]
A) 20 B)11 C)-20 D)29

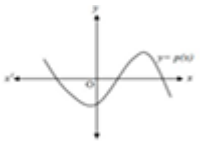
8. In the polynomial p(x) = $x^2 - 1$, the value of p(2) is, [Easy]
A) 2 B)3 C)0 D)1

9. In the figure, the number of zeroes of the polynomial y = p(x) represented in the graph is, [JUNE 2019, Easy]



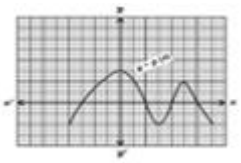
A) 4 B) 3 C) 2 D) 7

10. In the figure, the polynomialy = p(x) is represented in the graph. The number of zeroes of the polynomial is, [Easy]



A) 4 B) 2 C) 3 D) 1

11. In the figure, the number of zeroes of the polynomialy = p(x) is, [Easy]

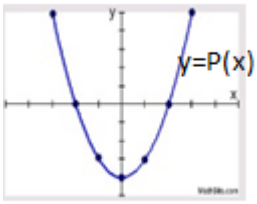


A) 3 B) 5 C) 4 D) 2

12. The quadratic polynomial whose sum and product of the zeroes are -2 and 8 is, [SLP 2019, Difficult]

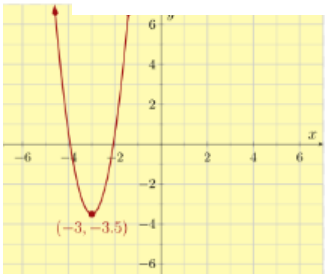
A) $x^2 + 2x + 8$ B) $x^2 - 2x - 8$ C) $x^2 + 2x - 8$ D) $x^2 - 2x + 8$

13. In the figure, the number of zeroes of the polynomialy = p(x) is, [Easy]



A) 1 B) 3 C) 2 D) 4

14. In the figure, the zeroes of the polynomialy = p(x) is, (EASY)



A) 1 and -4 B) -3 and -4 C) -2 and -4 D) -1 and -4

15. If αandβare the zeroes of the polynomial $p(x) = ax^2 + bx + c$, then the value of α x βis, [APRIL 2024, Easy]

A) $\frac{b}{a}$ B) $\frac{-b}{a}$ C) $\frac{c}{a}$ D) $\frac{-c}{a}$

16. If αandβare the zeroes of the polynomial $p(x) = ax^2 + bx + c$, then the value of α + βis, [Easy]

A) $\frac{b}{a}$ B) $\frac{-b}{a}$ C) $\frac{c}{a}$ D) $\frac{-c}{a}$

17. If one of the zeroes of the polynomial p(x) = $x^2 - x + k$is 2, then the value of k is,
[JUNE 2019, Difficult]

A) 2 B) -2 C) -6 D) 6

18. If the sum of the zeroes of the polynomial p(x) = kx^2 +2x +3k is equal to the product of its zeroes, then the value of k is, [Average]

A) $\frac{2}{3}$ B) $\frac{-2}{3}$ C) $\frac{3}{4}$ D) $\frac{-3}{4}$

19. The quadratic polynomial whose sum and product of the zeroes are 4 and 5 respectively is,
[,MQP2023,Easy]

A) p(x) = x^2 - 4x - 5 B) p(x) = x^2 + 4x - 5 C) p(x) = x^2- 5x+ 4 D) p(x) = x^2- 4x + 5

20. The sum of the zeroes of the polynomial p(x) = x^2 – 2x – 8 is, [MQP 2024, Average]

A) – 8 B) 2 C) – 2 D) 8

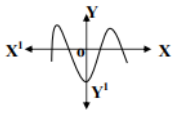
21. If the graph of a polynomial P(x) passes through the coordinate points (-3,0), (-1,-5), (0, -6) and (2,0) then the zeroes of the quadratic polynomial are, [MQP 2024: Difficult]

A) -3 and -6 B) 0 and -3 C) -1 and -5 D) -3 and 2

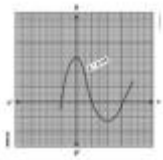
II. Answer the following questions. (1 Mark)

22. What is the maximum number of zeroes of a cubic polynomial? [Easy]

23. Find the number of zeroes of the polynomial p(x) from the given graph.
[MQP 2020, Easy]



24. Find the number of zeroes of the polynomial p(x) from the given graph.
[JUNE 2020, APRIL 2023, Easy]



25. Write the degree of the polynomial p(x) = x^3 + 2x^2 - 5x^4– 6 [APRIL 2016,Easy]
26. Write the degree of the polynomial f(x) = x^2 –3 x^3 + 2 [APRIL 2018,Easy]
27. Write the degree of the polynomial f(x) = 2x^2 – x^3 + 5 [APRIL 2019, Easy]
28. Write the degree of the polynomial p(x) = 3x^3 –4x^2 +5x^4 –3x +4 [APRIL 2023, Easy]
29. Write the degree of the polynomial p(x) = x(x^2 + 2x) + 3x - 5 [Average]
30. Write the degree of the polynomial g(p) = 7p^4 – 2p^3 + 3p^2 + p – 3 [MQP 2024, Easy]
31. Find the sum of the zeroes of the polynomial P(x) = x^2 –5x + 6 [JUNE 2023, Easy]
32. Find the product of the zeroes of the polynomial P(x) = 2x^2 – 9x + 10 [SLP 2020 , Easy]
33. Find the sum of the zeroes of the polynomial P(x) = x^2 + 7x + 10 [March 2024,Easy]

34. If the product of the zeroes of the polynomial f (x) = $2x^2 - 3x + k$ is 3, then find the value of 'k'. [Average]

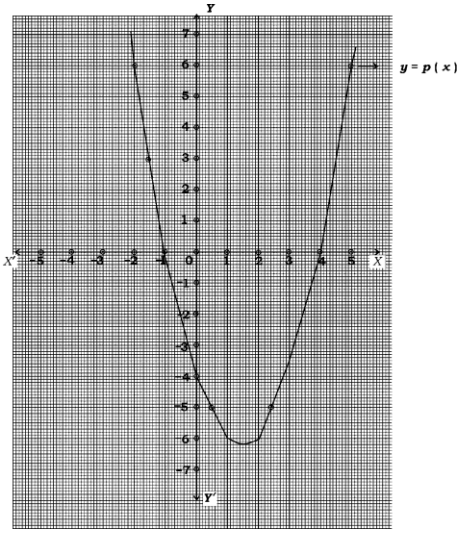
35. Write the quadratic polynomial whose sum and product of the zeroes are -3 and 2 respectively. [SLP 2019, Easy]

36. Find the zeroes of the polynomial p(x) = $x^2 - 3$ [Easy]

37. Find the zeroes of the polynomial p(x) = $x^2 - 25$ [Easy]

38. If P(x) = $2x^3 + 3x^2 - 11x + 6$, then find the value of p(1) [LO – 4, Average]

39. Write the zeroes of the polynomial y=p(x) given in the graph. [MARCH 2025, Easy]



40. Write a quadratic polynomial p(x) whose zeroes are α and β. (easy)

III. Answer the following questions. (2 Marks)

41. Write the standard form of linear polynomial and quadratic polynomial. [MQP 2020,Easy]

42. Find the zeroes of the polynomial P(x) = $6x^2 - 3 - 7x$ [MQP 2019, Average]

43. Find the zeroes of the polynomial P(x) = $4x^2 - 4x - 3$ [APRIL 2019, Average]

44. If the sum of zeroes of the polynomial p(x) = $ax^2 + bx + c$ is -3 and product of the zeroes is 2, then prove that b + c = 5a [Difficult]

45. If α and β are the two zeroes of the polynomial P(x) = $x^2 - 4x + 5$ then find the value of $\alpha^2 + \beta^2$. [Difficult)

46. If α and β are the two zeroes of the polynomial P(x) = $x^2 + 3x + 1$ then find the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ [Difficult]

47. If α and β are the two zeroes of the polynomial P(x) = $x^2 + 3x + 1$ then find the value of $\alpha^2\beta + \alpha\beta^2$ [Difficult]

48. One of the zeroes of the polynomial P(x) = $2x^2 - 6x + k$ is twice the other. Find the value of 'k' [SEPT 2020, Average]

49. The sum and product of the zeroes of the polynomial P(x) = $ax^2 + bx - 4$ are $\frac{1}{4}$ and -1 respectively. Find the value of a and b [Average]

50. Find the zeroes of the polynomial P(x) = $x^2 - 5x - 6$ [Average]

51. Find the polynomial whose zeroes are $\sqrt{3}$ and $-\sqrt{3}$ (Difficult)

IV. Answer the following questions. (3 Marks)

52. Find the zeroes of the quadratic polynomial $p(x) = x^2 - 2x - 8$ and verify the relationship between the zeroes and the coefficients. [Difficult]

53. Find the zeroes of the quadratic polynomial $p(x) = x^2 + 7x + 10$ and verify the relationship between the zeroes and the coefficients. [JUNE 2023, APRIL 2025,Difficult]

54. Find the zeroes of the quadratic polynomial $p(x) = 6x^2 - 7x - 3$ and verify the relationship between the zeroes and the coefficients. (MQP 2026,Avearge)

55. Find the zeroes of the quadratic polynomial $p(x) = x^2 + 6x + 8$ and verify the relationship between the zeroes and the coefficients. (SLP 2026 ,Average)

56. Find the zeroes of the quadratic polynomial $p(x) = x^2 + 6x + 5$ and verify the relationship between the zeroes and the coefficients. (Average)

57. Find the zeroes of the quadratic polynomial $p(x) = x^2 + 3x + 2$ and verify the relationship between the zeroes and the coefficients. (Average)

58. Find the zeroes of the quadratic polynomial $p(x) = x^2 + x - 12$ and verify the relationship between the zeroes and the coefficients. (Average)

59. Find the zeroes of the quadratic polynomial $p(x) = x^2 - 6x + 9$ and verify the relationship between the zeroes and the coefficients. (Average)

60. Find the zeroes of the quadratic polynomial $p(x) = x^2 - 2x - 15$ and verify the relationship between the zeroes and the coefficients. (Average)

61. Find the zeroes of the quadratic polynomial $p(x) = x^2 - 5x - 14$ and verify the relationship between the zeroes and the coefficients. (Average)

62. Find the zeroes of the quadratic polynomial $p(x) = x^2 - 2x + 1$ and verify the relationship between the zeroes and the coefficients. (Average)

63. Write the quadratic polynomial whose sum and product of the zeroes are -3 and 2 respectively and find the zeroes of this polynomial. [MARCH 2024,Difficult]

64. Write the quadratic polynomial whose sum and product of the zeroes are 7 and 12 respectively and find the zeroes of this polynomial. [JUNE 2024,Difficult]

65. Write the quadratic polynomial whose sum and product of the zeroes are 2 and -8 respectively and find the zeroes of this polynomial. (Avearge)

66. Write the quadratic polynomial whose sum and product of the zeroes are -4 and 4 respectively and find the zeroes of this polynomial. (Average)

67. Write the quadratic polynomial whose sum and product of the zeroes are 6 and 8 respectively and find the zeroes of this polynomial. (Average)

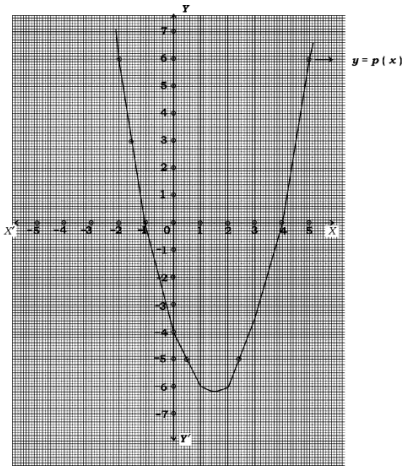
68. Write the quadratic polynomial whose sum and product of the zeroes are 3 and -10 respectively and find the zeroes of this polynomial. (Avearge)

69. Write the quadratic polynomial whose sum and product of the zeroes are 2 and -15 respectively and find the zeroes of this polynomial. (Average)

70. Write the quadratic polynomial whose sum and product of the zeroes are 5 and -6 respectively and find the zeroes of this polynomial. (Average)

71. Write the quadratic polynomial whose sum and product of the zeroes are 9 and 14 respectively and find the zeroes of this polynomial. (Average)

72. Find the quadratic polynomial represented in the graph. Verify the relationship between the zeroes and the coefficients. (Difficult)



73. Write the quadratic polynomial whose sum and product of the zeroes are -6 and 8 respectively. Find the zeroes of this polynomial. Verify the relationship between the zeroes and the coefficients. (Difficult)

74. If α and β are the zeroes of the quadratic polynomial $p(x) = x^2 + 3x + 1$ then, find the value of (i) $\frac{1}{\alpha}+\frac{1}{\beta}$ (ii) $\alpha^2\beta + \alpha\beta^2$ (MQP 2026, Difficult)

75. If α and β are the two zeroes of the polynomial $p(x) = x^2 + 3x + 2$, then find the value of $\alpha^2 + \beta^2$ (MQP 2026, Difficult)

76. If α and β are the two zeroes of the polynomial $p(x) = x^2 + 3x + 2$, then find the value of $\alpha^3\beta + \alpha\beta^3$ (MQP 2026, Difficult)

77. If one of the zeroes of the polynomial $P(x) = 2x^2 - 8x + (k+1)$ is seven times the other, then find the value of ' k '. (MQP 2026,Difficult)

UNIT 3 :PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

LO's number	LO	Question number
7	Find the solutions of pairs of linear equations in two variables using graphical and different algebraic methods.	32,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,47,48,49,50,51,52,55, 56,62,63,64,65,66,67,68,69,70
8	Find the solutions, graphs of the pair of linear equations by finding the ratio of the coefficients and also infer whether the pair of linear equations in two variables is consistent, inconsistent or dependent.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18,19,20,21,23,24,25,26,27, 28,29,31,
9	Express the given situations as a pair of linear equations and solve various daily life problems of simultaneous linear equations	22,30,57,58,59,60,61,

Number of questions	Easy	Average	Difficult
70	13	47	10

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. If the lines drawn for the pair of linear equations $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ are coincident then the correct relation among the following is, (June-2025, Easy)

A) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ B) $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$ C) $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$ D) $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}=\frac{c_1}{c_2}$

2. If the lines drawn for the pair of linear equations $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ are intersecting then the correct relation among the following is, (July-2021, Easy)

A) $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$ B) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ C) $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$ D) $\frac{a_1}{b_2}=\frac{b_1}{a_2}$

3. In the pair of linear equations, $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ if $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$ then,

(June-2022, Easy)

A) Equations do not have any solution
B) Equations have unique solution
C) Equations have three solutions
D) Equations have infinitely many solutions

4. If the pair of linear equations $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ have unique solution, then the correct relation among the following is,

(Easy)

A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ C) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

5. The lines representing the equations 2x+3y-9=0 and 4x+6y-18=0 are

A) Intersecting lines B) Perpendicular to each other (April-24, Average)

C) Parallel lines D) Coincident lines

6. The lines representing the equations x+2y-4=0 and 2x+4y-12=0 are

(September-2020, Average)

A) Intersecting lines B) Parallel lines

C) Perpendicular to each other D) Coincident lines

7. The pair of linear equations 2x-5y+4=0 and 2x+y-8=0 has **(**Easy)

A) exactly two solutions

B) infinitely many solutions

C) unique solution

D) no solution

8. The lines represented by the pair of linear equations x – 2y=0 and 3x+4y – 20=0 are

(July-2021, Average)

A) intersecting lines B) perpendicular to each other

C) parallel lines D) coincident lines

9. If the pair of linear equations x+2y – 4 =0 and 2x+4y – 12=0 are represented in a graph they are

(April-2024, Average)

A) intersecting lines B) perpendicular to each other

C) parallel lines D) coincident lines

10. The lines represented by the pair of linear equations x – y =8 and 3x – 3y=16 are

A) intersecting lines B) perpendicular to each other (June-2022, Average)

C) parallel lines D) coincident lines

11. If a pair of linear equations is inconsistent then the lines represented by them mutually are

(Easy)

A) intersecting B) perpendicular to each other

C) parallel D) coincident

12. If the lines represented by the pair of linear equations x+2y=3 and 2x+4y=k are coincident then the value of 'k' is, (August-2024, Difficult)

A) 3 B) 6 C) -3 D) -6

13. If the lines represented by the pair of linear equations 3x+2ky=2 and 2x+5y+1=0 are parallel then the value of 'k' is, (Difficult)

A) $\frac{-5}{4}$ B) $\frac{2}{5}$ C) $\frac{15}{4}$ D) $\frac{3}{2}$

14. The pair of linear equations representing coincident lines among the following is, (Average)

A) x-2y=0, 3x+4y=20 B) 2x+3y=9, 4x+6y=18 C) x+2y=4, 2x+4y=12 D) x+y=8, x-y=4

15. The incorrect statement with respect to the lines represented by the pair of linear equations among the following is, (Average)

A) If the lines are parallel, then the equations have no solution
B) If the lines are perpendicular to each other, then the equations have no solution
C) If the lines are coincident, then the equations have infinitely many solutions
D) If the lines are intersecting, then the equations have unique solution

16. The values of x and y which satisfy the equation 2x+3y=16 are (Average)

A) x=5, y=2 B) x=2, y=5 C) x=-5, y=-2 D) x=-5, y=2

II. Answer the following questions (1 mark)

17. Write the standard form of a pair of linear equation with variables 'x' and 'y'. (Easy)

18. How many solutions does the pair of linear equations in two variables have if they are inconsistent? (April-2022, Average)

19. How many solutions does the pair of linear equations $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ have if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$? (September-2022, Easy)

20. How many solutions does the pair of linear equations in two variables have if the lines represented by them are coincident? (Easy)

21. The perimeter of a rectangle having length 'l' units and breadth 'b' units is 32m. Form a linear equation in two variables for this statement. (Average)

22. In a class, 'The number of boys (x) is 1 more than twice the number of girls (y)'. Form a linear equation in two variables for this statement. (Average)

23. If the lines represented by the equations x+2y-4=0 and ax+by-12=0 are coincident, then find the value of 'a' and 'b'. (Average)

24. If the lines represented by the equations 4x+py+8=0 and 4x+4y+2=0 are parallel, then find the value of 'p'. (Difficult)

25. How many solutions does the pair of linear equations x+2y-4=0 and 3x+2y-5=0 have? (June-2023, Easy)

26. How many solutions does the pair of linear equations 2x+3y-9=0 and 4x+6y-18=0 have? (Easy)

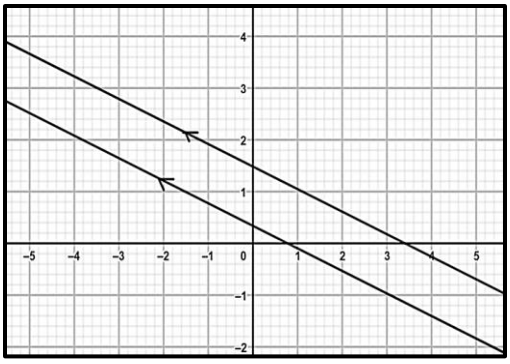
27. How many solutions does the pair of linear equation in two variables have if the lines represented by them are intersecting? (June-2024, Easy)

28. How many solutions does the pair of linear equations 2x-3y+4=0 and 3x+5y+8=0 have? (April-2024, Average)

29. How many solutions does the pair of linear equations 2x + 3y – 9 = 0 and 3x – 2y + 6 = 0 have? (March-2025, Average)

30. "Five years ago, Noori's age(x) was thrice the age of Sonu(y)". Write the standard form of linear equation in two variables for this statement. (MQP 2026,Average)

31. The graph of the pair of linear equations in two variables is shown below. What is the number of solutions does the pair have? (MQP 2026- Easy)



III. Answer the following questions (2 marks)

32. Solve the given pair of linear equations by elimination method.

$2x + y = 10$

$x - y = 2$ (March- 2025, Average)

33. Solve the given pair of linear equations by elimination method.

$3x - y = 15$

$2x - y = 5$ (Average)

34. Solve the given pair of linear equations by elimination method.

$2x + y = 8$

$x - y = 1$ (June-2024, Average)

35. Solve the given pair of linear equations by substitution method.

$x + y = 14$

$x - y = 4$ (Average)

36. Solve the given pair of linear equations by substitution method.

$x + 2y = 8$

$x - y + 1=0$ (Average)

37. Solve the given pair of linear equations by elimination method.

$2x+y=8$

$3x - y =7$ (March-2024, Average)

38. Solve the given pair of linear equations by elimination method. (Average)

$2x + y = 10$

$x + y = 6$

39. Solve the given pair of linear equations by elimination method. (Average)

$3x + y = 9$

$x + y = 5$

40. Solve the given pair of linear equations by elimination method. (Average)

$x + 2y = 6$

$x + y = 5$

41. Solve the given pair of linear equations by elimination method. (Average)

$2x + y = 2$

$x + y = 4$

42. Solve the given pair of linear equations by elimination method. (Average)

$x + 3y = 10$

$x + y = 6$

43. Solve the given pair of linear equations by elimination method. Average)

$2x - y = 8$

$x + y = 7$

44. Solve the given pair of linear equations by elimination method. (Average)

$3x - y = 4$

$x + y = 8$

45. Solve the given pair of linear equations by elimination method. (Average)

$4x + y = 13$
$x - y = 2$

46. Solve the given pair of linear equations by elimination method. (Average)

$x + y = 13$
$x - y = 1$

47. Solve the given pair of linear equations by elimination method. (Average)

$x + 4y = 14$
$x - y = -1$

48. Solve the given pair of linear equations by elimination method. (Average)

$2x - y = 5$
$x - y = 1$

49. Solve the given pair of linear equations by elimination method. (Average)

$5x - y = 14$
$x - y = -2$

50. Solve the given pair of linear equations by substitution method. (Average)

$2x + y = 10$
$x + y = 6$

51. Solve the given pair of linear equations by substitution method. (Average)

$3x + y = 10$
$x + y = 4$

52. Solve the given pair of linear equations by substitution method. (Average)

$x + 2y = 13$
$x - y = -2$

53. The sum and difference of two positive integers are 10 and 2 respectively. Find the integers. (Average)

54. The sum of two positive integers is 15. If one number is 1 more than the other, then find the integers. (Average)

55. Solve the given pair of linear equations by elimination method. (Difficult)

$3x+2y=5$
$x - y = 1$

56. Solve the given pair of linear equations by elimination method. (Difficult)

$2x + 5y = 7$

$5x + 2y = 7$

IV. Answer the following questions (3 mark)

57. A fraction becomes $\frac{9}{11}$ when 2 is added to both numerator and denominator but when 3 is added to both numerator and denominator it becomes $\frac{5}{6}$. Find the fraction (Difficult)

58. After 10 years x will be twice as old as 'y'. Ten years ago, the age of 'x' was six times of 'y'. Find their present ages. (Difficult)

59. Ritu takes 2 hours to row 20 km downstream and 2 hours to row 4 km upstream. Determine Ritu's speed in still water and the speed of the stream. (Difficult)

60. The ratio of monthly income of two persons is 9 : 7 and the ratio of their monthly expenditures is 4 : 3. If each of them manages to save Rs. 2000 at the end of the month then find their monthly income. (Difficult)

61. Five years hence, the age of 'A' will be three times that of his son. Five years ago, 'A's age was seven times that of his son. Find their present ages. (Difficult)

V. Answer the following questions (4 mark)

62. Solve the given pair of linear equations by graphical method.

(MQP2026, SLP 2026, Average)

$2x + y = 8$

$x - y = 1$

63. Solve the given pair of linear equations by graphical method

(MAY 2026, Average)

$2x + y = 8$

$x + y = 6$

64. Solve the given pair of linear equations by graphical method.

(MARCH 2025, MARCH 2026, Average)

$x + 2y = 6$

$x + y = 5$

65. Solve the given pair of linear equations by graphical method. (Average)

$x + 3y = 11$

$x + y = 5$

66. Solve the given pair of linear equations by graphical method. (Average)

$2x + y = 13$

$x + y = 8$

67. Solve the given pair of linear equations by graphical method. (Average)

$x + 2y = 10$

$x + y = 8$

68. Solve the given pair of linear equations by graphical method. (Average)

$2x + y = 4$

$x + y = 3$

69. Solve the given pair of linear equations by graphical method. (Average)

$x + y = 5$

$2x + y = 8$

70. Solve the given pair of linear equations by graphical method. (Average)

$x + 2y = 14$

$x + y = 8$

UNIT4 : QUADRATIC EQUATIONS

LO's number	Learning outcomes	Question number
10	Write the standard form of quadratic equation and express the given quadratic equation in the standard form.	10,4,6,17,18,25,29,
11	Verify whether the given equations are quadratic or not and translate the given statements into quadratic equation.	2,3,5,7
12	Demonstrate techniques for finding the roots of a quadratic equation and determine the nature of its roots by finding the discriminant.	8,9,10,11,12,13,14,15,16,19,20,21, 22,23,24,26,27,28,30,31,32,33,34, 35,36,37,38,39,40,41,42,43,44,45, 46,47,48,49,5051,52,53,54,55,56,57, 58,59,60
13	Verify whether the given daily life situations exist and if exist, find the solutions using quadratic equations.	61,62,63,64,65,66,67,68,69,70,71,72,73, 74,75,76,77,78,79,80,81,82,83,84,85,86, 87,88,89,90,91,92,93,94

Number of questions	Easy	Average	Difficult
94	16	59	19

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. The standard form of a quadratic equation is,

(MQP II -2020 :Easy)

A) ax^2-bx+c=0 B) ax^2+bx+c=0 C)) ax^2-bx-c=0 D)) ax^2-bx-c=0

2.The quadratic equation among the following is,

(APRIL-2025 EXAM-1 : Average)

A) x^3-6x B) p(x)= x^2+7x C)) $3x = 9$ D) x^2+3x+4=0

3. The quadratic equation among the following is, (SLP-2022 :Easy)

A) $x^{-2} - 3x + 2 = 0$B)) $2x + 3 = 0$C) $x^2 - 5x + 6 = 0$ D) $2x^3 + 7x + 1 = 0$

4. The constant obtained when the quadratic equation $5x^2$=2(2x+3) is written in the standard form is,

A) 5 B) 6 C) 4 D) -6 (MQP II -2020 :Average)

5. x(x+2)=6 This is a (MQP-1: 2025 : Average)

A) linear equation B) quadratic equation

C) cubic polynomial D) quadratic polynomial

6. The standard form of a quadratic equation$2x^2 = 3x - 5$ is, (Easy)

A) $x^2 - x + 5 = 0$ B) $2x^2 + 3x - 5 = 0$

C) $2x^2 - 3x - 5 = 0$ D) $2x^2 - 3x + 5 = 0$

7. The product of two consecutive positive integers is 30. The equation for this statement is,

(APRIL -2019 : Easy)

A) (x+2)=30 B) (x-2)=30 C) (x-3)=30 D) x (x+1)=30

8. The discriminant of the quadratic equation $ax^2 + bx + c = 0$ is,

(APRIL-2024 EXAM-3 : Easy)

A) $b^2 - 4ac$ B) $c^2 - 4ab$ C) $b^2 + 4ac$ D) $a^2 + 4ab$

9. The value of discriminant of the quadratic equation $x^2 + 4x + 4 = 0$ is,

A) 0 B) 12 C) 16 D) 48 (APRIL-2024 :Average)

10. If the value of discriminant of a quadratic equation is zero, then the nature of the roots is

A) Distinct, Real and Irrational B) Real and Equal

C) Distinct, Real and Rational D) No real roots (MQP-2022 :Easy)

11.The nature of the roots of the quadratic equation $x^2 - 2x + 1 = 0$ is, it has

A) it has two equal real roots

B) it has two distinct, real and rational roots

C) it has two distinct, real and irrational roots

D) it hasno real roots (MQP-2021 -Average)

12.If the roots of the quadratic equation $x^2 + 6x + k = 0$ are real and equal, then the value of ' k' is,

A) 9 B) -9 C) 8 D) 5 (MQP 1-2020-Average)

13. If the roots of the quadratic equation $ax^2 + bx + c = 0$ are real and distinct, then

A) $a^2 - 4ac > 0$ B) $b^2 - 4ac = 0$ C) $a^2 - 4ac = 0$D) $b^2 - 4ac > 0$ (SLP-2024 – Easy)

14. The roots of the equation (x-3)(x+2) = 0 are (JULY-2021 :Easy)

A) -3,2 B) 3,-2 C) -3,-2 D) 3,2

15. If one of the roots of the quadratic equation (2x-3)(x+5)=0 is-5 then the other root is,

A) 5 B) $\frac{-3}{2}$ C) $\frac{3}{2}$ D) $\frac{2}{3}$ (MQP-2021 : Easy)

16. If one of the roots of the quadratic equation$2x^2 + ax + 6 = 0$ is 2 then the value of'a'is

(JULY-2021 : Average)

A) 7 B)$\frac{7}{2}$ C) -7 D) $\frac{-7}{2}$

II. Answer the following questions (1 mark)

17. Express the equation x(2+x)=3 in the standard form of a quadratic equation

(APRIL -2023 :Easy)

18. Express the equation $\frac{x+1}{2} = \frac{1}{x}$ in the standard form of a quadratic equation.

(JUNE -2020 :Average)

19. Write the discriminant of the quadratic equation px^2 +qx -r = 0

(MQP-2020:Average)

20. Find the discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$

(APRIL-2019 :Average)

21. If one of the roots of the quadratic equation (x+4)(x+3)=0 is -4 then find the other root. (SEPT -2020:Easy)

22. Find the roots of the quadratic equation (x-1)(x+3) = 0 (SLP -2024 :Easy)

23. Find the discriminant of the quadratic equation $x^2 - 5x + 1 = 0$ (JUNE-2023 : Average)

24. Write the nature of the quadratic equation $x^2 - 9 = 0$ (MQP-4, 2024 : Average)

25. Write the equation $2m^2 = 2 - m$ in the standard form of the quadratic equation. (Easy)

26. Find the roots of the quadratic equation $x^2 - x = 0$ (Easy)

27. Write the roots of the quadratic equation $x(x + 2) = 0$ (MARCH-2025 :Easy)

28. Write the roots of the quadratic equation $ax^2 + bx + c = 0$ (May 2025 Easy)

29. 'The product of two consecutive positive integers is 306'. Write this statement in the standard form of quadratic equation. (Average)

III. Answer the following questions (2 marks)

30. Find the roots of the quadratic equation $x^2 + 7x + 12 = 0$by factorization method. (JUNE-2019 : Average)

31. Find the roots of the quadratic equation$x^2 + 4x - 60 = 0$ (MQP-4,2024 :Average)

32. Find the roots of the quadratic equation $x^2 + 3x + 2 = 0$ by factorisation method. (MQP-2, 2024 :Average)

33. Find the roots of the quadratic equation$2x^2 + x - 6 = 0$ (SLP-4,2024 :Average)

34. Find the roots of the quadratic equation$x^2 + 8x + 12 = 0$ (APRIL-2025 : Average)

35. Find the roots of quadratic equation $3x^2 - 6x + 3 = 0$ by factorization method. (Average)

36. Find the roots of quadratic equation $x^2 - 3x - 10 = 0$ by factorization method. (Average)

37. Find the roots of quadratic equation $x^2 + 6x + 8 = 0$ by factorization method. (Average)

38. Find the roots of quadratic equation $2x^2 + 4x + 2 = 0$ by factorization method. (Average)

39. Find the roots of quadratic equation $x^2 + 5x + 6 = 0$ by factorization method. (Average)

40. Find the roots of quadratic equation $x^2 + 5x + 4 = 0$ by factorization method. (Average)

41. Find the discriminant of the quadratic equation $2x^2 + 3x - 7 = 0$ and write the nature of roots (Average)

42. Find the discriminant of the quadratic equation $x^2 + 5x + 6 = 0$ and write the nature of roots (Average)

43. Find the discriminant of the quadratic equation $-2x^2 + 7x + 1 = 0$ and write the nature of roots (Average)

44. Find the discriminant of the quadratic equation $3x^2 + 5x - 3 = 0$ and write the natur of roots (Average)

45. Find the discriminant of the quadratic equation $-x^2 + 4x - 7 = 0$ and write the nature of roots (Average)

46. Find the discriminant of the quadratic equation $2x^2 + 8x + 8 = 0$ and write the nature of roots (Average)

47. Express $(x + 2)^3 = x^3 - 4$ in the standard form of quadratic equation. (Average)

48.Express $(2x+3)\, x = x^2+1$ in the standard form of quadratic equation. (Average)

49. Find the discriminant of the quadratic equation, $2x^2 - 5x + 3 = 0$and write the nature of the roots. (SEPT-2020 : Average)

50. Find the discriminant of the quadratic equation, $4x^2 - 4x + 1 = 0$and write the nature of the roots. (JUNE-2019 :Average)

51. Find the discriminant of the quadratic equation,$2x^2 - 6x + 3 = 0$and write the nature of the roots. (MQP-1,-2021 :Average)

52. Find the discriminant of the quadratic equation,$x^2 + 4x + 4 = 0$and write the nature of the roots. (SLP-2024,Average)

53. Find the discriminant of the quadratic equation,$2x^2 - 5x - 1 = 0$and write the nature of the roots. (SEPT-2020,Average)

54. Prove that the roots of the quadratic equation $x^2 + ax - 4 = 0$ are real and distinct. (MQP-1,2021 : Average)

55. For what value of 'k' the roots of the equation $kx^2 + 6x + 1 = 0$are equal? (SLP-2022 : Average)

56. If the quadratic equation $x^2 + bx + 9 = 0$ has two equal real roots then find the equation. (MQP-1,2024:Average)

57. Find the value of 'k' for which the quadratic equation $2x^2 + kx + 3 = 0$ has equal real roots.

(MQP-2, 2024 :Average)

58. Find the discriminant of quadratic equation $x^2 + 4x + 5 = 0$ and hence write the nature of the roots. (APRIL-2024 :Average)

59. Find the roots of the equation $3x^2 - 5x + 2 = 0$ by Factorisation method.

(MQP-2,2021 :Average)

60. Find the roots of the quadratic equation $3x^2 - 6x + 3 = 0$ by factorisation method.
(average)

IV. Answer the following questions (3/4marks)

61. The sum of the areas of two squares is $640m^2$. If the difference between their perimeters is 64 m, then find the sides of the square. (MQP-1,2020 :Average)
62. The sum of the squares of two consecutive odd positive integers is 290. Find the integers.
(MQP-2,2021 :Average)
63. Age of mother is twice the square of age of her son. After 8 years mother's age will be 4 years more than the thrice the age of her son. Find their present ages.
(APRIL-2023:Average)
64. The difference between the altitude and base of a right angled triangle is 5cm. If the area of the triangle is $150cm^2$, then find the base and altitude of the triangle.
(APRIL-2025 :Difficult)
65. The sum of the squares of two consecutive even positive integers is 164. Find the integers.
(APRIL-2024:Average)
66. Find the two numbers whose sum is 27 and the product is 182. (MQP-1,2024 :Average)
67. The altitude of a right angled triangle is 7 cm less than its base. If the hypotenuse is 13 cm, then find the other two sides. (MQP-1,2024: Average)
68. A student bought some books for ₹60. Had he bought 5 more books for the same amount each book would have cost ₹1 less. Find the number of books bought by him.
(MQP-2,2024 :Difficult)
69. Age of a father is 30 years more than his son. After 5 years, the product of their ages becomes 400. Find the present ages of both the son and father. (MQP-3,2024 :Average)
70. A number is 3 more than the other number. If the sum of their squares is 29 then find the numbers. (MQP-3, 2024: Average)

71. The base of a triangle is 4 cm more than twice its height. If the area of triangle is $48cm^2$, then find the length of the base and height of the triangle. (MQP-4,2024 :Average)
72. Some students planned a picnic. The budget for the food was ₹.900. As 10 of them failed to join the picnic, the cost of the food for each member was increased by ₹.15. Find how many students went for the picnic. (SLP-2024 :Difficult)
73. The area and perimeter of a rectangular field are 60 m^2 and 32 m respectively. Find the length and breadth of the field. (MQP-2023:Average)
74. A train travels 480 km at a uniform speed. If the speed had been 10 km/h more, it would have taken 4 hours less for the same journey. Find the speed of the train. (MQP-2, 2021: Difficult)
75. The area and perimeter of a rectangular field are 400 m^2 and 80 m respectively. Find the length and breadth of the field. (Average)
76. To save fuel, to avoid air pollution and for good health two persons 'A' and 'B' ride bicycle for a distance of 12 km to reach their office. As the cycling speed of 'B' is 2 km/h more than that of 'A', 'B' takes 30 minutes less than that of 'A' to reach the office. Find the time taken by A and B to reach the office. (April 2020 – Difficult)
77. A dealer sells an article for ₹24 and gains as much percent as the cost price. Find the cost price of the article. (Average)
78. A dealer sells an article for ₹. 24 and loses as much percent as the cost price. Find the cost price of the article. (Average)
79. If the equation $(1+m^2)x^2$ +2mcx+ c^2 - a^2 = 0 has equal roots, then prove that $c^2 = a^2(1+m^2)$ (Difficult)
80. If the roots of the equation $(b-c)x^2+(c-a)x+(a-b)=0$ are equal then prove that $2b = a + c$ (June 2019- Difficult)
81. A motor boat whose speed is 11km/h in still water takes 2 hours 45 minutes to go 12 km upstream then to return downstream to the same spot. Find the speed of the stream. (SLP-2024:Difficult)
82. The ages of two students 'A' and 'B' are 19 years and 15 years respectively. Find how many years it will take so that the product of their ages becomes equal to 480. (JUNE-2019 :Average)
83. A motor boat goes down the stream 30 km and again returns to the starting point in a total time of 4 hours and 30 minutes. If the speed of the stream is 5km/h, then find the speed of the motor boat in still water. (SLP-2020 :Difficult)

84. An express train takes 1 hour less than a passenger train to travel 132 km between two towns A and B. The Average speed of the express train is 11km/h more than that of a passenger train. Find the Average speed of these trains. (SLP-2022 :Difficult)

85. Age of person 'A' is 26 years more than age of person 'B' .The product of their ages 3 years from now will be 360. Find the present ages of person 'A' and person 'B'

(SLP-2023 :Difficult)

86. A farmer wishes to grow a 100 m^2 rectangular vegetable garden. Since he has only 30m barbed wire, he fences the sides of the rectangular garden letting his house compound wall act as the fourth side fence. Find the dimensions of the garden. (Difficult)

87. The denominator of a fraction is one more than twice it numerator. The sum of this fraction and its reciprocal is $\frac{29}{10}$. Find the fraction. (May 2025 - Average)

88. In a school, it was decided to distribute ₹1500 equally to the students who secure A+ grade in the 10^{th} standard annual examination. But after the results, 5 more students secured A+ grade than expected before the examination. Hence the amount received by each student was reduced by ₹ 25. Find the number of students who secured A+ grade after examination

(SLP- 2025: Difficult)

89. If the sum of two consecutive positive integers is 365 , then find those numbers. (Difficult)

90. A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was ₹ 90, find the number of articles produced and the cost of each article. (Difficult)

91.The duration of the spacewalk of astronaut 'A' is 6 hours longer than the duration of the spacewalk of astronaut 'B'. If they both continue spacewalk for 4 more hours, the product of their spacewalk duration becomes 720 hours. Find the spacewalk durations of astronauts A and B. (MQP 2026 , Difficult)

92. The difference between the altitude and base of a right angled triangle is 5cm. If the area of the triangle is 150cm^2, then find the base and altitude of the triangle.

(MQP 2026 , Difficult)

93. The perimeter of square ABCD is 12m less than the perimeter of the square PQRS. The sum of the areas of these two squares is $117m^2$. Find the ratio of the area of the square ABCD to the area of square PQRS. (MARCH 2026 , Difficult)

94. Two persons A and B start the same type of work at same time separately. 'B' takes 3 days less than 'A' to complete that work. If they work for 4 more days, then the product of their working days will be equal to 130. Find the number of days taken by the persons 'A' and 'B' to complete the work separately.

(SLP 2026 , Difficult)

UNIT 5 :ARITHMETIC PROGRESSIONS

LO's number	Learning outcomes	Question number
30	Identify patterns in numbers. Develop strategies to derive formula in arithmetic progression and apply the concept of Arithmetic Progression (A.P.) to daily-life situations to solve related problems.	1,2,3,4,5,6,7,8,9,10,10,11,12,13,14,15,16 ,17,18,19,20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,47,48,49,50,51,52,53,54,55, 56,57,58,59,60,61,62,63,64,65,66,67,68 ,69,70,71,72,73,74,75,76,77,78,79,80,81, 82,83,84,85,86,87,88,89,90,91,92,93,94 95,96,97,98,99,100,101,102,103,104,105, 106,107,108,109,110,111

Number of questions	**Easy**	**Average**	**Difficult**
111	**15**	**81**	**15**

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. (1 Mark)

1. The arithmetic progression in the following is, (Easy)
   A) 1, 2, 4, 8……. B) 3, 7, 10, 14……. C) 1, 4, 9, 16…… D) 5, 9, 13, 17……..

2. The common difference of the arithmetic progression -7,-9,-11,-13……. is, (Easy)
   A) -7 B)-2 C)2 D)3

3. The common difference of the arithmetic progression 100 , 93 , 86…….. is,
   (MARCH 2025) (Easy)
   A) -7 B) 7 C) 3 D) 5

4. The formula to find the n^{th} term of an arithmetic progression is (AUG 2024) (Easy)
   A) $a_n = a + (n-1)\, d$ B) $a_n = a + (n+1)\, d$ C) $a_n = a - (n-1)d$ D) $a_n = n+1$

5. If the n^{th} term of an arithmetic progression is$5n+3$, then the 3^{rd} term of the progression is, (June 2019) (Average)

A) 11 B) 18 C) 12 D) 13

6. If the n^{th} term of an arithmetic progression$a_n = 3n - 2$, then the 9th term is (September 2020) (Easy)

A) -25 B) 5 C) -5 D) 25

7. If the n^{th} term of an arithmetic progression $a_n = 24 - 3n$, then the 2^{nd} term is, (APRIL 2019) (Easy)

A) 18 B) 15 C) 0 D) 2

8. If the n^{th} term of the arithmetic progression $a_n = 2n - 1$ then the 4^{th} term is, (Easy)

A) -7 B) 7 C) 5 D) 6

9. In an arithmetic progression if $a_n = 3n+4$ then $a_{n+1}{}^{th}$ term is, (Average)

A) 3 B) 3n+1 C) 3n+7 D) 3n+5

10. In an arithmetic progression, if $a_n = 2n+1$ then the common difference of the progression is, (JUNE 2020 ,Easy)

A) 0 B) 1C) 2 D) 3

11. If 6, x , 14 are in arithmetic progression, then the value of x is, (APRIL 2024: Easy)

A) 10 B) 20 C)18 D)12

12. In an arithmetic progression, if a =12, d =4, a_n =76 then, n =

A) 17 B) 18 C) 16 D) 19 (Average)

13. In an arithmetic progression, if a = -7 , d=5 then, a_{12} = (Average)

A) 48 B) 45 C) 46 D) 42

14. If the first term of an arithmetic progression is 'm' and the common difference is 3 then the 10^{th} term of the progression is,

A) m +25 B) m+12 C) m+30 D) m+27 (Average)

15. If (2p+1), 13, (5p-3) are the three consecutive terms of an arithmetic progression, then the value of 'p' is,

(Average)

A) 4 B) -4 C)2 D)3

16. If 4, x_1 , x_2 , 22, 28 are in arithmetic progression, then the value of x_1 and x_2 respectively is,

A) 10, 16 B) 16,10 C)16, 22 D)22,16 (Average)

17. There are 20 terms in an arithmetic progression. If the first term is 2 and the last term is 78, then the arithmetic progression is, (JUNE 2024 EXAM 2 Average)

A) 2, 5 8 ..... B) 2, 7, 12, ... C) 2, 6, 10,..... D) 2, 4, 6,.....

18. The nth term of the arithmetic progression 3, 7, 11, 15,..... is, (Average)

A)a_n = 4n-1 B) a_n = 3n-4 C)a_n = 4n-7 D) a_n = 4n +1

19. The formula to find the sum of all terms of the arithmetic progression with first term 'a' and the last term 'l' is (Easy)

A) $s_n=\frac{n}{2}$ (a+l) B) $s_n = \frac{n}{2}$ (a-l) C) $s_n = \frac{n}{2}$ (a $\times$ l) D) $s_n =\frac{n}{2}$ (a $\div$ l)

20. If a_n , S_n and S_{n-1} represent the nth term, sum of the first n terms and sum of first (n – 1) terms, then the correct relation among the following is,

(JUNE 2025 - Easy)

A) $S_{n-1} = a_n + S_n$ B) $a_n = S_n - S_{n-1}$ C) $S_n = S_{n-1} - a_n$ D) $S_n = a_n - S_{n-1}$

II. Answer the following questions (1 Mark)

21. If the first term of an arithmetic progression is 'a' and the last term is 'a_n' then write the formula to find the sum of the first n terms of the arithmetic progression.

(JUNE 2019) (EASY)

22. In an arithmetic progression if 'b' is the first term and 'd' is the common difference, then write its 'n^{th} term. (Easy)

23. If a, a+d, a+2d ..... /is an arithmetic progression then find the n^{th} term of the progression from the last term (Easy)

24. If the sum of three consecutive terms of an arithmetic progression is 21, then find the second term. (Average)
25. If the 2^{nd} term of an arithmetic progression is 7 and the 5^{th} term is 19, then find the common difference. (Average)

26. In an arithmetic progression the sum of first 4 terms is 20 and the sum of first 3 terms is 12 then find the 4^{th} term of the arithmetic progression. (Average)
27. If the 4^{th} term of an arithmetic progression is 11 and the 3^{rd} term is 7, then what is the common difference? (Average)

28. If the 3^{rd} term of an arithmetic progression is 13 and the 2^{nd} term is 8, then find the first term of the progression. (Average)

29. Write the general term of an arithmetic progression. (Easy)

30. If 4, x, 28 are in arithmetic progression then find the value of x. (Average)

31. If the n^{th} term of an arithmetic progression $a_n = 7 - 4n$ then find the common difference. (Average)
32. If the n^{th} term of an arithmetic progression $a_n = 4n + 1$ then find its first three terms (Average)

III. Answer the following questions. (2 marks)

33. Find the 15^{th} term of the arithmetic progression 2, 7, 12,..... using formula.(Average)

34. Find the number of terms of the arithmetic progression 100, 96, 92, ...12. (Average)
35. There are 10 terms in an arithmetic progression. If the last term is 34 and common difference is 3, then find the first term of the progression. (Average)

36. Find out, which term of the arithmetic progression -1, 3, 7, 11..... is 95 using formula (Average)
37. Find whether 77 is a term of the arithmetic progression 1,5,9,13..... using formula. (Average)

38. Find the 26^{th} term of the arithmetic progression 5, 8, 11……. using formula.
(Average)

39. Find the 30^{th} term of the arithmetic progression 2, 5, 8……using formula.
(AUG 2024) (APRIL 2024) (JUNE 2024 EXAM – 2) (Average)

40. Find the 23^{rd} term of the arithmetic progression 2, 6, 10, 14,……using formula. (Average)

41. Find the 40^{th} term of the arithmetic progression 4, 9, 14,19,…….. using formula.
(Average)

42. Find the 35^{th} term of the arithmetic progression 3, 6, 9, 12,…….. using formula.
(Average)

43. Find the 18^{th} term of the arithmetic progression 6, 10, 14,18,…….. using formula.
(Average)

44. Find the 20^{th} term of the arithmetic progression 11, 14, 17,…….. using formula.
(Average)

45. Find the 25^{th} term of the arithmetic progression 3, 7, 11,…….. using formula. (Average)

46. Find the which term of the arithmetic progression 3, 8, 13, 18……. is 78 by using formula.
(Average)

47. Find the number of terms in the arithmetic progression 7, 13, 19…….205 (Average)

48. The 17^{th} term of an AP exceeds its 10^{th} term by 7. Find the common difference.
(Average)

49. Find how many three digit numbers are divisible by 7 ? (Average)

50. How many multiples of 4 lie between 10 and 250 ? (Average)

51. In a flower bed, there are 23 rose plants in the first row, 21 in the second ,19 in the third, and so on. There are 5 rose plants in the last row. How many rows are there in the flower bed? (Average)

52. Find the which term of the arithmetic progression 2, 7, 12……is 47 by using formula
(MQP 2026 Average)

53. In an arithmetic progression if the first term is 1 and 14^{th} term is 53 then, find its n^{th} term.
(Average)

54. In an arithmetic progression if S_{20}=820 and a_{20}=79 then, find its first term.(Average)

55. Find how many numbers between 201 and 401 are divisible by 6? (Average)

56. Find the sum of first 20 terms of arithmetic progression 11, 15, 19, 23,.....using formula. (Average)

57. Find the sum of first 20 terms of arithmetic progression 6, 10, 14,..... using formula. (Average)

58. Find the sum of first 20 terms of arithmetic progression 5, 8, 11, ,..... using formula. (Average)

59. Find the sum of first 20 terms of arithmetic progression 3, 7, 11, ,..... using formula. (Average)

60. Find the sum of first 10 terms of arithmetic progression 3, 7, 11, ,..... using formula. (Average)

61. Find the sum of first 20 terms of arithmetic progression 11, 14, 17 ,..... using formula. (Average)

62. Find the sum of first 20 terms of arithmetic progression 2, 5, 8, 11,..... using formula. (Average)

63. Find the sum of first 30 terms of arithmetic progression 4, 8, 12,..... using formula. (Average)

64. Find the sum of first 10 terms of arithmetic progression 5, 10, 15,..... using formula. (Average)

65. Find the sum of the first 40 positive integers divisible by 6. (Average)

66. Find the sum of the first 15 multiples of 8. (Average)

IV. Answer the following questions. (3 Marks)

67. The sum of first 6 terms in an arithmetic progression is 114. If the sum of first 5 terms of the progression is 80, then find the progression. (Average)

68. The 7^{th} term of an arithmetic progression is four times its 2^{nd} term. If the 12^{th} term is 2 more than thrice the fourth term, then find the arithmetic progression.

(APRIL 2019) (Average)

69. Find the arithmetic progression whose third term is 16 and its 7th term exceeds the 5th term by 12. (July 2022: Average)
70. The 5^{th} term of an arithmetic progression is 26 and the common difference is three times the first term. Find the sum of first 20 terms of the progression. (Average)

71. The digits of a three digit number are in arithmetic progression and the sum of the digits is 15. If the digits of units place and hundreds place are interchanged, then the number obtained is 594 less than the original number. Find the original number.

(Average)

72. The number 56 is divided into 4 parts such that they are the terms of arithmetic progression. If the ratio of the product of their extremes to the product of their means is 5:6 then find the four terms.

(Difficult)

73. A straight wooden stick of length 25 cm is cut into 5 parts whose lengths are in arithmetic progression. The sum of the squares of each part is 135. Find the length of the each part.

(Difficult)

74. The 9^{th} term of an arithmetic progression is one more than 5 times its 2^{nd} term and its 12^{th} term is 7 more than twice the 5^{th} term. Find the arithmetic progression.

(Average)

75. Find the sum of the integers between 1 and 100, all of which leave a remainder 1 when divided by 5.

(Average)

76. The sum of three numbers in an arithmetic progression is 216. The biggest number is 7 times the smallest number. Find the numbers.

(Average)

77. The sum of the 4^{th} term and 8^{th} term of an arithmetic progression is 24 and the sum of 6^{th} term and 10^{th} term of the progression is 44. Find the first three terms of the progression.

(JUNE 2019) (Average)

78. The three angles of a triangle are in arithmetic progression. If the smallest angle is half the biggest angle then find the measures of all the angles of the triangle.

(Average)

79. If the m^{th} term of an arithmetic progression is $\frac{1}{n}$ and n^{th} term is $\frac{1}{m}$ then prove that the mn^{th} term is 1.

(Difficult)

80. If the p^{th} term of an arithmetic progression is 'a', q^{th} term is 'b' and r^{th} term is 'c' then prove that a(q-r) +b(r-p) +c(p-q) =0

(Difficult)

81. The sum of first 9 terms of an Arithmetic progression is 144 and its 9th term is 28. Then find the first term and common difference of the Arithmetic progression.

(April- 2022: Average)

82. Find the 31^{st} term of an AP whose 11^{th} term is 38 and the 16^{th} term is 73. (Average)

83. Which term of an AP 3, 15, 27, 39,...will be 132 more than its 54^{th} term? (Average)

84. Determine the AP whose third term is 16 and the 7^{th} term exceeds the 5^{th} term by (Average)

85. How many terms of the AP 9, 17, 25,.....must be taken to give a sum of 636?

(Average)

86. Find the sum of first 22 terms of an AP in which d = 7 and 22^{nd} term is 149. (Average)

87. Find the sum of the odd numbers between 0 and 50 ? .(Average)

IV. Answer the following questions. (4 /5 Marks)

88. In an arithmetic progression the first term is 22, n^{th} term is -11 and the sum of the first 'n' terms is 66. Find the number of terms of the progression and common difference.

(Average)

89. Five integers are in arithmetic progression. The difference obtained on subtracting the square of the first term from the square of the fifth term is 192 and the sum of the 2^{nd} and 4^{th} term is 16. Find the five terms of the progression

(Easy)

90. In an arithmetic progression the sum of the first 'n' term is 210 and the sum of the first (n-1) terms is 171. If the first term of the progression is 3, then find the progression. Also find the 20^{th} term of the progression.

(APRIL 2024) (Average)

91. The sum of the interior angles of a polygon of 'n' sides is $(n - 2)\ 180^0$. The interior angles of a pentagon are in arithmetic progression. If the smallest angle is 72^0 then find the angles of the pentagon.

(April 2024 -Average)

92. A person works in a shop from Monday to Saturday. His every day earnings are in arithmetic progression. His total earnings from Monday to Wednesday are Rs. 525 and Friday he gets Rs. 100 more than his Monday's earning. Find his every day's earning.

(August 2024) (Average)

93. The angles of a quadrilateral are in arithmetic progression. If the sum of a pair of opposite angles is 130^0, then find the angles of the quadrilateral.
(Average)

94. An arithmetic progression consists of 16 terms. The sum of all its terms is 768. If the last term of the progression is 93, then find the arithmetic progression. Also show that the sum of all the terms of this progression is equal to 3 times the sum of first 16 odd natural numbers using formula.

(March 2025 -Average)

95. In an arithmetic progression 7^{th} term is five times its 2^{nd} term and 5^{th} term is 1 less than twice the 3^{rd} term. Write the Arithmetic progression. Find the 15^{th} term of this progression using formula. (May 2025: Average)

96. The ratio of 11^{th} and 8^{th} terms of an arithmetic progression is 3:2. Find the ratio of sum of the first 5 terms to the sum of first 21 terms.

(Difficult)

97. The 7^{th} term of an arithmetic progression is four times its 2^{nd} term and the 12^{th} term is 2 more than thrice its 4^{th} term. Find the progression.

(Difficult)

98. The 'p'^{th} term of an arithmetic progression is 'q' and 'q'^{th} term is 'p'. Prove that 'r'^{th} term of the progression is p+q-r (Average)

99. There are five terms in an Arithmetic Progression. The sum of these terms is 55, and the fourth term is five more than the sum of the first two terms. Find the terms of the Arithmetic progression. (April 2020: Average)

100. In an Arithmetic Progression sixth term is one more than twice the third term. The sum of the fourth and fifth terms is five times the second term. Find the tenth term of the Arithmetic Progression.

(April 2020: Average)

101. The sum of first 'n' terms of an arithmetic progression is $5n - n^2$. Write the progression. Find the 21^{st} term and also find the sum of first 21 terms of the progression.

(Average)

102. The common difference of two different arithmetic progressions is equal. The first term of the first progression is 3 more than the first term of the second progression. If the 7^{th} term of the first progression is 28 and the 8^{th} term of the second progression is 29, then find the progressions.

(Difficult)

103. An arithmetic progression contains 30 terms. 17^{th} term of the progression is 4 more than the thrice of its 5^{th} term. The 10^{th} term of the progression is 31. Find the last three terms of the progression and also find the progression.

(June-2024: Average)

104. An arithmetic progression consists of 14 terms. The first term of this progression is equal to the sum of the first 8 positive integers. If the sum of the first term and last term of the progression is 111, then find the last three terms of the arithmetic progression.

(MAY 2026 , Difficult)

105. An arithmetic progression consists of 37 terms. The sum of the last three terms of the progression is 429, and the middle term of the progression is 75. Find by how much the 33^{rd} term of the progression exceeds its 28^{th} term.

(MAY 2026 , Difficult)

106. The 10^{th} term of an arithmetic progression is 2 more than the three times of the first term and the 8^{th} term is 6 more than twice the first term. Find how many terms of progression make the sum 540. (MQP 2026 , Difficult)

107. In an arithmetic progression the ratio of the first term and common difference is 3: 2 and sum of first 26 terms is 1456. Find the arithmetic progression and also find which term of the progression is 62? (MQP 2026 , Difficult)

108. The sum of the first 6 terms of an arithmetic progression is 42. If the ratio of the 10^{th} term to the 30^{th} term of the progression is 1:3, then find the 13^{th} term of the progression.

(MQP 2026 , Difficult)

109. In an arithmetic progression, the sum of 4^{th} term and 8^{th} terms is 24, and sum of 6^{th} term and 10^{th} terms is 44. Find the arithmetic progression and also find the 25^{th} term of the progression. (MQP 2026 , Difficult)

110. An arithmetic progression consists of four terms whose sum is 32. The ratio of the product of first and last terms to the product of second and third terms is 7 : 15. Find the terms of the progression. (MQP 2026 , Difficult)

111. A book contains 432 pages. A student wants to read fixed number of pages of the book daily. He reads 25 pages on the first day. From the next day onwards he decides to read 2 pages more than what he read on the previous day. By using formula, find how many pages will he read on 12^{th} day and also find the number of days the student takes to read the book completely.

(MQP 2026 , Difficult)

UNIT 6 :TRIANGLES

LO's number	Learning outcomes	Question number
14	Develop methods to distinguish between congruent figures and similar figures.	1,2,25,26
15	Establish the properties of similarity of two triangles using logical reasoning. State and Prove Basic Proportionality Theorem. Prove the theorems related to SSS, AAA, SAS criteria of similar triangles	31,32,,60,61,62,63
16	Solve various geometric problems on similar triangles using basic proportionality theorem, SSS, AAA, SAS, criteria of similar triangles.	3,4,5,6,7,8,9,10,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,26,27, 28,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,47,48,49,50,51,52,53, 54,55,56,57,58

Number of Questions	Easy	Average	Difficult
63	17	39	7

I. Four alternatives are given for each of the following questions/incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. (1 Mark)

1) In the following, the shapes which are always similar are, (March 2025 (Easy)
   A) Any two equilateral triangles
   B) Square and rectangle
   C) Square and rhombus
   D) Any two trapeziums

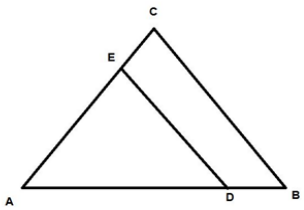
2) Which of the following pair of triangles are always similar? [Model : 2022 [Average]
   A) Two isosceles triangles B) Two scalene triangles
   C) Two equilateral triangles D) Two right angled triangles

3) In ΔABC, DE || AB. If CD = 3 cm, EC = 4 cm, BE = 6 cm, then DA is equal to (Average)

   A) 7.5 cm B) 3 cm C) 4.5 cm D) 6 cm

4) D and E are the points on sides AB and AC of triangle ABC. If DE || BC, AD = 2 cm, BD = 3 cm and BC = 7.5 cmand then length of DE is

(Average)

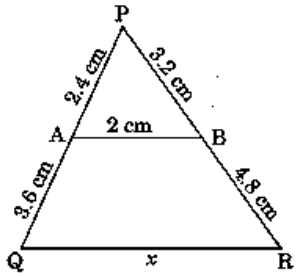


A) 2.5 cm B) 3 cm C) 5 cm D) 6 cm

5) ΔABC and ΔDEF are similar and if $\frac{AB}{DE} = \frac{BC}{FD}$ then the correct relation among the following is (Average)

A) ∠B = ∠E B) ∠A = ∠D C) ∠B = ∠D D) ∠A = ∠F

6) In the figure, value of *x* is (Average)



A) 4 cm B) 5 cm C) 6cm D) 8 cm

7) In ΔABC, DE || BC, AD = x, DB = x – 2, AE = x + 2 and EC = x – 1 then value of x is (Average)

A) 3 B) 4 C) 5 D) 3.5

8) ΔABC is similar to ΔDEF such that 2 AB = DE and BC = 8 cm, then length of EF is

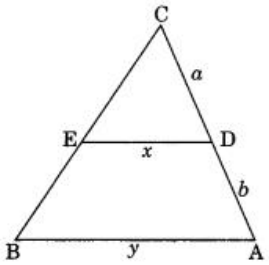
A) 12 cm B) 4 cm C) 16 cm D) 8 cm (Average)

9) In ΔABC, AE = $\frac{1}{4}$ AC , AB = 6 cm and DE || BC then length of AD is

A) 2 cm B) 1.2 cm C) 1.5 cm D) 4 cm (Average)

10) In the figure, If DE || AC then the correct relation among the following is

(Average)

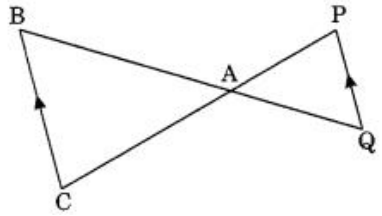


A) x = $\frac{a+b}{ay}$ B) y= $\frac{ax}{a+b}$ C) x = $\frac{ay}{a+b}$ D) $\frac{x}{y} = \frac{a}{b}$

11) ΔABC ~ ΔDEF. If AB = 4 cm, BC = 3.5 cm, CA = 2.5 cm and DF = 7.5 cm then, Perimeter of ΔDEF is

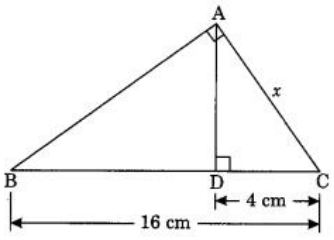
A) 10 cm B) 14 cm C) 30 cm D) 25 cm (Average)

12) In the figure, ΔACB ~ ΔAPQ. AB = 6 cm, BC = 8 cm and PQ = 4 cm then length of AQ is (Easy)



A) 2 cm B) 2.5 cm C) 3 cm D) 3.5 cm

13) In the figure, the value of x is (Average)



A) 4 cm B) 5 cm C) 8 cm D) 3 cm

14) In ΔLMN, ∠L = 50° and ∠N = 60° If ΔLMN ~ ΔPQR then measure of ∠Q is (Easy)

A) 50° B) 70° C) 60° D) 40°

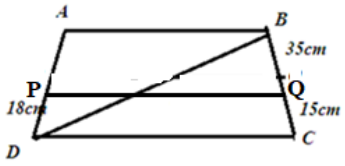
15) D and E are midpoints of sides AB and AC ofΔABC. If BC = 6cm and DE||BC then, length of DE is

(Easy)

A)12 cm B)3 cm C)5 cm D)6 cm

16) In trapezium ABCD, AB||DC and P,Q are points on sides AD and BC respectively. If PQ||DC, PD = 18cm, BQ = 35cm and QC = 15cm then length of AD is

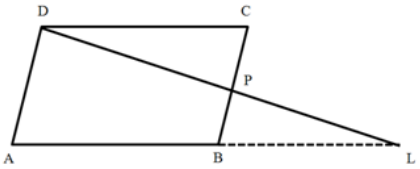
(Difficult)



A)5cm B) 57cm C) 60cm D) 62cm

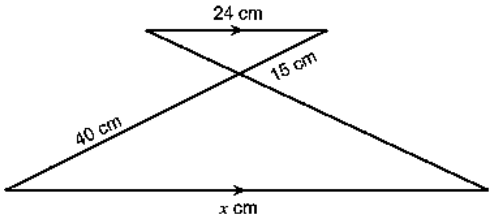
17) ABCD is a parallelogram. If P is a point on BC and AB is produced to meet DP at L, then the correct relation among these is

(Difficult)



(A) $\frac{DP}{BL} = \frac{DC}{PL}$ (B) $\frac{DP}{PL} = \frac{DC}{BL}$ (C) $\frac{DP}{PL} = \frac{BL}{DC}$ (D) $\frac{DP}{PL} = \frac{AB}{DC}$

18) In the figure, value of x is (Average)



(A) 64 cm (B) 60cm (C) 25cm (D) 53cm

19) If a flag pole of height 5m casts a shadow of length 4m then the height of the tree that casts a shadow of 20m at the same time is, (Difficult)

(A) 25m (B) 30m (C) 60m (D) 20m

20) If in ΔABC and ΔDEF, $\angle B = \angle E$, $\angle C = \angle F$ and $AB = 3DE$, then the triangles are, (Easy)

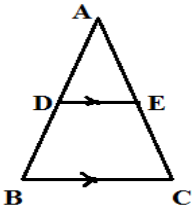
A) congruent but not similar B) similar but not congruent

C) neither congruent nor similar D) congruent and similar

21) If in ΔADE and ΔABC, $\angle D = \angle B$ and $\angle E = \angle C$ then which of the following is incorrect? (Easy)

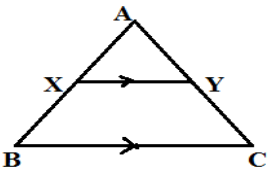
A) $\frac{AD}{DB} = \frac{AE}{CE}$ B) $\frac{AD}{AB} = \frac{AE}{AC}$ C) $\frac{DE}{BC} = \frac{AD}{AB}$ D) $\frac{AE}{AC} = \frac{DE}{BC}$

22) In the figure, D and E are midpoints of AB and AC respectively. If DE = 4cm then BC is equal to
(Easy)



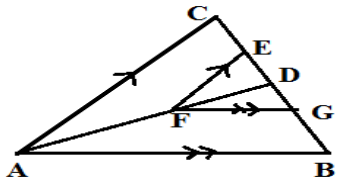
A) 4cm B) 6cm C) 8cm D) 12cm

23) In the figure, if XY∥BC then $\frac{AX}{AB}$ is equal to (July:2021) (Easy)



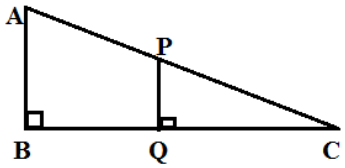
A) $\frac{AX}{AY}$ B) $\frac{AX}{XB}$ C) $\frac{AY}{AC}$ D) $\frac{AC}{AY}$

24) In the figure, if EF‖CA and FG ‖AB then $\frac{DE}{EC}$ is equal to (Difficult)



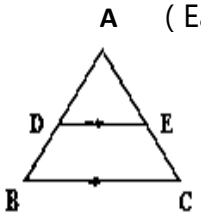
A) $\frac{DG}{GB}$ B) $\frac{GB}{DG}$ C) $\frac{AF}{DF}$ D) $\frac{AB}{AD}$

25) In the figure AB||PQ. If PQ = 1.5cm, QC = 2cm and BQ = 8cm then length of AB is, (Average)



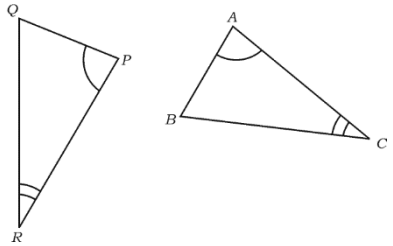
A) 10cm B) 7.5cm C) 9.5cm D) 3.5cm

26) In the figure DE||BC and if AD = x, BD = y, AE =m and CE =n, then the correct relation among the following is (Easy)



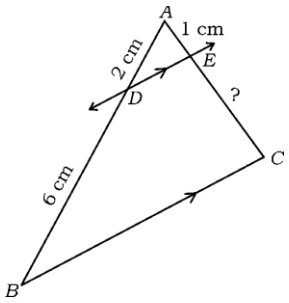
A) $\frac{X}{y} = \frac{m}{m+n}$ B) $\frac{X}{y} = \frac{n}{m}$ C) $\frac{X+y}{y} = \frac{m}{m+n}$ D) $\frac{X}{x+y} = \frac{m}{m+n}$

27) In the figure, If ΔPQR ~ ΔABC then the pair of corresponding sides among these is (Average) (MQP-1 2024-25)



A) PQ and AB B) PR and AB
C) QR and AC D) PR and BC

28) In the figure, DE||BC. If AD =2 cm, AE = 1 cm and BD = 6 cm then the length of EC is
(May 2025 Easy)



A) 2 cm B) 3 cm C) 4 cm D) 5 cm

II. Answer the following questions (1 mark)

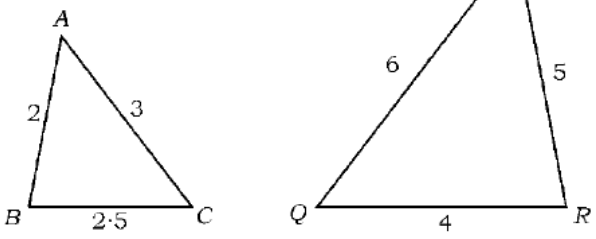
29) What are similar figures? (Easy)

30) Write two conditions for similarity of polygons. (Easy)

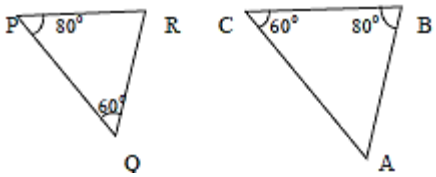
31) State Basic proportionality theorem (Thales theorem) (June/may:2022 - Easy)

32) State AAA criterion for similarity of triangles. (Easy)

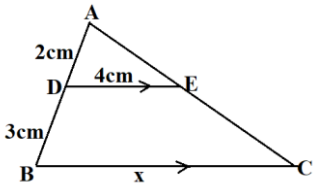
33) In the given figure, write the similarity criterion used to show that $\Delta ABC \sim \Delta QRP$.
(March 2025) (Easy)



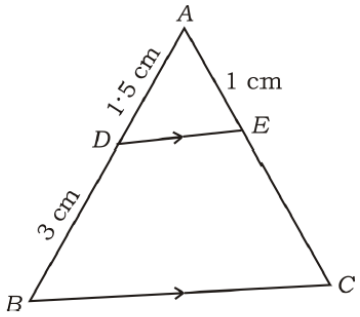
34) In the given figure, write the side of ΔPQR corresponding to the side AB of ΔABC.
June-2023 (Average)



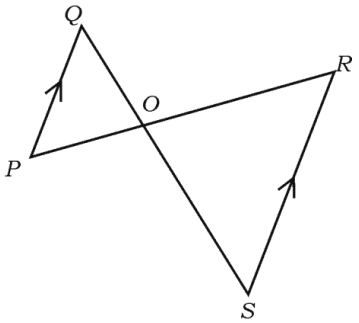
35) In the given figure, find the value of x . (Average)



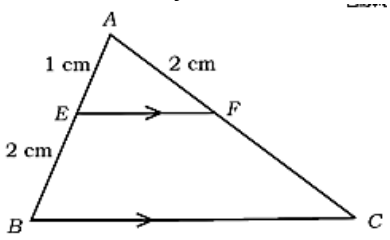
36) In triangle ABC, if DE||BC, AD = 1.5 cm, BD = 3 cm and AE = 1 cm then, find the length of EC. (Average)



37) In the figure ΔPOQ ~ Δ ROS and PQ||SR . If PQ:SR = 1 :2 then, find OS : OQ (MQP-1 2024-25) (Average)



38) In the given figure, find the length of FC (Easy)



39) A vertical pole of length 6m casts a shadow 4m long on the ground and at the same time, a building casts a shadow 28m long. Find the height of the building. (easy)

III. Answer the following questions (2 marks)

40) In the parallelogram ABCD, E is midpoint of AD and BE cuts CD at F.

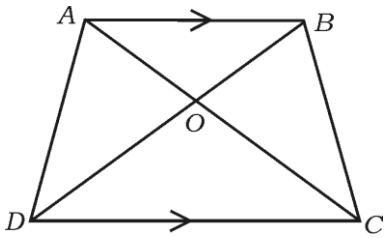
Prove that ΔABE ~ΔCFB (Average)

41) In ΔABC, DE||BC. If AD=2.4cm, AB=3 cm, AC=5cm then find AE

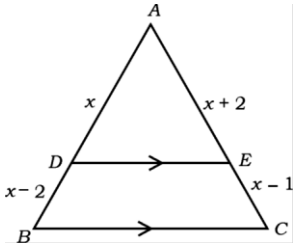
(Average)

42) Two line segments *AB* and *CD* intersect each other at a point *'O'*. Join *AC* and *BD* such that *AC* || *BD* and prove that $\Delta AOC \sim \Delta BOD$. (March 2025 Average)

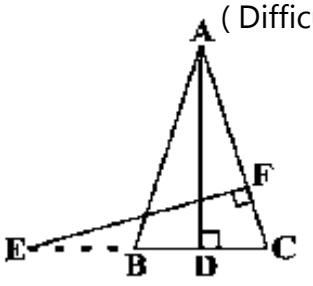
43) In the trapezium ABCD, AB || DC. Diagonals AC and BD intersect each other at O. show that $\frac{AO}{BO} = \frac{CO}{DO}$ (Difficult)



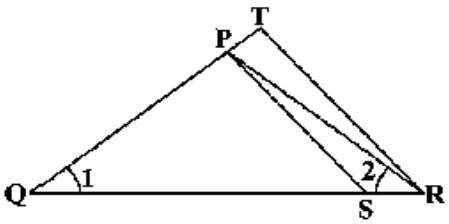
44) In triangle $\boldsymbol{ABC}$, $\boldsymbol{DE} \parallel \boldsymbol{BC}$. If $\boldsymbol{AD} = \boldsymbol{x}$, $\boldsymbol{BD} = \boldsymbol{x} - \boldsymbol{2}$, $\boldsymbol{AE} = \boldsymbol{x} + \boldsymbol{2}$ and EC $= \boldsymbol{x} - \boldsymbol{1}$then find x and hence find$\boldsymbol{AD} : \boldsymbol{DB}$. (Difficult)



45) In the figure, E is a point on side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, prove that Δ ABD ~ Δ ECF. (Difficult)



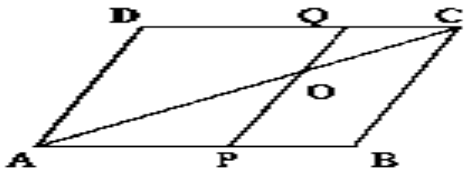
46) In the figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and ∠ 1 = ∠ 2. Show that Δ PQS ~ Δ TQR. (Average)



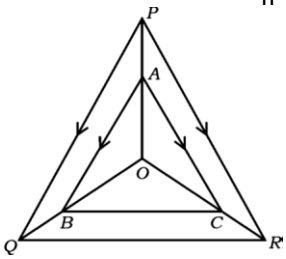
IV. Answer the following questions (3 mark)

47) D is a point on the side BC of a triangle ABC such that $\angle$ ADC = $\angle$ BAC. Show that AC^2 = BC.CD (Average)

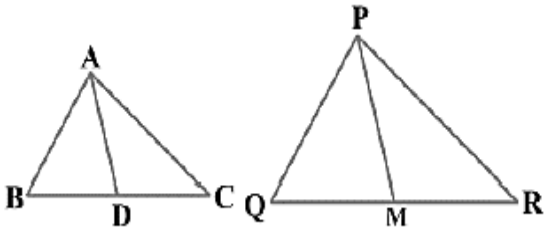
48) In the figure, ABCD is a parallelogram. If P divides AB in the ratio 2:3 and Q divides DC in the ratio 4:1 then prove that OA = 2 × OC (Average)



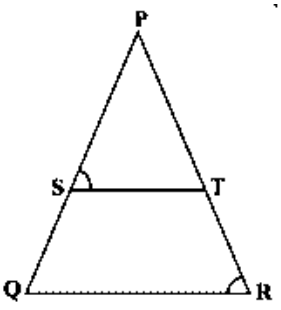
49) In the figure, A, B and C are points on OP, OQ and OR respectively such that AB || PQ and AC || PR. Show that BC || QR. (MQP 2– 2024 -25) [Easy]



50) Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of Δ PQR. Show that Δ ABC ~ Δ PQR (Average)



51) In the figure, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle$ PST = $\angle$ PRQ. Prove that PQR is an isosceles triangle. (Easy)



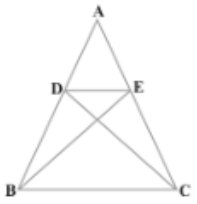
52) ABC is a right angled triangle. If $\angle BAC = 90°$ and AD⊥BC, then show that $AB^2 = BC \times BD$ (Average)

53) In an isosceles triangle PQR, PQ = PR. The angular bisector of angle P meets QR at 'O'.

Prove that $\frac{OQ}{OR} = 1$ (Difficult)

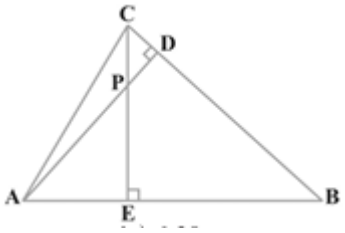
54) ABCD is a parallelogram. E is a point on BC. Diagonal BD intersects the line joining A and E at F. Prove that $DF \times EF = FB \times FA$. (Average)

55. In figure, if Δ ABE $\cong \Delta$ ACD, show that Δ ADE ~ Δ ABC. (Average)



56. E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB. (Average)

57. in the figure, altitudes AD and CE of Δ ABC intersect each other at the point P. Show that: (i) Δ AEP ~ Δ CDP (ii) Δ ABD ~ Δ CBE (iii) Δ AEP ~ Δ ADB (iv) Δ PDC ~ Δ BEC (LO – 16, Average)



58. CD and GH are respectively the bisectors of $\angle$ ACB and $\angle$ EGF such that D and H lie on sides AB and FE of Δ ABC and Δ EFG respectively. If Δ ABC ~ Δ FEG, show that: i) Δ DCB ~ Δ HGE ii) Δ DCA ~ Δ HGF. (Average)

59. In an isosceles triangle PQR, PQ = PR. The angular bisector of angle P meets QR at 'O'.
Prove that $\frac{OQ}{OR} = 1$ (MQP 2026)

V. Answer the following Questions (4 marks)

60) State and prove Basic Proportionality theorem.
(March 2018 / 2017April 2023/2025) (Average)

61) Prove that "If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (or proportion) and hence the two triangles are similar."
(March 2022 /March 2019/April 2023/March 2025) (Average)

62) Prove that "If in two triangles, sides of one triangle are proportional to (i.e., in the same ratio of) the sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar." (MQP 2025 – 03 Average)

63) Prove that "If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar."
(MQP 2025 – 02 Average)

UNIT 7:COORDINATE GEOMETRY

LO's number	Learning outcomes	Question number
20	Locate coordinates on cartesian plane. Derive formulas to establish relationships related to geometric figures in the coordinate plane, such as distance formula, section formula and midpoint formula.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18,19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36,37,47,48, 49,50,51,52,53,54,55,56,57,58,59,60, 61,62
21	Apply distance formula, section formula, midpoint formula to solve various problems.	38,39,40,41,42,43,44,45,46,

Number of questions	Easy	Average	Difficult
62	**27**	**27**	**8**

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. The coordinates of the point lying on x – axis are, [Easy]

   A) (x , 0) B) (y , 0) C) (0, x) D) (0 , y)

2. The coordinates of the point lying on y – axis are, [Easy]

   A) (x , 0) B) (y , 0) C) (0, x) D) (0 , y)

3. The perpendicular distance of the point A(2, 5) from y – axis is, [Easy]

   A) 2 units B) 5 units C) 7 units D) 3 units

4. The distance of the point (3, -4) from the x – axis is, [Easy]

   A) 3 unitsB) 5 units C) 4 units D) -4 units

5. The coordinates of origin are, [MQP 2018/2019:Easy]

   A) (1, 1) B) (2, 2) C) (0, 0) D) (3, 3)

6. The distance of the point P(a, b) from the origin (0,0) is, [April 2018, July 2022:Easy]

   A) $a^2 + b^2$ B) $\sqrt{a^2 - b^2}$ C) $\sqrt{a + b}$ D) $\sqrt{a^2 + b^2}$

7. The distance of the point P(x, y) from the origin is, [June 2019, March 2025, May 2025:Easy]

   A) $x^2 + y^2$ B) $\sqrt{x^2 - y^2}$ C) $\sqrt{x + y}$ D) $\sqrt{x^2 + y^2}$

8. The distance between the points A (5, k) and (1, 0) is 5 units. The value of 'k' is,

A) ± 3 B) - 3 C) - 2 D) ± 4 [Average]

9. The coordinates of the midpoint of the line segment joining the points (2, 3) and (4, 7) are,

[JUNE-2018 : Easy]

A) (-3, 5) B) (1, 2) C) (3, 5) D) (6, 10)

10. The coordinates of the midpoint of the line segment joining the points (-4, 2) and (-2, 6) are,

[MQP-3, 2025: Easy]

A) (3, 2) B) (-3, 4) C) (-2, 3) D) (-4, 1)

11. If the coordinates of the midpoint of the line segment joining that points A(-5, 9) and (8, 9) are P$(\frac{x}{2}, 4)$ then the value of 'x' is,

[Average]

A) 13 B) 3 C) - 2 D) – 3

12. The distance between the points A (x_1, y_1) and B (x_2, y_2) is,

[MODEL PAPER-4:2025: Easy]

A) $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ B) $\sqrt{(x_2 + x_1)^2 - (y_2 + y_1)^2}$

C) $\sqrt{(x_1 + x_2) + (y_2 + y_1)}$ D) $\sqrt{x^2 + y^2}$

13. The distance of the point (-3, 4) from the origin is, [Easy]

A) 7 B) 1 C) 5 D) -5

14. In the following, a point on the x – axis is, [Easy]

A) (-2, 0) B) (0, 2) C) (3, 3) D) (0, -2)

II. Answer the following questions. (1 Mark)

15. Find the distance between the points (0,0) and (-3, 5). [Easy]

16. Find the distance of the point (6, 8) from the origin.

[Model paper-1:2025: Easy]

17. Write the coordinates of the midpoint of the line segment joining the points A(x_1, y_1) and B(x_2, y_2).

[April-2020, MQP -2 : 2024/25 : Easy]

18. Find the coordinates of the midpoint of the line segment joining the points A(5, 4) and B(1, 4)

[MODEL PAPER-4: 2025: Easy]

19. Find the coordinates of the midpoint of the line segment joining the points (2, 3) and (4, 3)

(Oct-2024:Easy)

20. Find the coordinates of the midpoint of the line segment joining the points P(3, 4) and Q(5, 6) using midpoint formula.

[April 2022:Easy]

21. If the midpoint of the line segment joining the points (6, 3) and (4, y) are (5, 5), then find the value of 'y'.

[Average]

22. Write the coordinates of the point P which divides the line segment joining the points A(x_1, y_1) and B(x_2, y_2) internally in the ratio m_1:m_2

[Easy]

23. Write the coordinates of the point P which divides the line segment joining the points A(x_1, y_1) and B(x_2, y_2) internally in the ratio 1:1.

[Easy]

III. Answer the following questions. (2 Marks)

24. Find the distance between the points P (2, 3) and Q (4, 1) using distance formula.

[June 2019, July2022, Easy]

25. Find the distance between the points P (2, 4) and Q (8, 12) using distance formula.

[June-2018 : Easy]

26. Find the distance between the points P (5, 6) and Q (1, 3) using distance formula. [MQP-2025:Easy]

27. Find the distance between the points (-5, 7) and (-1, 3) using distance formula.

[APRIL -2020, OCT-2024 : Easy]

28. Find the distance between the points A (2, 6) and B(5, 10) using distance formula.

[April-2022:Easy]

29. Find the distance between the points A(5, -7) and B(1, -3). [Easy]

30. If the distance between the points P(2, -3) and Q(10, y) is 10 units, then find the value of 'y'.

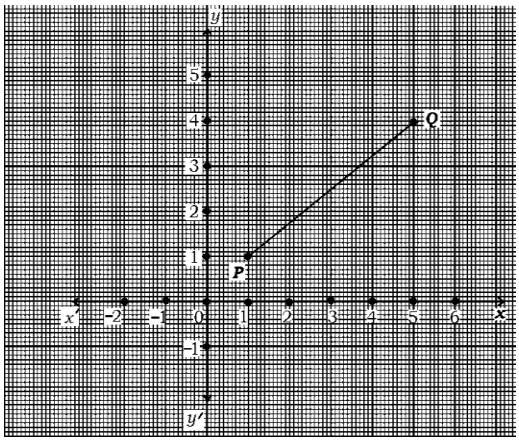
[Average]

31. If the distance between the points (3, 1) and (0, x) is 5 units, then find the value of 'x'.

[MQP-2025:Average]

32. Find the coordinates of the point P and Q from the given graph and find the length of PQ using distance formula.

[APRIL-2024 : Easy]



33. Find the ratio in which the point (-4, 6) divides the line segment joining the points (-6, 10) and (3, -8) internally.

[JULY-2022 : Average]

34. Find the coordinates of the point which divides the line segment joining the points (4, -3) and (8, 5) internally in the ratio 3 : 1.

[MARCH-2019, APRIL- 1 : 2024, JUNE- 2 : 2024 Average]

35. Find the coordinates of the point which divides the line segment joining the points (-1, 7) and (4, -3) internally in the ratio 2 : 3.

[MARCH – 2023, MARCH -1 : 2025 : AUGUST-3 : 2024, Average]

36. Find the coordinates of the point which divides the lines segment joining the points (1, 6) and (4, 3) in the ratio 1 : 2 internally.

[APRIL -2020, MODEL PAPER-3:2025, Average]

37. Find the coordinates of the point which divides the line segment joining the points (1, -3) and (8, 5) internally in the ratio 3 : 1.

[MODEL PAPER:2025, Average]

38. Find the coordinates of a point A, where AB is the diameter of a circle whose centre is (2, – 3) and B is (1, 4).

[Average]

39. A(2, 4) and B(2, 8) are the end points of the diameter AB of a circle. Find the coordinates of the center of the circle.

[May 2025: Average]

40. A circle with center (-5, 4) is passing through a point (-7, 1). Find the radius of the circle.

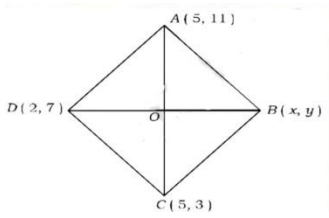
[Model paper-2025: Average]

41. If the coordinates of the midpoint of the line segment joining the points A (4, 6) and B (x, y) are (6, 5) then find the coordinates of point B. (MQP 2026, Average)

42. Find the coordinates of the point which divides the line segment joining the points (1, 6) and (4, 3) in the ratio 3 : 1 internally. (MQP 2026, Average)

43. A(x, 5) and B(2, y) are the co ordinates of the end points of the diameter AB of a circle with center P(4,3). Find the values of 'x' and 'y'. Also find the length of the diameter of the circle. (MARCH 2026, Average)

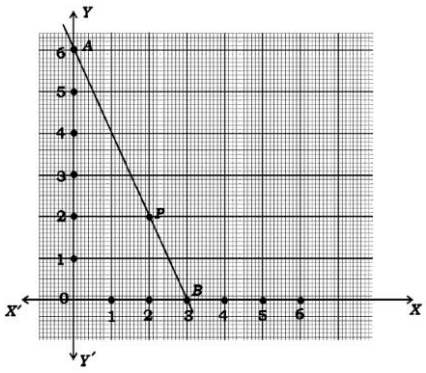
44. A(5,11) ,B(x,y), C(5,3) and D(2,7) are the vertices of a rhombus in order. Find the co ordinates of point 'B' and the length of diagonal BD. (SLP 2026, Average



IV. Answer the following questions. (3 Marks)

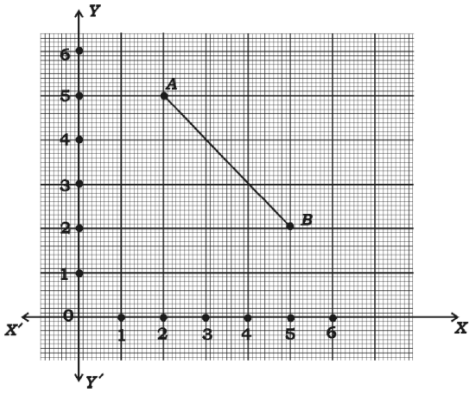
45. Find the ratio in which the point 'P' divides the line segment 'AB' in the given graph using formula.

[Model Paper-2025:Average]



46. In the figure, find the coordinates of the point which divides the line segment 'AB' internally in the ratio 1:2 using section formula.

[Model Paper-2025:Average]



47. Prove that the points A (1, 5) , B(2, 4) andC(9, -3) are collinear using distance formula.

[Average]

48. Verify whether the points A (7, -2), B(5, 1) and C(3, 4) are collinear using distance formula.

[Average]

49. Verify whether the points (5, -2) (6, 4) and(7, -2) are the vertices of an isosceles triangle.

[Average]

50. The vertices of a triangle are A(8, -4), B(9, 5) and C(0, 4). Show that it is an isosceles triangle.

[September-2020:Average]

51. The midpoint of a line segment joining the points A(x, 0) and B(0, y) is (4, 3). Find the length of AB.

(March-2023:Difficult)

52. Find the coordinates of the point of trisection of the line segment joining the points (4, -1) and (-2, -3).

(Difficult)

53. Find the coordinates of the point of trisection of the line segment joining the points (2, -2) and (-7, 4).

(Model Paper-2025:Difficult)

54. Find the ratio in which the line segment joining A(1, – 5) and B(– 4, 5) is divided by the x-axis. Also find the coordinates of the point of division.

[Average]

55. Find a relation between x and y such that the point (x, y) is equidistant from the point (3, 6) and (– 3, 4).

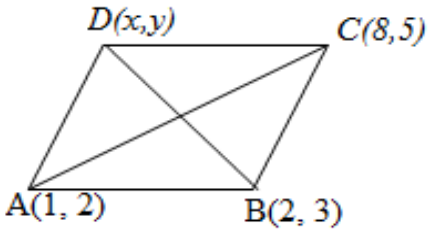
[Difficult]

56. The point P(x, y) is equidistant from the points A(7, 1) and B(3, 5). Find the relationship between x and y. If the points A, P and B are collinear, then find the coordinates of the point 'P'.

[Model Paper-2025:Difficult]

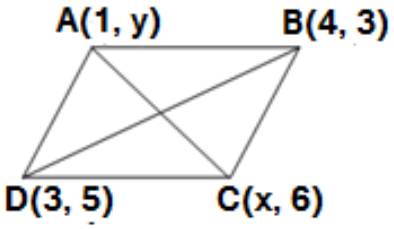
57. The coordinates of the three vertices of a parallelogram are A(1, 2), B(2, 3) and C(8, 5). Find the coordinates of the 4th vertex.

[Difficult]

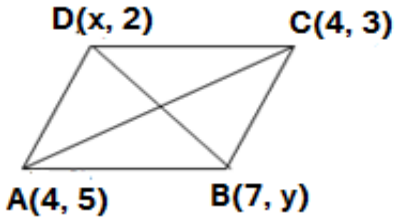


58. If A(1, y), B(4, 3), C(x, 6) and D(3, 5) are the consecutive vertices of a parallelogram, then find the value of 'x' and 'y'.

[March 2025:Difficult]



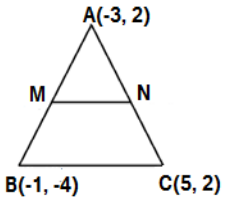
59. If A(4, 5), B(7, y), C(4, 3) and D(x, 2) are the vertices of a parallelogram, then find the values of x and y.



[Model Paper-2025:Difficult]

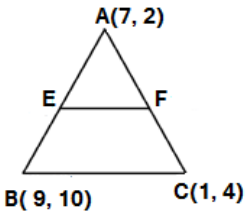
60. The vertices of a triangle ABC are A(-3, 2), B(-1, -4) and C(5, 2) and M and N are the midpoints of AB and AC respectively. Prove that 2MN = BC

[April-2019:Difficult]



61. The vertices of a triangle ABC are A(7, 2), B(9, 10) and C(1, 4) and E and F are the midpoints of AB and AC respectively. Prove that EF = $\frac{1}{2}$ BC

[Difficult]



62. Prove that the points (1, 7), (4, 2), (-1, -1) and (-4, 4) are the vertices of a square.

[Average]

UNIT 8 :INTRODUCTION TO TRIGONOMETRY

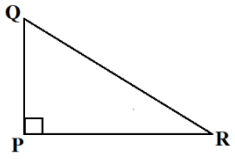
LO's number	Learning outcomes	Question number
22	Determine all trigonometric ratios for a given acute angle in a right-angled triangle and identify the relation between them. Find the value of standard angles for these ratios.	1,2,3,4,5,6,7,8,9,10,11,22,23,24,25, 26,27,28,29,30,31,32,33,34,35,36, 37,38,39,40,41,42,43,44,45,46,47, 48,49,50,51,52,68,70,72,73,74,76, 77,78,79,99,100
23	Prove trigonometric identities and use them to prove various trigonometric equations	53,54,55,56,57,58,59,60,61,62,63, 64,65,66,67,69,71,75,80,81,82,83, 84,85,86,87,89,90,91,92,93,94,95, 96,97,98,101,102,103

Number of questions	Easy	Average	Difficult
103	13	59	31

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

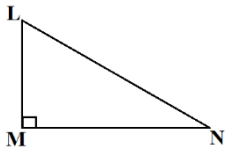
(1 Mark)

1.In the figure, cosR is equal to (LO – 22, Easy)



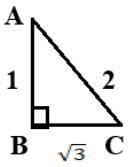
A) $\frac{PQ}{PR}$ B) $\frac{PR}{QR}$ C) $\frac{PR}{PQ}$ D) $\frac{PQ}{QR}$

2. In the figure, $\frac{LN}{MN}$= (Easy)



A) cos L B) cot L C) cosec L D) sec L

3. In the figure, the value of sinC is, [July-2021: Easy]



A) $\frac{2}{\sqrt{3}}$ B) $\frac{\sqrt{3}}{2}$ C) $\frac{1}{2}$ D) 1

4. If $sin\theta = \frac{5}{13}$, then the value of $cosec\theta$is, [Easy]

A) $\frac{13}{5}$ B) $\frac{5}{12}$ C) $\frac{13}{12}$ D) $\frac{12}{13}$

5. If ∠A = 30^0, then the value of $\sin^2 A$ is, [Average]

A) 0 B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) C) $\frac{1}{\sqrt{2}}$

6. The value of $\sin 30^0 + \cos 60^0$ is, [MQP- 2020: Easy]

A) $\frac{1}{2}$ B) $\frac{3}{2}$ C) $\frac{1}{4}$ D) 1

7. If $\sin A = \frac{1}{\sqrt{2}}$, then the value of ∠A, [MQP- 2020:Average]

A) 90^0 B) 60^0 C) 30^0 D) 45^0

8. If $cosec\theta = \frac{5}{3}$, then the value of$sin\theta$ is, [Easy]

A) $\frac{5}{3}$ B) $\frac{3}{5}$ C) $\frac{3}{4}$ D) $\frac{5}{4}$

9. If $13cos\theta = 12$, then the value of$sec\theta$is, [Average]

A) $\frac{12}{5}$ B) $\frac{13}{5}$ C) $\frac{12}{13}$ D) $\frac{13}{12}$

10. The value of $\sec^2 26^0 - \tan^2 26^0$is, [Average]

A) $\frac{1}{2}$ B) 0 C) 2 D) 1

11. The value of $\sin 45^0 \times \cos 45^0$is, [Average]

A) $\frac{1}{\sqrt{2}}$ B) $\frac{\sqrt{3}}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{2}$

12. The value of $\tan 45^0 \times \cot 45^0$is, [Average]

A) $\sqrt{3}$ B) 2 C) 1 D) $\frac{1}{\sqrt{3}}$

13. If $2sin2\theta = \sqrt{3}$, then the value of'θ'is, [MQP 1 -2021:Average]

A) 90^0 B) 60^0 C) 30^0 D) 45^0

14. If $sin\theta = \frac{x}{y}$, then the value of $cos\theta$is, [MQP 1- 2021: Difficult]

A) $\frac{y}{\sqrt{y^2-x^2}}$ B) $\frac{y}{x}$ C) $\frac{x}{\sqrt{y^2-x^2}}$ D) $\frac{\sqrt{y^2-x^2}}{y}$

15. If $\sin A + \sin^2 A = 1$, then the value of $\cos^2 A + \cos^4 A$ is, [MQP 1- 2021:Difficult]

A) $\frac{1}{2}$ B)2 C) 3 D) 1

16. If $sin\theta = \frac{3}{5}$, then the value of $(1 - cos^2\theta)$ is, [MQP-2 2021:Average]

A) $\frac{9}{25}$ B) $\frac{6}{10}$ C) $\frac{9}{5}$ D) $\frac{25}{9}$

17. The correct relation among the following is, [July 2021:Average]

A) $tan^2\theta = sec^2\theta + 1$ B) $sin\theta = \frac{1}{Sec\theta}$

C) $cot\theta = \frac{Sin\theta}{Cos\theta}$ D) $sin^2\theta + cos^2\theta = 1$

18. The value of $(\sin 30^0 + \cos 60^0 - \tan 45^0)$ is, [July 2021:Average]

A) 0 B) – 1 C) 2 D) 1

19. $(3 + \sec^2 A)$ is equal to, [July- 2021:Average]

A) $4 + \tan^2 A$ B) $4 + \cot^2 A$ C) $2 + \cot^2 A$ D) $3 + \cot^2 A$

20. The value of (sin A × cosecA) is, [July- 2021:Average]

A) 2 B) 1 C) $-\frac{1}{2}$ D) $\frac{\sqrt{3}}{2}$

21. $(1 + tan^2\theta)$is equal to, [June- 2022:Average]

A) $cosec^2\theta$ B) $cos^2\theta$ C) $sec^2\theta$ D) $cot^2\theta$

22. $(sec^2\theta - 1)(1 - cosec^2\theta)$is equal to, [Difficult]

A) – 1 B) $cot\theta$ C) 0 D) $cosec\theta$

23. $cot^2\theta - \frac{1}{Sin^2\theta}$is equal to, [Average]

A) – 1 B) 1 C) $sin^2\theta$ D) $cos^2\theta$

24. If (secA – tanA) = k, then (secA + tanA) is equal to, [Average]

A) $1 - \frac{1}{k}$ B) 1 – k C) 1 + k D) $\frac{1}{k}$

25. If 8tan P = 15, then sin P – cos P is equal to, [, Average]

A) $\frac{8}{17}$ B)$\frac{17}{8}$ C) $\frac{1}{17}$ D) $\frac{7}{17}$

26. If $\tan^2\theta = \frac{8}{7}$ where $\theta$is an acute angle,then the value of $\frac{(1+sin\theta)(1-sin\theta)}{(1+cos\theta)(1-cos\theta)}$ is, [Difficult]

A) $\frac{8}{7}$ B)$\frac{7}{8}$ C) $\frac{7}{4}$ D) $\frac{64}{49}$

II. Answer the following questions. (1 Mark)

27. In ΔABC, if ∠ABC = 90^0 and∠ACB = 30^0, then find AB:AC. [June 2019:Difficult]

28. If $sin\theta = \frac{3}{5}$and$cos\theta = \frac{4}{5}$, then find the value of $sin^2\theta + cos^2\theta$ [MQP 1 2020:Average]

29. Find the value of cosec60^0 + sec30^0. [Easy]

30. Find the value of sin90^0 + tan45^0 [MQP 2 2020:Average]

31. In ΔABC, if AB⊥BC, ∠ACB = 30^0 and AB = 15m, then find the measure of BC. [SLP 2020:Difficult]

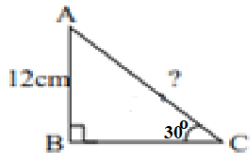
32. Find the value of tan45^0 + cot45^0. [LO – 22, June 2020: Easy]

33. If $cos\theta = \frac{24}{25}$,then find the value of $sec\theta$. [September 2020:Easy]

34. If $\sin^2 A = 0$, then find the value of cosA. [September 2020:Easy]

35. If 15cotA = 8, then find the value of tanA. [Average]

36. In the figure, ABC is a right angled triangle. If ∠C = 30^0 and AB = 12cm then find the measure of AC. [LO – 22, June 2022:Average]



37. If $x \tan 45° \cdot \sin 30° = \cos 30° \cdot \tan 30°$, then find the value of x. [Average]

38. Find the value of $5\tan^2 A - 5\sec^2 A + 1$. [Difficult]

39. What is the value of sinA · cosecA? [Average]

40. What is the value of tanA · cotA – cosA · secA? [Difficult]

41. Find the value of $\tan^2 45^0 - \sin^2 30^0$. [Average]

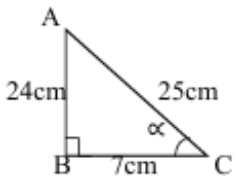
42. If sinA = cosA, then what is the value of A? [Average]

III. Answer the following questions. (2 Marks)

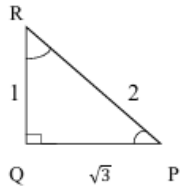
43. If sin θ = $\frac{12}{13}$and cos θ =$\frac{5}{13}$, then find the value of sec θand tan θ [Easy]

44. If $cosec\theta = \frac{13}{12}$and $\tan\theta = \frac{5}{12}$, then find the value of $\cos\theta$ [Average]

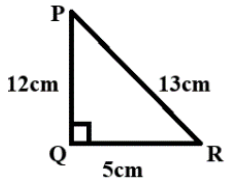
45. In the adjoining figure, find the value of sin∝and cos∝. [Average]



46. In the figure, find the value of sinP and tanR. [SLP 2023:Easy]



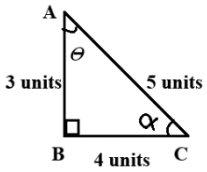
47. In the figure, find the value of tanP –cotR. [LO – 22, Average]



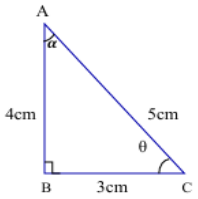
48. In the figure,∠ABC = 90^0. Write the values of the following. [March 2025:Easy]

i) $sin\alpha$

ii) $tan\theta$



49. In the figure, find the value of sin∝ + cosθ [Average]



50. If $sin\ A = \frac{3}{5}$ then find the value of tan A [Average]

51. Evaluate : $2tan^245^0 + cos^230^0 - sin^260^0$. [MQP 2019:Average]

52. If $\sqrt{3}$tan θ =1 andθis an acute angle, find the value of sin 3θ + cos 2θ. [April 2023:Average]

53. Show that $(tanA \times sinA)+cosA = secA$. [June 2019:Average]

54. If $cos\theta$ = 0.6, then show that 5 $Sin\theta$ – 3 $tan\theta$ = 0. [MQP 2020: Difficult]

55. Prove that $(sec^4\theta - sec^2\theta) = tan^2\theta + tan^4\theta$. [MQP 2020:Difficult]

56. Prove that cosecA (1- cosA) (cosecA + cotA) = 1. [September 2020: Difficult]

57. Prove that $tan^2\theta - sin^2\theta = tan^2\theta.sin^2\theta$ [, Difficult]

58. Prove that $cot^2\theta - cos^2\theta = cot^2\theta.cos^2\theta$ [Difficult]

59. Prove that $sin30^0 + cos60^0 + tan45^0 = Sec60^0$. [Average]

60. Prove that $\frac{sin30^0+cos60^0}{cosec30^0 - cos45^0} = sin90^0$. [April 2024:Average]

61. Find the value of $\frac{cos45^0.\ sin45^0}{sec30^0 - cot60^0}$ [Average]

62. Prove that $\frac{1+cosA}{1-cosA} = (cosecA + cotA)^2$ [April 2019:Average]

63. Prove that $\frac{1+sinA}{1-sinA} = (secA + tanA)^2$ [Difficult]

64. Prove that $\frac{cosA}{1+sinA} + \frac{1+sinA}{cosA} = 2secA$ [April 2025:Average]

65. Prove that $\frac{sinA}{1+cosA} + \frac{1+cosA}{sinA} = 2cosecA$ [Average]

66. Prove that $\frac{cosA - sinA.cosA}{cosA + sinA.cosA} = \frac{cosecA - 1}{cosecA + 1}$ [April 2024:Average]

67. Prove that $sin30^0.cos60^0 + cos30^0.sin60^0 = sin90^0$ [July 2024:Average]

68. If $\frac{\sqrt{3}SecA}{CosecA} = 1$, then find the value of A. [July 2024:Average]

69. Prove that secA (1- sinA) (secA + tanA) = 1 [Difficult]

70. If 2sinθ = 1, then find the value of $cos^2 60^0 + sec^2 30^0$ [Average]

71. Prove that $tan^2\theta + cot^2\theta = sec^2\theta + cosec^2\theta - 2$ [Difficult]

72. Evaluate: $4sin30^0 + cos60^0.sec60^0 - 3tan45^0$. [Average]

73. Evaluate : $6cos60^0 - sin30^0 + sin^2 45^0 + cos^2 45^0$. [Average]

74. Evaluate :$\frac{5cos^2 60 + 4sec^2 30 - tan^2 45}{sin30^0 + cos30^0}$ [March 2025:Average]

75. Prove that $\frac{sec60^0}{cot45^0} - \frac{2sin90^0}{cos\ 0^0} + \frac{tan45^0}{cosec30^0} = \frac{1}{2}$ [Average]

76. If $sin\theta = \frac{1}{3}$, then find the value of $(2cot^2\theta + 2)$ [Average]

77. Find the value of $2cos^2\theta + \frac{2}{1+cot^2\theta}$ [Difficult]

78. Find the value of $\frac{5}{cot^2\theta} - \frac{5}{cos^2\theta}$ [Difficult]

79. If $sec^2 A(1+sinA)(1-sinA) = k$, then find the value of 'k' [Average]

IV. Answer the following questions. (3 Marks)

80. Prove that $\frac{sinA}{1-cotA} + \frac{cosA}{1-tanA} = sinA + cosA$. [MQP 1 2021:Difficult]

81. Prove that $\frac{1+cosA}{sinA} - \frac{sinA}{1+cosA} = 2cotA$. [SLP 2020:Average]

82. Prove that $\frac{1+sinA}{cosA} - \frac{cosA}{1+sinA} = 2tanA$. [Average]

83. Prove that $\frac{cos\theta - 2cos^3\theta}{2sin^3\theta - sin\theta} = cot\theta$. [MQP 1 2021:Difficult]

84. Prove that $\frac{sin\theta-2sin^3\theta}{2cos^3\theta-cos\theta} = tan\theta$. [Difficult]

85. Prove that $\frac{sinA-cosA}{sinA+cosA} + \frac{sinA+cosA}{sinA-cosA} = \frac{2}{2sin^2A-1}$. [MQP 2 2021:Difficult]

86. If x = p tanθ + q secθand y = p secθ + q tanθ, then prove that $x^2 - y^2 = q^2 - p^2$.
[June 2020:Difficult]

87. Prove that (secθ – cosθ){(cosecθ – sinθ)(tanθ + cotθ)} = 1. [MQP-2 2021:Difficult]

88. Prove that $\frac{secA+tanA-1}{tanA-secA+1} = \frac{1+sinA}{cosA}$. [June 2024:Difficult]

89. Prove that $\frac{sin\theta}{1-cos\theta} + \frac{tan\theta}{1+cos\theta} = cot\theta + sec\theta.cosec\theta$. [Difficult]

90. Prove that $\frac{tanA-sinA}{tanA+sinA} = \frac{secA-1}{secA+1}$. [Difficult]

91. Prove that $(sinA + cosecA)^2 + (cosA + secA)^2 = 7 + tan^2A + cot^2A$.
[MQP1 2024:Average]

92. Prove that secθ(1 – sinθ)(secθ +tanθ) = 1. [March 2022:Average]

93. Prove that cosecA(1 – cosA)(cosecA + cotA) = 1. [Average]

94. Prove that (cosecA – sinA)(secA – cosA) = $\frac{1}{tanA+cotA}$ [Difficult]

95. Prove that $\sqrt{\frac{1+cosA}{1-cosA}} = cosecA + cotA$. [April 2023:Average]

96. Prove that $\sqrt{\frac{1+sinA}{1-sinA}} = secA + tanA$. [Average]

97. Prove that(secA – cosA)(cotA + tanA) = tanA.secA. [June 2023:Average]

98. Prove that (cosecA – sinA)(tanA + cotA) = cotA.cosecA. [, Average]

99. If $tan\theta = \sqrt{3}$, then find the value of $\frac{4sin\theta-cos\theta-1}{4sin\theta+cos\theta+1}$. [Difficult]

100. Evaluate :$\frac{2cos(90^0-30^0)+tan45^0-\sqrt{3}cosec60^0}{\sqrt{3}sec30^0+2cos60^0+cot45^0}$ [June 2022: Difficult]

101. Prove that $\frac{cos^3\theta+sin^3\theta}{cos\theta+sin\theta} + \frac{cos^3\theta-sin^3\theta}{cos\theta-sin\theta} = 2$. [, Difficult]

102. Prove that: $sec\ A\ (1 - sin\ A)\ (sec\ A + tan\ A)\ (\sqrt{(\mathbf{1} + \boldsymbol{cos\ A})(\mathbf{1} - \boldsymbol{cos\ A})})$ cosecA
[Average]

103. Prove that $\frac{sin\theta}{1-cos\theta} + \frac{tan\theta}{1+cos\theta} = cot\theta + sec\theta.cosec\theta$
[Average]

UNIT 9: SOME APPLICATIONS OF TRIGONOMETRY

LO's number	Learning outcomes	Question number
24	Apply trigonometric ratios and angles to solve problems involving heights and distances in daily-life situations.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18,19,20,21,22,23,24,25,26, 27,28,29,30,31,32,33,34,35,36,37, 38,39,40,41,42,43,44,45,46,47,48, 49

Number of questions	**Easy**	**Average**	**Difficult**
49	**11**	**19**	**19**

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet (1mark)

1. The length of shadow of a tower on level ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of sun is, (Easy)

A) 45° B)30° C)60° D)90°

2. If a tower of height 6m casts a shadow of length $2\sqrt{3}$ m on the ground, then the angle of elevation of the sun is, (Easy)

A) 60^0 B) 45^0 C) 90^0 D) 30^0

3. The ratio of the height of a tower and the length of its shadow on the ground is $\sqrt{3}$:1 . The angle of elevation of Sun is, (Easy)

A) 30^0 B) 45^0 C) 60^0 D)75^0

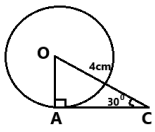
4. At some time of the day, if the length of the shadow of a tower is equal to its height then the angle of elevation of the sun is, (Easy)

A) 30° B)60° C)90° D)45°

5. In a circle with centre 'O' AC is a tangent at 'A'. If OC=4cm and ∠ACO=30° then the radius of the circle is,

A) $\sqrt{3}\ cm$ B) $4\sqrt{3}\ cm$ C) $2\ cm$ D) $3\ cm$

[MQP 2021 Difficult]



II. Answer the following questions (1 mark)

6. A person standing at a distance of 10m away from the foot of building observes its top at an angle of 45^0. Find the height of the building. (Easy)

7. Name the angle formed by the line of sight with the horizontal when the line of sight is above the horizontal level. (Easy)

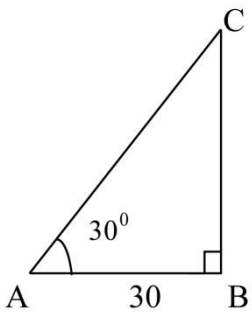
8. Name the angle formed by the line of sight with the horizontal when the line of sight is below the horizontal level. (Easy)

9. A ladder makes an angle of 60^0 with the ground, when placed against a wall. If foot of the ladder is 6m away from the wall, find the length of ladder. (Easy)

10. At certain time in a day, if the height and length of the shadow of a tree are equal, then find the angle of elevation of sun. (Easy)

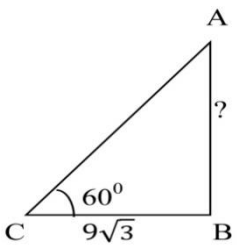
III. Answer the following questions (2 mark)

11. The angle of elevation of the top of a tower from a point on the ground which is 30m away from the foot of the tower is 30^0. Find the height of the tower. (MQP 2019, Easy)



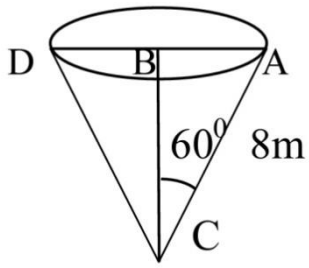
12. The angle of elevation of the top of a vertical tower on a level ground from a point at a distance of $9\sqrt{3}$ m from its foot on the same ground is 60^0. Find the height of the tower.

(MQP 2019 , Easy)

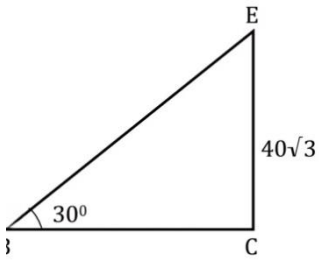


13. Find the diameter of the circular base of right circular cone whose slant height is 8cm and semi vertex angle is 60^0.

(MQP 2020 , Average)



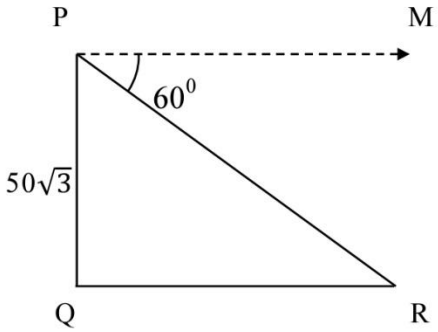
14. A person standing on a ground observes the top of a windmill of height $40\sqrt{3}$ m at an angle of elevation 30^0. Find the distance between the person and the foot of windmill. (Average)



B

15. From the top of a building of height $50\sqrt{3}$m a person observes an object on the ground at angle of depression 60^0. Find the distance of the object from the building.

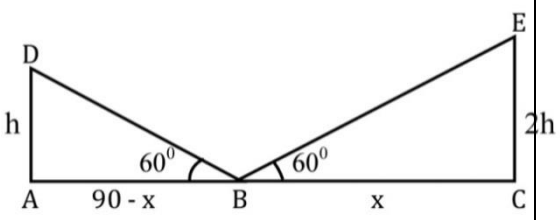
(MQP 2020 , Average)



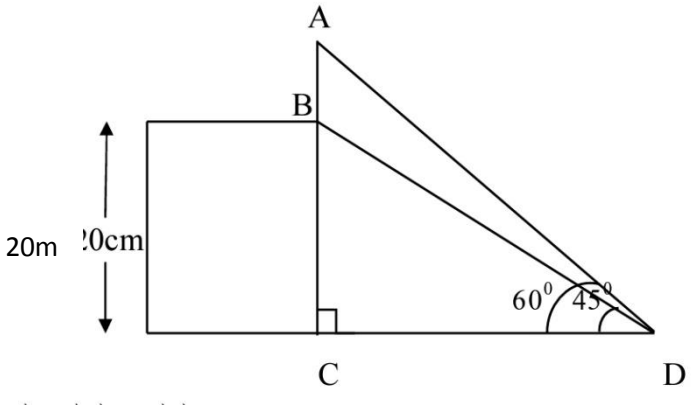
IV. Answer the following questions (3/4 mark)

16. Two windmills of height 50m and $40\sqrt{3}$m are on either side of the field. A person observes the top of the windmills from a point in between them. The angle of elevation was found to be 45^0 and 30^0. Find the distance between the windmills. (June 2019 , Average)

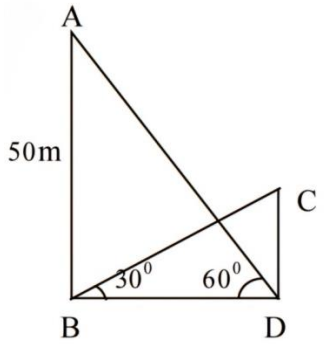
17. Two vertical poles are on either side of the road. The width of the road is 90 feet and heights of the pole are in the ratio 1:2. From a point between them on the road the angle of elevation to the top of the poles is 60^0. Find the heights of the poles. (SLP 2020 , Average)



18 .From a point on the ground, the angles of elevation of the top and bottom of a transmission tower fixed at the top of a 20m high building are 60^0 and 45^0 respectively. Find the height of the transmission tower. (MQP-1 2021 , Average)

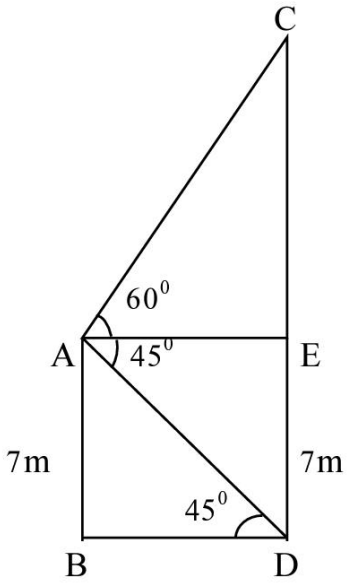


19. A tower and a building are standing vertically on the same level ground. The angle of elevation of the top of the building from the foot of the tower is 30^0 and the angle of elevation of the top of the tower from the foot of the building is 60^0. If the tower is 50m high, find the height of the building. (MQP 2022 , Average)



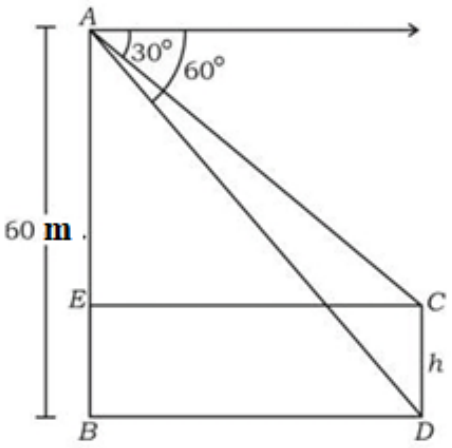
20. A cable tower and a building are standing vertically on the same level ground. From the top of the building which is 7m high, the angle of elevation of the cable tower is 60^0 and the angle of depression of its foot is 45^0. Find the height of the tower.

(June 2022 , Average)



21. A tower and a pole stand vertically on the same level ground. It is observed that the angles of depression of the top and foot of the pole from the top of tower of height 60 m is 30^0 and 60^0 respectively. Find the height of the pole.

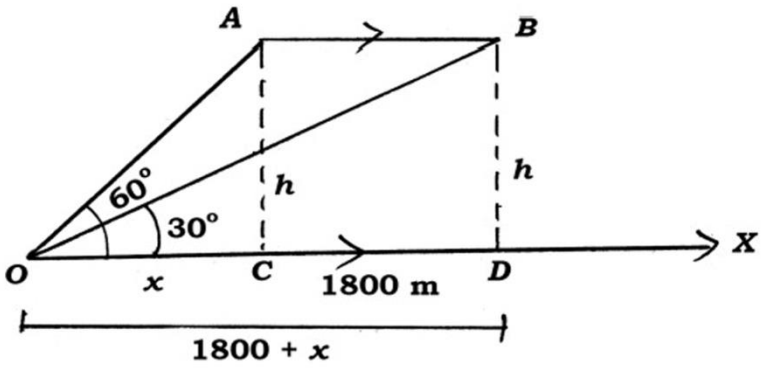
(June 2020 , Average)



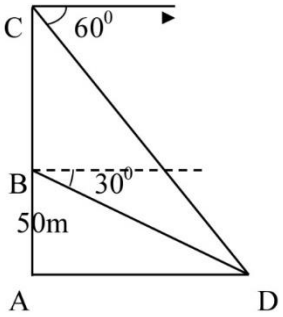
22. An aircraft flying parallel to the ground in the sky from the point A through the point B is observed, the angle of aircraft at A from a point on the level ground is 60^0, after 10 seconds it is observed that the angle of elevation of aircraft at B is found to be 30^0 from the same point. Find at what height the aircraft is flying, if the velocity of aircraft is 648 km/hr.

(Take $\sqrt{3}$ =1.73)

(September 2020 , Average)

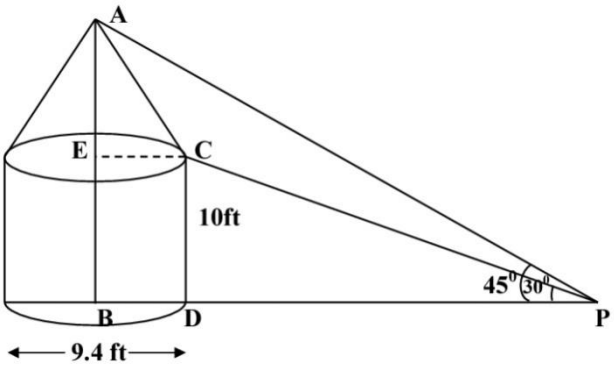


23. The angle of depression from the top of a vertical tower to a point on the ground is found to be 60^0 and from a point 50m above the foot of the tower the angle of depression to the same point is found to be 30^0 as shown in the figure. Find the height of the tower.



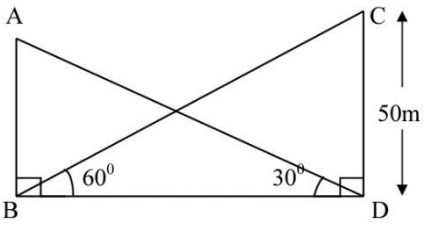
(MQP 2022 , Average)

24. A building on the ground is in the form of a conical tomb surmounted by a cylinder of height 10 feet as shown in the figure. From a point P on the same ground the angle of elevation of the top edge of the cylinder is found to be 30^0 and the angle of elevation to the vertex of the cone is found to be 45^0. If the diameter of the outer edge of circular base of the cylinder is 9.4 feet, find the height of the conical shaped tomb. (LO – 24, SLP 2022 , Average)



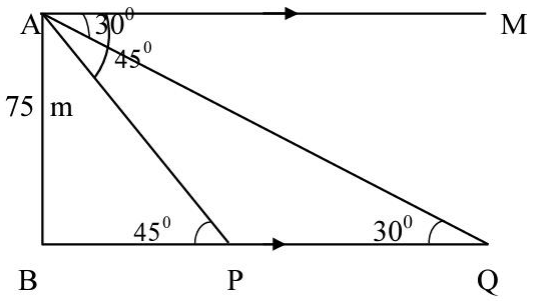
25. The angle of elevation of the top of a building from the foot of a tower is 30^0 and the angle of elevation of the top of the tower from the foot of the building is 60^0. Both the tower and building are on the same level. If the height of the tower is 50m, then find the height of the building.

(April 2022 , Average)

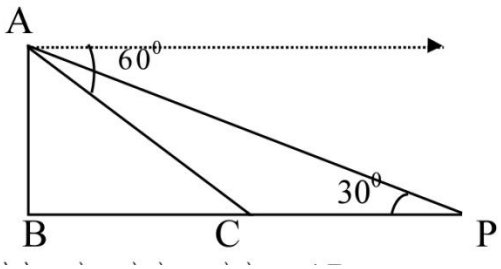


26. As observed from the top of a 75 m high light house from the sea level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light house, then find the distance between the two ships.

(MQP 2023 , April 2020- Average)

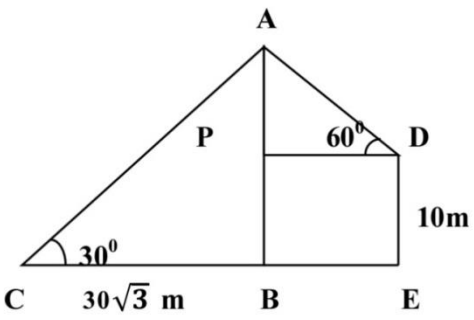


27.As observed from the top of a building standing vertically on the ground, the angle of depression of a point 'C' on the ground is 60°. From the foot (B) of the building when moved through point 'C' in a straight line and observe the top of the building, from point 'P', if the angle of elevation has to be 30^o (as shown in the figure) then show that the distance moved from 'C' to 'P' is twice the distance BC. (MQP 2023 , Average)

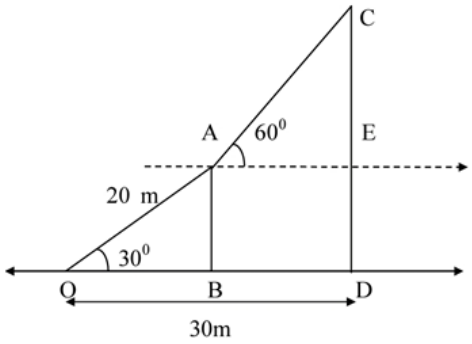


28.A tower and a building are standing vertically on a level ground. The angles of elevation of the top of the tower from a point on the same ground and from the building are found to be 30^0 and 60^0 respectively. If the distance of the point from the foot of the tower is $30\sqrt{3}$ m and height of the building is 10m, then find the distance between the foot of the tower and building and also the distance between their tops.

(SLP 2023 , Average)

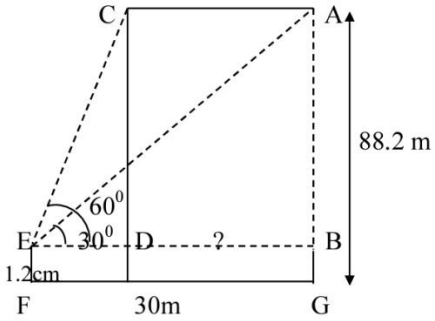


29.In the given figure, a rope is tightly stretched and tied from the top of a vertical pole to a peg on the same level ground such that the length of the rope is 20 m and the angle made by it with the ground is 30°. A circus artist climbs the rope, reaches the top of the pole and from there he observes that the angle of elevation of the top of another pole on the same ground is found to be 60°. If the distance of the foot of the longer pole from the peg is 30 m, then find the height of this pole. (Take $\sqrt{3}$ = 1·73)

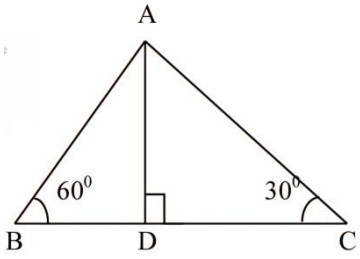


(April 2023 , Difficult)

30. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60^0. After some time the angle of elevation reduces to 30^0 (see the figure). Find the distance travelled by the balloon during the interval. (June 2023 , Average)

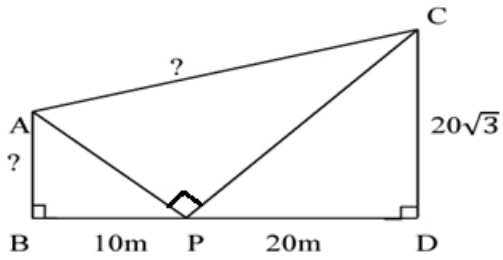


31 .In Δ ABC, AD ⊥ BC. If ∟ABC = 60°, ∟ACB = 30° and BC = 36 cm, then find measures of AB, AC and AD. (MQP 2024 , Average)

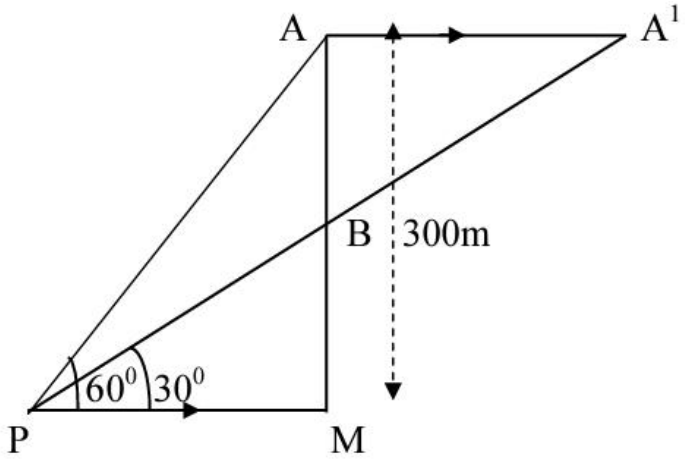


32. In the figure, the poles AB and CD of different heights are standing vertically on a level ground. Calculate the angle of elevation from a point P on the line joining the foot of the poles on the level ground, to the tops of the poles. The height of CD and the distance PD are $20\sqrt{3}$ m and 20 m respectively. If $\angle APC = 90°$ and BP is 10 m, then find the length of the pole AB and the distance AC between the tops of the poles.

(Difficult)

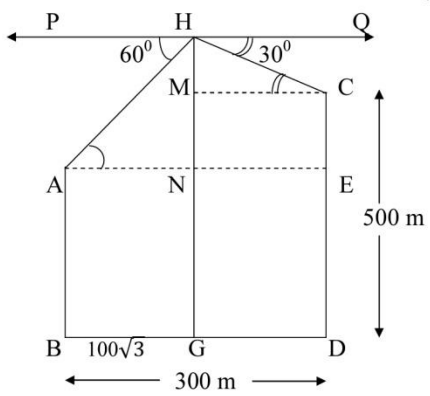


33.Two kites 'A' and 'B' are flying one below the other above the horizontal ground as shown in the figure. Kite 'A' is flying 300 m above the ground. The angles of elevation of kites 'A' and 'B' as observed from a point 'P' on the ground are 60° and 30° respectively. Find the distance between the two kites (AB). After some time when the thread of kite 'A' is released, it moves horizontal to the ground and reaches the point 'A^{I} ' in the sky. If P, B, A^{I} are in the same line, then find the distance between the kites ($A^{1}B$). (LO – 24, June 2024 , Difficult)

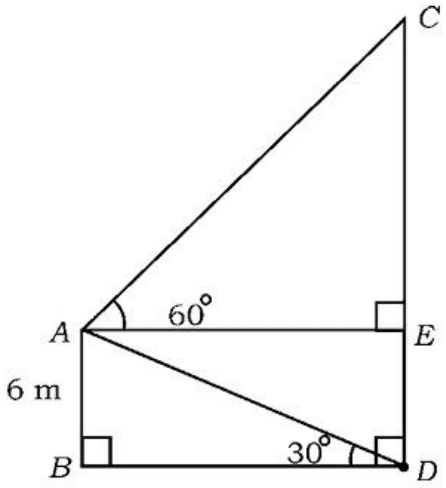


34.There are two vertical towers on a level ground which are 300m apart. A soldier in an helicopter above the ground observes the top of the towers and he found the angles of depression to be 60^0 and 30^0 as shown in the figure. If the height of the taller tower is 500 m and the distance between the foot of the shorter tower and the foot of the altitude from the helicopter to the ground is $100\sqrt{3}$ m, then find the height of the shorter tower.

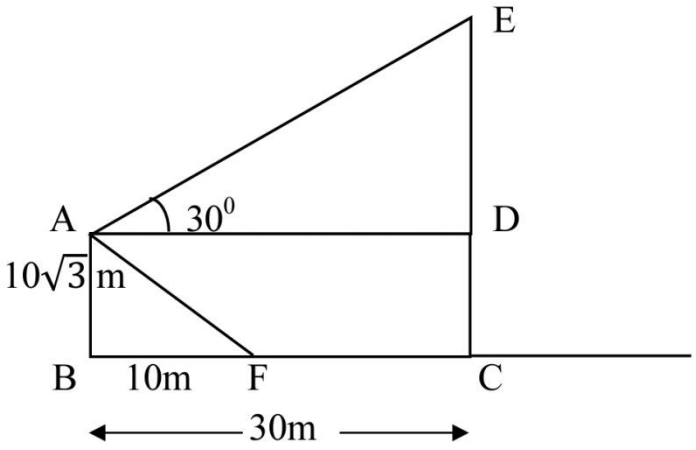
(Exam-3 2024, Difficult)



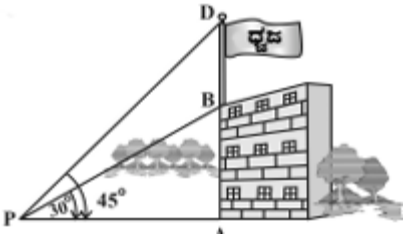
35. A pole and a tower are standing vertically on a level ground. The height of the pole is 6m and the angle of elevation to the top of the pole from the bottom of the tower is 30^0.The angle of elevation to the top of the tower from the top of the pole is 60^o as shown in the figure . Find the height of the tower (CD) . Also find the distance (AC) between the top of the pole and the top of the tower (April 2025 , Difficult)



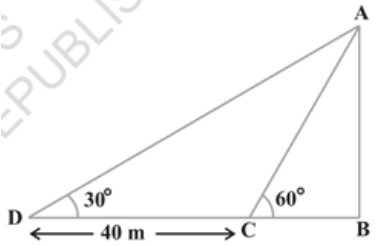
36.The lighthouse [AB] of height $10\sqrt{3}$ m stands vertically on a sea shore. A tower [CE] and a ship [F] are standing 30m and 10m away from the foot of the lighthouse respectively. The angle of elevation of the top of the tower from the top of the lighthouse is 30^0 . Find the height of the tower and distance between the top of the lighthouse to the top of the tower [AE]. Also find the angle of depression formed from the top of the lighthouse to the ship. (Difficult)



37. From a point P on the ground the angle of elevation of the top of a 10 m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff and the distance of the building from the point P. (You may take $\sqrt{3}$ = 1.732) [Difficult]

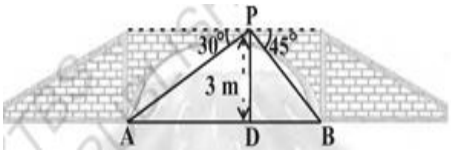


38. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60°. Find the height of the tower. [Difficult]



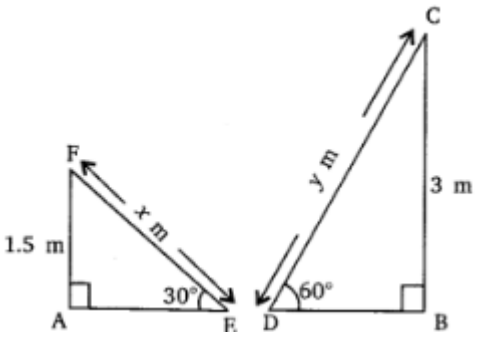
39. The angles of depression of the top and the bottom of an 8 m tall building from the top of a multi-storied building are 30° and 45°, respectively. Find the height of the multi storied building and the distance between the two buildings. [Difficult]

40. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45°, respectively. If the bridge is at a height of 3 m from the banks, find the width of the river.



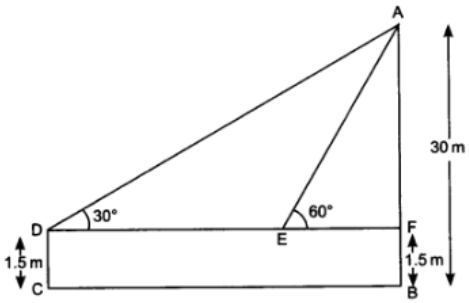
[Difficult]

41. A contractor plans to install two slides for the children to play in a park. For the children below the age of 5 years, she prefers to have a slide whose top is at a height of 1.5 m, and is inclined at an angle of 30° to the ground, whereas for elder children, she wants to have a steep slide at a height of 3m, and inclined at an angle of 60° to the ground. What should be the length of the slide in each case?

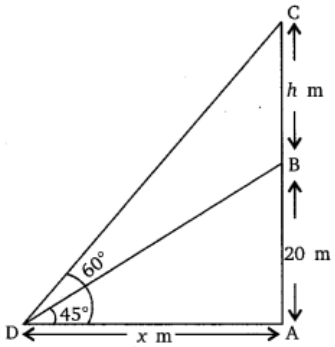


[Difficult]

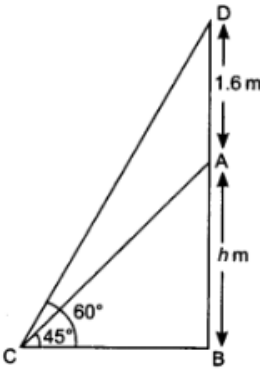
42. A 1.5 m tall boy is standing at some distance from a 30 m tall building. The angle of elevation from his eyes to the top of the building increases from 30° to 60° as he walks towards the building. Find the distance he walked towards the building. [LO – 24, Difficult]



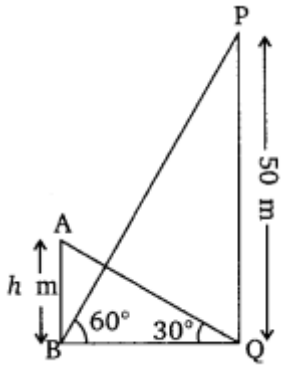
43. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower. [Difficult]



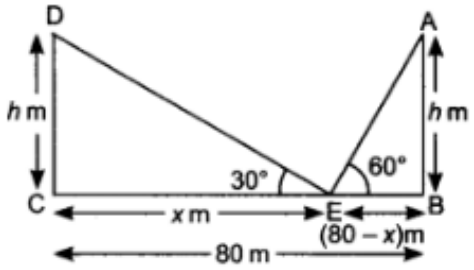
44. A statue, 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal. [Difficult]



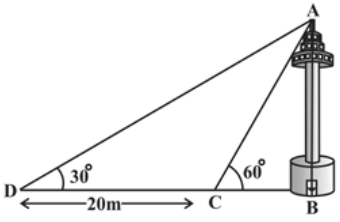
45. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, find the height of the building. [Difficult]



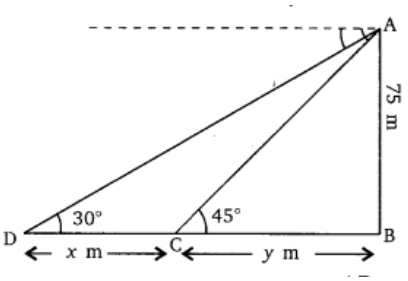
46. Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30°, respectively. Find the height of the poles and the distances of the point from the poles. [Difficult]



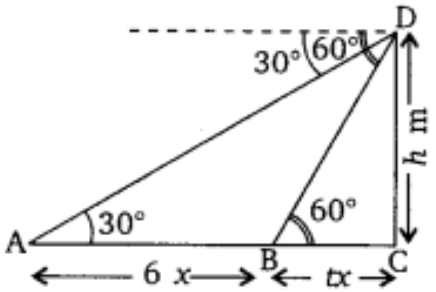
47. A TV tower stands vertically on a bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of the tower is 60°. From another point 20 m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the top of the tower is 30° . Find the height of the tower and the width of the canal. [Difficult]



48. As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships. [Difficult]



49. A straight highway leads to the foot of a tower. A man standing at the top of the tower observes a car at an angle of depression of 30°, which is approaching the foot of the tower with a uniform speed. Six seconds later, the angle of depression of the car is found to be 60°. Find the time taken by the car to reach the foot of the tower from this point. [Difficult]



UNIT 10: CIRCLES

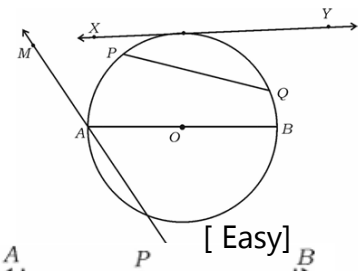
LO's number	Learning outcomes	Question number
17	Define tangents and secants and identify them.	1,2,3,4,7,8,20,21,24
18	Logically prove that the length of tangents drawn from and external point to a circle are equal and apply theorem to solve various problems	10,12,13,17,18,19,23,27,28,29,33,36, 37,39,40,42,43,44,48,50,51,
19	Prove that the radius of a circle is perpendicular to the tangent at the point of contact logically and apply theorem to solve various problems	5,6,9,11,14,15,16,22,25,26,30,31,32, 34,35,38,41,45,46,47,49,52,53

No. of Questions	Easy	Average	Difficult
53	**19**	**31**	**3**

I. Four alternatives are given for each of the following questions/incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. (1 Mark)

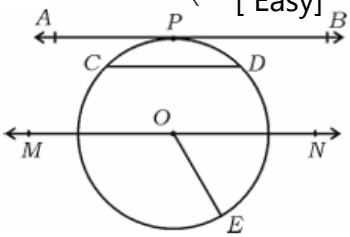
1) In the figure, secant to the circle is, [JUNE 2022, Easy]

A) AB B) PQ C) XY D) MN



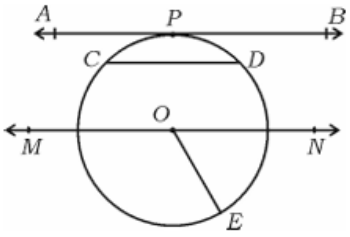
2) In the figure, the tangent to the circle is, [Easy]

A) MN B) OE C) CD D)AB (Easy)

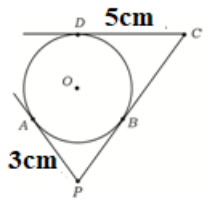


3) In the figure, point of contact is, (Easy)

A) P B) C C) D D)E



4) In the figure, PA, PC and PD are tangents drawn to the circle with centre O. If AP = 3cm, CD = 5cm then the length of PC is, [JUNE 2019, Easy]



A) 3 cm B) 5 cm C) 8 cm D) 2 cm

5)The angle between the tangent and radius drawn at the point of contact is, [LO – 19, MARCH 2022,Easy]

A)30^0 B)60^0 C) 90^0 D)180^0

6) The distance between the parallel tangents in the circle of radius 3.5cm is, [Average]

A) 7cm B)14cm C) 3.5cm D)1.75cm

7) A line intersecting a circle in 2 points is a, [JUNE 2020, Easy]

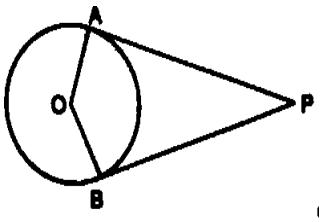
A) chord B) secant C) tangent D)radius

8) The line that intersects circle at only one point is a, [APRIL 2020, Easy]

(A) tangent (B) secant (C) radius (D) Chord

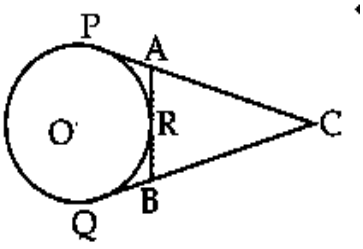
9) In the figure, PA and PB are tangents to the circle with centre O. If $\angle APB=80^0$ then $\angle AOB$ is equal to (Average)

A) 80^0 B)100^0 C)180^0 D)360^0



10) In the figure CP and CQ are tangents to the circle with centre O. ARB is another tangent at R.

If CP =11cm, BC = 7cm then length of BR is, [Average]

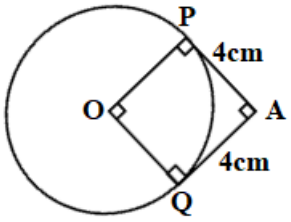


A)7 cm B)5 cm C)12 cm D) 4 cm

11) If the angle between the two radii drawn in a circle is 130°, then the angle between the tangents drawn at the ends of the radii is, [Average]

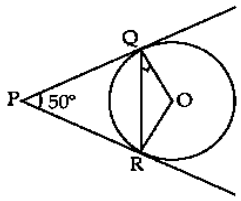
A)90^0 B)50^0 C)70 D)40^0

12) In the figure, O is the centre of a circle. AP and AQ are tangents drawn to the circle from the point A such that $\angle PAQ = 90°$. If AP = 4cm then the radius of the circle is, (Average)



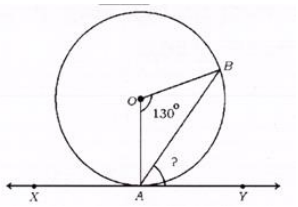
A)2 cm B)3cm C) 4 cm D)1cm

13) In the figure, PQ and PR are tangents drawn to the circle with centre O from the point P such that $\angle QPR = 50°$ then ∠OQR is equal to, [Easy]



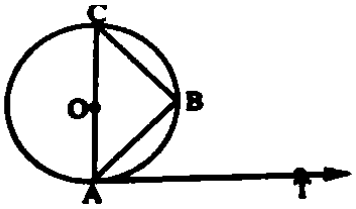
A)25^0 B)35^0 C)40^0 D)20^0

14) In the figure, XY is tangent to the circle with centre O. If $\angle AOB = 130^0$ then the measure of $\angle BAY$ is, [MARCH 2025 ,Average]



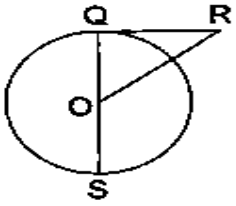
A)90^0 B)25^0 C)50^0 D)65^0

15) In the figure, if ∠ACB=50^0 then ∠BAT is equal to, [Average]



A)70^0 B)60^0 C)50^0 D)40^0

16) In the figure, RQ is tangent to the circle with centre O. If SQ = 6cm, QR = 4cm then the length of OR is [Easy]



A)4cm B)5cm C)6cm D)3cm

17) A tangent PQ at a point P of a circle of radius 5cm meets a line through the centre O at a point Q so that OQ = 12cm. Length of PQ is, [Average]

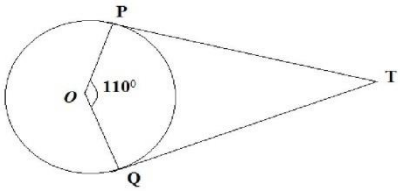
A) 12cm B)13cm C) 8.5cm D)$\sqrt{119}$cm

18) If the length of the tangent drawn from Q to the circle is 24cm and the distance from Q to the centre of the circle is 25cm then the radius of the circle is [Easy]

A) 7cm B) 12cm C) 15cm D)24.5cm

19) In the figure, TP and TQ are tangents to the circle with centre O. If ∠POQ=110^0 then the measure of ∠PTQ is (Easy)

A) 60^0 B) 70^0 C) 80^0 D) 90^0



II. Answer the following questions (1 mark)

20) What is a tangent? (Easy)

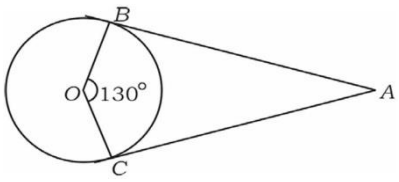
21) What is a secant? (Easy)

22) What is the measure of the angle between the tangent and radius drawn at the point of contact in a circle? (Easy)

23) What is the maximum number of tangents that can be drawn to a circle from an external point? (Easy)

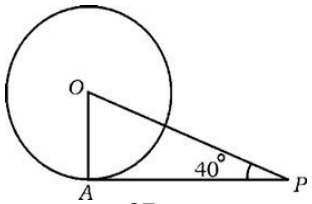
24) How many tangents can be drawn at a point on the circle ? (Easy)

25) In the figure, AB and AC are tangents drawn to a circle with centre O from the external point A. If ∠BOC = 130°then find the measure of ∠BAC. [APRIL 2020, Easy]



26) In the figure, O is the centre of a circle. OA is the radius and AP is the tangent. If ∠OPA=40° then find the measure of∠AOP.

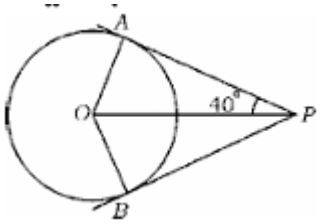
[JUNE 2024 Easy]



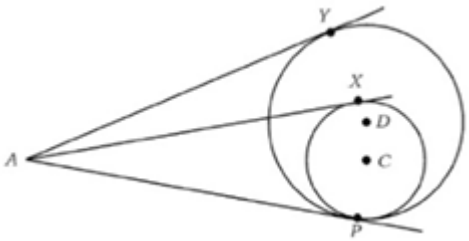
III. **Answer the following Questions (2 mark)**

27) **I**n the given figure , PA and PB are tangents to the circle with centre 'O' . If PA= 4 cm and $\angle APO = 40^0$,then find the measure of $\angle AOB$ and find the length of PB

[MARCH 2025, Average]



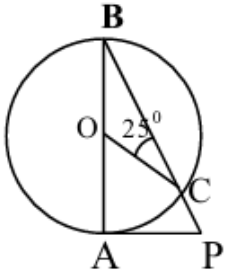
28) In the given figure, AP, AX and AY are the tangents drawn to the circles. Prove that AY = AX [JUNE 2019,Easy]



29) Two concentric circles of radii 5 cm and 3 cm are drawn. Find the length of the chord of the larger circle which touches the smaller circle at point P. [JUNE 2019, Easy]



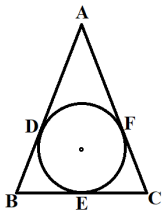
30) In a circle with centre O, AB is the diameter and AP is the tangent. If $\angle OCB = 25^0$ then find the measure of ∠APB [MODEL 2019,Average]



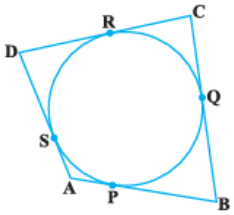
31) Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.

[Average]

32) In the figure,ABC is an isosceles triangle in which AB = AC, and a circle is inscribed in it. Show that E bisects BC. (Average)



33) A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC



[Average]

34) Prove that the tangents to drawn to the circle at the ends of the diameter are parallel.

[Average]

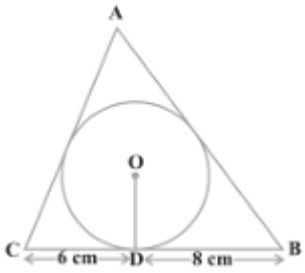
35. Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre. (Average)

36. The length of a tangent from a point A at distance 5 cm from the center of the circle is 4 cm. Find the radius of the circle. (Average)

37. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle. (Average)

38. Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the center. (Average)

39. Prove that the parallelogram circumscribing a circle is a rhombus. (Average)

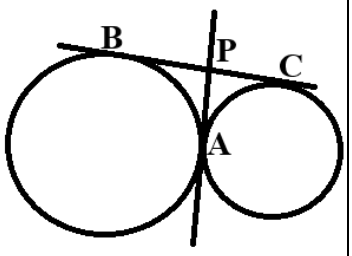


40. A triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 8 cm and 6 cm respectively. Find the sides AB and AC.

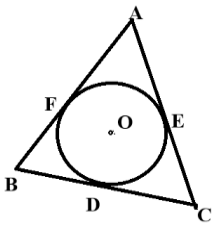
(Average)

41. Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the center of the circle. (Average)

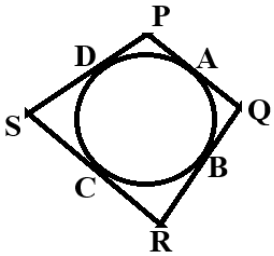
42. In the given figure, two circles touch each other at A. BC and AP are common tangents to these circles. If BP = 3.8cm, then find the length of BC. (Average)



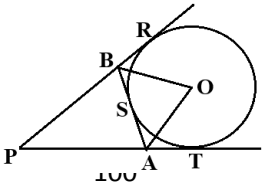
43. In the given figure, sides BC, CA and AB are of ΔABC touch a circle at point D, E and F respectively. If BD = 4cm, DC = 3cm and CA = 8cm, then find the perimeter of ΔABC. (Average)



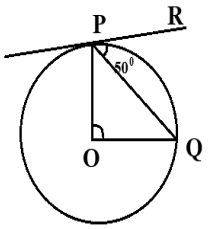
44. In the given figure, if sides PQ, QR, RS and SP of a quadrilateral PQRS touch a circle at points A, B, C and D respectively, then prove that PD + BQ = PQ. If DS = 2cm and BR = 3cm then find the length of RS. (,Average)



45. ΔPAB is formed by three tangents to circle with centre O and , ∠APB = 40^0 as shown in the figure. Find the measure of , ∠AOB. (Average)



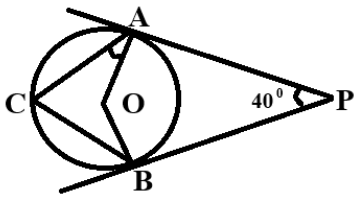
46. In the given figure, O is the centre of a circle and PQ is a chord. If the tangent PR at P makes an angle of 50^0 with PQ, then find the measure of ∠POQ.



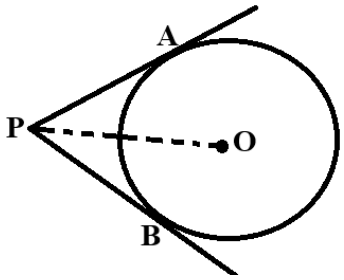
(Average)

47. In the figure, PA and PB are tangents at points A and B respectively to a circle with centre O. If C is a point on the circle and ∠APB = $40^{0,}$ then find the measure of ∠ACB.

(Average)



48. In the given figure, PA and PB are tangents from an external point P to a circle with centre O. If the radius of of the circle is 5cm and PA⊥PB, then find the length of OP. (Average)

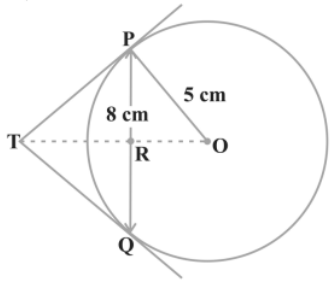


IV.Answer the following questions (3 mark)

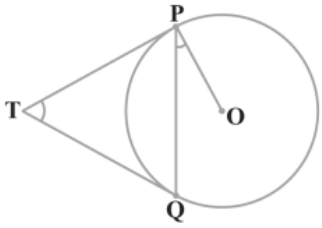
49) Prove that "The tangent at any point of a circle is perpendicular to the radius through the point of contact". [,MARCH 2025, Average]

50) Prove that "the lengths of tangents drawn from an external point to a circle are equal". [MARCH, JULY 2019, SEPTMBER 2020,MARCH 2022, MARCH,JUNE,AUGUST 2024, Average]

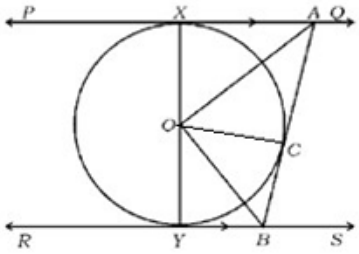
51) PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q intersect at a point T. Find the length of TP. (Difficult)



52) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle$ PTQ = 2 $\angle$ OPQ. (Difficult)



53) In the given figure, PQ and RS are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting PQ at A and RS at B. Prove that ∠AOB = 90°. [APRIL 2019, Difficult]



UNIT 11: AREAS RELATED TO CIRCLES

LO's number	Learning outcomes	Question number
26	Calculate areas of segments, sectors, and find the length of the arc of a circle in given situations. Solve various problems by applying the formula.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,26,27,28,29, 30,31,32,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,47,48,49

Number of questions	**Easy**	**Average**	**Difficult**
49	**9**	**30**	**10**

I. Four alternatives are given for each of the following questions/incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.
(1 Mark)

1. If area of the circle is 49π sq. units then its perimeter is,

[April 2019 Easy]

A) 7πunits B) 9πunits C) 14πunits D) 49πunits

2. The total area of two congruent circles of radius r units is,

[MQP 2019 Easy]

A) $2\pi r^2$ B) 2 C) $\frac{1}{2}\pi r^2$ D) πr^2

3. In a circle of radius r the length of an arc of a sector of angle θ is,

[June 2020 Easy]

A) $\frac{\theta}{360} \times \pi r^2$ B) $\frac{\theta}{360} \times 2\pi r^2$ C) $\frac{\theta}{180} \times \pi r$ D) $\frac{\theta}{180} \times 2\pi r$

4. The area of sector of $\frac{1}{4}^{\text{th}}$ part of the circle with radius r cm is,

[SLP 2020 Easy]

A) $\frac{\pi r^2}{360}$ cm^2 B) $\frac{\pi r^2}{90} cm^2$ C) $\frac{\pi r^2}{4} cm^2$ D) $\frac{\pi r^2}{2}$ cm^2

5. The area of sector of $\frac{3}{4}^{th}$ part of the circle with radius r cm is,

[Average]

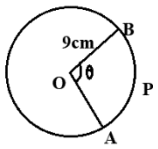
A) $\frac{\pi r^2}{360}cm^2$ B)$\frac{\pi r^2}{90}$ cm^2 C) $\frac{3\pi r^2}{4}$ cm^2 D) $\frac{\pi r^2}{2}$ cm^2

6. If diameter of the circle is 14cm, then its circumference is [June 2024 Average]

A) 28 cm B) 44 cm C) 56 cm D) 88 cm

7. In the figure, O is centre of the circle and length of the arc APB is 4π cm. If OB = 9 cm then the measure of $\theta$is, [March 2025 Average]

A) 60^0 B) 80^0 C) 85^0 D) 70^0



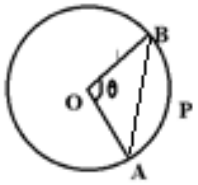
8. In the figure, area of segment APB is, (Average)

A) Area of circle – area of Δ AOB

B) Area of circle – Area of minor sector

C) Area of sector OAPB – area of Δ AOB

D) Area of circle – Area of major sector



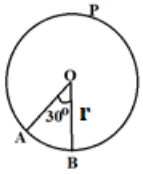
9. If the diameter of a circle is 21cm, then its circumference is,

[Average]

A) 44 cm B) 88 cm C) 66 cm D) 55 cm

10. If the area of a circle is 154cm^2, then its circumference is, [Average]

A) 11 cm B) 22 cm C) 44 cm D) 55 cm



11. In the figure, radius of the circle with centre O is r cm. Area of sector OAPB is,

[Average]

A) $\frac{(360-30)\pi r^2}{360}cm^2$ B)$\frac{(360+30)\pi r^2}{360}cm^2$ C) $\frac{30\pi r^2}{360}cm^2$ D)$\frac{60\pi r^2}{360}cm^2$

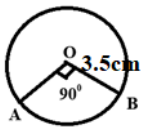
12. The length of arc of a quadrant of radius r cm is,

[Average]

A) $\frac{\pi r}{4}$cm B) $4\pi r$ cm C) $\frac{\pi r}{2}$ cm D) $2\pi r$ cm

II. Answer the following questions (1 mark)

13. Write the formula to find area of a sector of a circle, if angle at the centre is 'θ' degrees. [June 2019 Easy]
14. Write the formula to find length of the arc of sector of a circle, if angle at the centre is 'θ' degrees. (Easy)
15. A circle is divided into 8 equal parts. Find the measure of the angle formed at the centre in each sector. (Easy)
16. In the figure, O is the centre of a circle of radius 3.5cm and ∠AOB = 90^{o}. Find the length of the minor arc [Average]



17. If the diameter of the circle is 7cm then find the length of the semicircular arc. [Average]
18. The area of a quadrant is $\frac{77}{2}cm^2$. Find the radius of the circle. (Easy)
19. The length of the arc of the quadrant of a circle is 22cm. Find the radius of the circle. (Easy)
20. If the area of a circle and its circumference are numerically equal then find the radius of the circle. (Average)

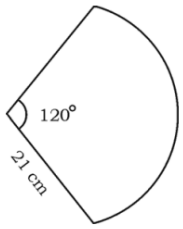
III. Answer the following questions (2 marks)

21. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the length of the arc [Average]
22. In a circle of radius 4 cm, an arc subtends an angle of 45° at the centre. Find the area of the sector.
    ($Use\ \pi = 3.14$) [Average]
23. Areas of two circles C_1 and C_2 are $92cm^2$ and $62cm^2$ respectively. Find the radius of the circle C_3 whose area is equal to sum of areas of C_1 and C_2. [June 2019 Average]
24. The length of the minute hand in a clock is 14 cm. Find the area swept by the minute hand in 10 minutes. [MQP -2 2025 Average]
25. Find the area of the quadrant of a circle whose radius is 20 cm and also find the perimeter of the quadrant. [MQP -2 2025 Average]

IV. Answer the following (3 marks)

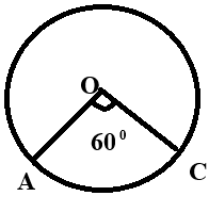
26. A hand fan is made up of cloth fixed in between the metallic wires. It is in the shape of a sector of a circle of radius 21 cm and of angle 120° as shown in the figure. Calculate the area of the cloth used and also find the total length of the metallic wire required to make such a fan.

[June 2020 Difficult]

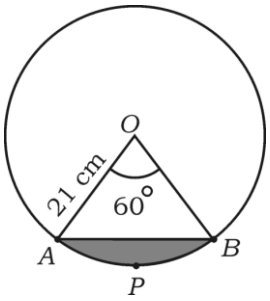


27. In a circle of radius 21 cm, an arc AC subtends an angle of 60° at the centre. Find: (i) the length of the arc AC (ii) area of the sector OAC formed by the arc

[SLP 2022 Average]



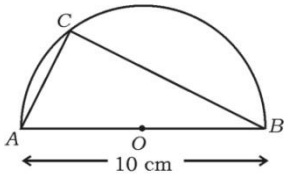
28. In the given figure, O is the centre of the circle of radius 21cm. If ∠AOB = 60° then find the area of the segment. (Take $\sqrt{3} = 1.73$)



[March 2025 Average]

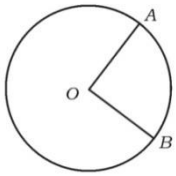
29. In the given figure, *ACB* is a semicircle. If *AB* = 10 cm and *AC* = 6 cm, then find the area of the segments in the semicircle.

[Difficult]

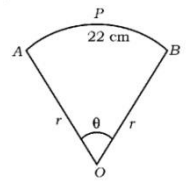


30. In the figure *'O'* is the centre of the circle. Area of a sector *AOB* : Area of the circle = 1 : 5 and if the radius of the circle is 7 cm then find the length of the arc *AB*.

[MQP 3 2025 Difficult]

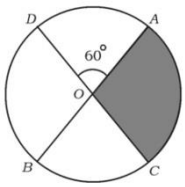


31. In the figure, the area of the sector AOBP is 231 cm^2 and length of the arc APB is 22cm. Find the radius and the measure of angle θ [April 2024 Difficult]



32. In the figure, diameters AB and CD intersect at O. If the length of the arc BC = 22cm and∠AOD = 60° then find the area of the sector AOC.

[Aug 2024 Difficult]

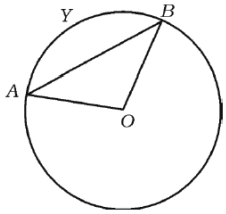


33. The area of the sector of a circle is numerically equal to the length of the arc of the same sector. If the length of the arc is $\frac{44}{21}$cm, then find the radius of the circle and also the angle subtended by the arc at the centre.

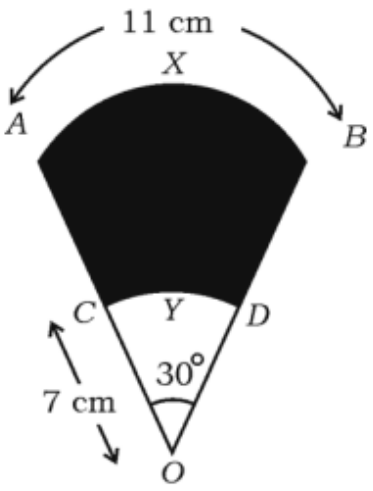
[, MQP Difficult]

34. The area of the sector *OAYB* shown in the figure is 462 cm^2 . Find the length of the arc *AYB* if ∠*AOB* = 120°.

[Average]

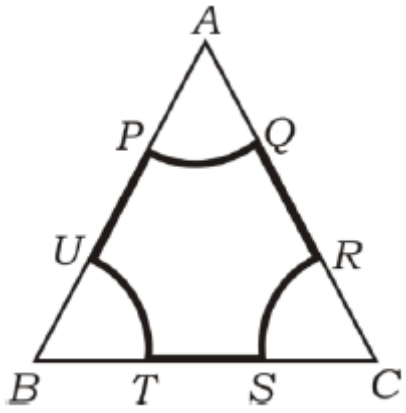


35. In the figure AXB and CYD are the arcs of two concentric circles with centre O. The length of the arc AXB is 11 cm. If OC = 7 cm and ∠ AOB = 30°, then find the area of the shaded region. [Take π =$\frac{22}{7}$]



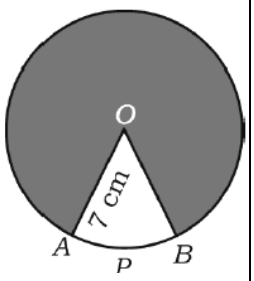
(Difficult)

36. ABC is an equilateral triangle. Arcs are drawn in ΔABC with *A, B* and *C* as the centres of the circles of radius3·5 cm as shown in the figure.If the area of the ΔABC is $49\sqrt{3}$ cm2 , then find theperimeter of the shape PQRSTUP.



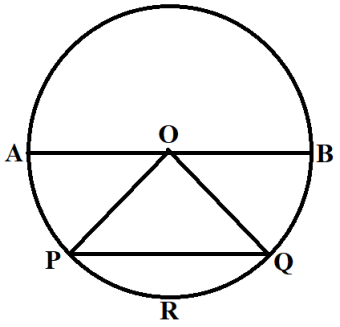
(Difficult)

37. In the given figure O is centre of the circle of radius 7cm. If the length of the arc APB is $\frac{22}{3}$ cm then find the area of the shaded region. (Take $\pi = \frac{22}{7}$)

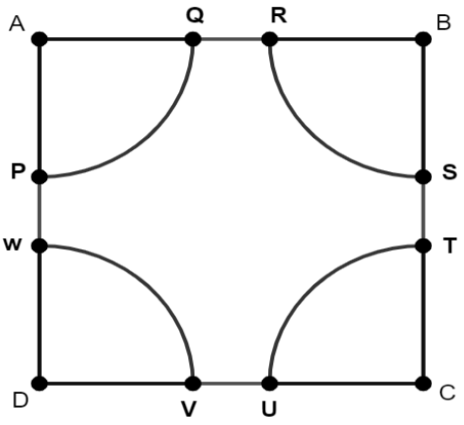


(May 2025 - Difficult)

38. In the given figure, the length of the semicircular arc of the circle with centre O is 44cm. If $\angle OPQ = 45°$ then find the area of the segment PRQ. (SLP 2025 – Difficult)



39. Arcs are drawn in square ABCD with A, B, C and D as the centres of the circles of radius 3·5cm as shown in the figure. If the area of the square ABCD is 144cm^2, then find the perimeter of the shape PQRSTUVWP formed by arcs within the square.

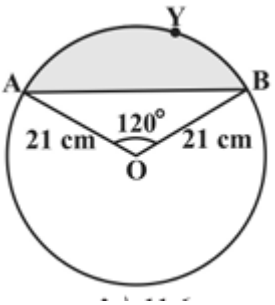


[Average]

40. The minute hand of a wall clock is 18 cm long. Find the area swept by the minute hand in 35 minutes. Find the length of the arc formed by the sweep of the minute hand.

[LO – 26, Average]

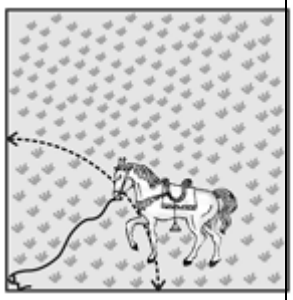
41. Find the area of the segment AYB shown in figure if radius of the circle is 21 cm and $\angle$ AOB = 120°. (Average)



42. A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding : (i)minor segment (ii)major sector. (Use π = 3.14) (Average)

43. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find: (i) the length of the arc (ii) area of the sector formed by the arc (iii) area of the segment formed by the corresponding chord. (Average)

44. A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope . Find (i) the area of that part of the field in which the horse can graze. (ii) the increase in the grazing area if the rope were 10 m long instead of 5 m. (Use π = 3.14)(Average)



45. A brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in figure. Find : (i) the total length of the silver wire required. (ii) the area of each sector of the brooch.



(Average)

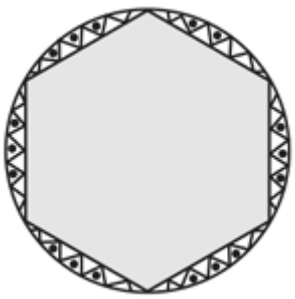
46. An umbrella has 8 ribs which are equally spaced . Assuming umbrella to be a flat circle of radius 45 cm, find the area between the two consecutive ribs of the umbrella. (Average)



47. A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of 115°. Find the total area cleaned at each sweep of the blades.
(Average)

48. To warn ships for underwater rocks, a lighthouse spreads a red coloured light over a sector of angle 80° to a distance of 16.5 km. Find the area of the sea over which the ships are warned. (Use π = 3.14)
(Average)

49. A round table cover has six equal designs as shown in figure. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of ` 0.35 per cm^2. (Use$\sqrt{3}$ = 1.7) (Average)



UNIT 12: SURFACE AREAS AND VOLUMES

LO's number	Learning outcomes	Question number
25	Find the surface area and volume of objects in the surroundings by considering them as combinations of solids such as cylinders, cones, spheres, hemispheres and other composite solids.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,26,27,28, 29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48,49,50,51,52, 53,54,55,56,57,58,59,60,61,62,63,64, 65,66,67,68,69,70,71,72,73,74

Number of questions	**Easy**	**Average**	**Difficult**
74	**25**	**23**	**26**

I. Four alternatives are given for each of the following questions/incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet. (1 Mark)

1. The formula to find the total surface area of cube of edge 'a' units is, [Easy]

A) $4a^2$ B) $6a^2$ C) $4a^3$ D) $6a^3$

2. The formula to find the lateral surface area of cube of edge 'a' units is, [Easy]

A) $6a^2$ B) $4a^3$ C) $6a^3$ D) $4a^2$

3. The formula to calculate the volume of a cube of edge 'a' units is, [Easy]

A) a^2 B) a^4 C) a^3 D) a^6

4. The formula to find the total surface area of a cuboid of length 'l', breadth 'b' and height 'h' is, [Easy]

A) 2(lb+bh+hl) B) lxbxh C) 2l (bxh) D) l+b+h

5. The formula to find the lateral surface area of a cuboid of length 'l', breadth 'b' and height 'h' is, [Easy]

A) 2l (b+h) B) 2h(l+b) C) lxbxh D) 2lx2bx2h

6. The formula to find the volume of a cuboid of length 'l', breadth 'b' and height 'h' is, [Easy]

A) l+b+h B) l×b×h C) lb÷h D) (l×h) ÷b

7. The formula to find the curved surface area of a right circular cylinder of base radius 'r' and height 'h' is, [Easy]

A) πr^2h B) $\pi r(r+h)$ C) $\pi h(r+r)$ D) $2\pi rh$

8. The formula used to find the total surface area of a right circular cylinder of base radius 'r' and height 'h' is, [,Easy]

A) $2\pi r\ (r+h)$ B) $2\pi rh$ C) $\pi h(r+r)$ D) πr^2h

9. The formula used to find the volume of a right circular cylinder of base radius 'r' and height 'h' is, [Easy]

A) πr^2 B) $2\pi r^2h$ C) πr^2h D) $2\pi rh$

10. The formula used to find the curved surface area of a right circular cone of base radius 'r' and slant height '/ is, [Easy]

A) πrl B) πr^2l C) πr^2h D) $\frac{1}{3}\pi r^2h$

11. The formula used to find the total surface area of a right circular cone of base radius 'r' and slant height '/ is, [Easy]

A) $2\pi rh$ B) $\pi r(r+l)$ C) πr^2h D) $\frac{1}{3}\pi r^2h$

12. The formula used to find the volume of a right circular cone of base radius 'r' and slant height '/ and vertical height 'h' is, [Easy]

A) πr^2h B) $\pi r(r+l)$ C) $\frac{1}{3}\pi r^2h$ D) πrl

13. The formula used to find the surface area of a sphere of radius 'r' is [,Easy]

A) πr^2 B) $2\pi r^2$ C) $3\pi r^2$ D) $4\pi r^2$

14. The formula used to calculate volume of a sphere of radius 'r' units is (July 2022) [Easy]

A) $\frac{2}{3}\pi r^2\ cm^3$ B) $\frac{1}{3}\pi r^3\ cm^3$ C) $\frac{4}{3}\pi r^3\ cm^3$ D) $\frac{4}{3}\pi r^2\ cm^3$

15. The ratio between volumes of cylinder and cone whose base radius and vertical heights are equal [Average]

A) 1 : 3 B) 6 : 1 C) 3 : 1 D) 1 : 6

16. The base radius and the height of a cylinder and cone are equal. If the volume of cylinder is 60 cm^3 then the volume of cone is, [Average]

A) $180cm^3$ B) $18cm^3$ C) $30cm^3$ D) $20cm^3$

17. The base radius of a cone is 8cm and its slant height is 10cm. Its vertical height is, [Average]

A) 3cm B) 6cm C) 5cm D) 10cm

18. The volume of a cube of edge 6cm is, [Average]

A) $36cm^3$ B) $12cm^3$ C) $216cm^3$ D) $18cm^3$

19. The volume of a cuboid whose length, breadth and height are 2cm, 3cm and 5cm respectively is, [Easy]

A) $10cm^2$ B) $16cm^3$ C) $60cm^3$ D) $30cm^3$

20. The curved surface area of a cylinder is $100cm^2$ and its height is 10cm. The circumference of its base is, [Easy]

A) 100cm B) 10cm C) 20cm D) 50cm

21. The amount of water required to fill the tank of length 5m, breadth 6m and height 2m completely is, [Difficult]

A) 6L B) 60L C) 20L D) 60,000L

22. If the area of base of a cylinder is 22cm and height is 10 cm then its volume is [Easy]

A) $2200cm^2$ B) $2200cm^3$ C) $220cm^3$ D) $220cm^2$

23. The base radius and the height of a cylinder and cone are equal. If the volume of cylinder is $360cm^3$ then the volume of cone is

(Sept 2020) [Average]

A) $120cm^3$ B) $180cm^3$ C) $90cm^3$ D) $360m^3$

24. The surface area of sphere with radius 7cm is

(Sept 2020 Average)

A) $154cm^2$ B) $616cm^3$ C) 616 cm^2 D) 308 cm^2

25. The volume of a cube with edge is 5 cm is (Easy)

A) 125 cm^2 B) 30 cm^3 C) 100 cm^3 D) 125 cm^3

II. Answer the following: (1 mark)

26. Write the formula to find the total surface area of a hemisphere with radius is 'r' units. [Easy]

27. Write the formula to find the curved surface area of a hemisphere whose radius is 'r' units. [Easy]

28. Write the formula to find the volume of a hemisphere whose radius is 'r' units. [Easy]

29. Write the formula to find the volume of a sphere whose radius is 'r' units. [Easy]

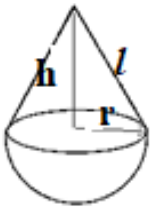
30. Find the ratio of the volumes of sphere and hemisphere having equal radius. [Average]

31. Find the ratio of the total surface areas of sphere and hemisphere having equal radius. [Average]

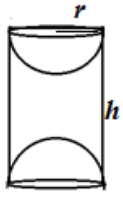
32. The base radius and the height of a cylinder and cone are equal. If volume of the cone is $30cm^3$ then find the volume of cylinder. [Average]

33. The circumference of the base of a cylinder is 10cm and its height is 25cm. Find its curved surface area. [Average]

34. Write the formula to calculate the total surface area of the toy shown in the figure. [Difficult]



35. The hemispheres are hollowed out from the base of a cylinder as shown in the figure. Write the formula to find the volume of the solid. [Difficult]



36. Find the radius of the cylinder whose volume is $500cm^3$ and height is 10cm. [Average]

37. The ratio of diameters of two cylinders is 9:1 and the ratio of their heights is 1:9. Find the ratio of their volumes. [Difficult]

38. Find the surface area of a sphere of radius 7cm. [April 2018 Easy]

III. Answer the following questions : (2 marks)

39. Find the curved surface area of a cylinder whose height is 20cm and radius is 6cm. [Easy].

40. A cuboid is formed by joining two identical cubes of volume $27cm^3$. Find the total surface area of the cuboid. [Easy]

41. A toy is made by joining a cone of radius 7cm and height 4cm on a hemisphere of radius 7cm. Find the volume of the toy.

[Average]

42. Two hemispheres of radius 7cm are joined at the ends of a cylinder of radius 7cm and height 10cm. Find the total surface area of the solid.

[Average]

43. The volume of a cube is $125cm^3$. Find its lateral surface area.

[Average]

44. The volume of a sphere is 38808 cm^3. Find its surface area. [Difficult]

IV. Answer the following questions (3 marks)

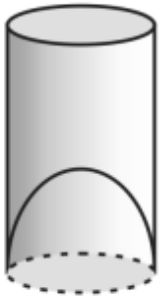
45. A toy is in the form of a cone of radius 6 cm mounted on a hemisphere of same radius. The total height of the toy is 14 cm. Find the total surface area of the toy. [Average]

46. A solid is made as shown in the figure. The height of the cylinder is 10cm and its radius is 3.5cm. Find the total surface area of the solid. [Average]



47. A juice seller was serving his customers using glasses as shown in Figure. The inner diameter of the cylindrical glass was 6 cm and the height of a glass is 12 cm. Find the actual capacity of the glass .

[Difficult]

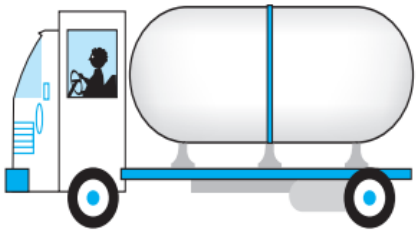


48. A circus tent is built in the shape of a cylinder surmounted by a conical top using canvas. If the height and diameter of the cylinder are 5 m and 126 m respectively, and the total height of the tent is 21 m, then find the area of the canvas used for making the tent.

[Difficult]

V. Answer the following questions (4/5 marks)

49. A lorry has a fully filled petrol tank with hemispheres attached at both ends of the cylinder as shown in the figure. Petrol was drained from the tank at a rate of 742.5L per minute in 1 hour. If the diameter of the tank is 3m, find the length of the tank. [Difficult]



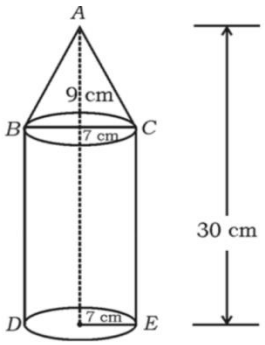
50. A cone is mounted on a hemisphere whose radius is same as that of the hemisphere. If the volume of hemisphere is $\frac{539}{6}$ $cm^3$and the slant height is 12.5cm then find the surface area of the solid. [Average]

51. A spherical glass vessel has a cylindrical neck 8 cm long, 2 cm in diameter; the diameter of the spherical part is 8.5 cm. By measuring the amount of water it holds, a child finds its volume to be 345 cm^3.Check whether she is correct, taking the above as the inside measurements, and $\pi = 3.14$.

[Difficult]

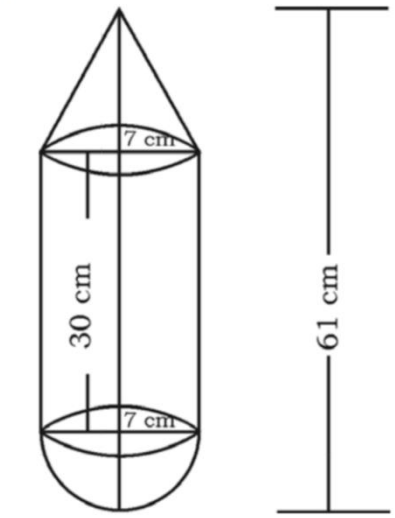
52. A solid is in the form of a cone mounted on a right circular cylinder, both having same radii as shown in the figure. The radius of the base and height of the cone are 7 cm and 9 cm respectively. If the total height of the solid is 30 cm, find the volume of the solid.

[April 2018 Average]

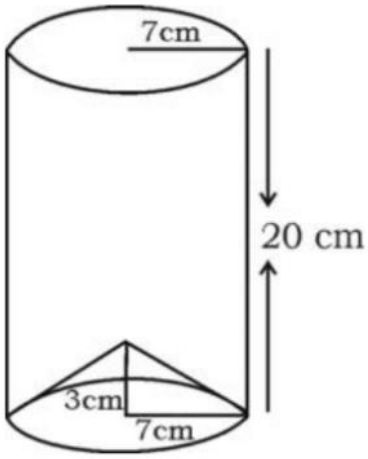


53. A solid is in the shape of a cylinder with a cone attached at one end and a hemisphere attached to the other end as shown in the figure. All of them are of the same radius 7 cm. If the total length of the solid is 61 cm and height of the cylinder is 30 cm, calculate the cost of painting the outer surface of the solid at the rate of Rs. 10 per 100 cm^2 .

[June2018, Difficult]

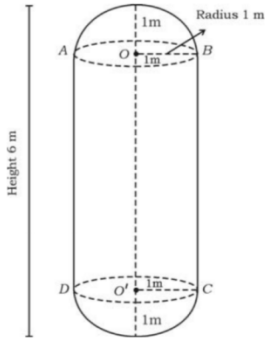


54. The bottom of a right cylindrical shaped vessel made from metallic sheet is closed by a cone shaped vessel as shown in the figure. The radius of the circular base of the cylinder and radius of the circular base of the cone each is equal to 7 cm. If the height of the cylinder is 20 cm and height of cone is 3 cm, calculate the cost of milk to fill completely this vessel at the rate of Rs. 20 per litre. [March 2019 Difficult]



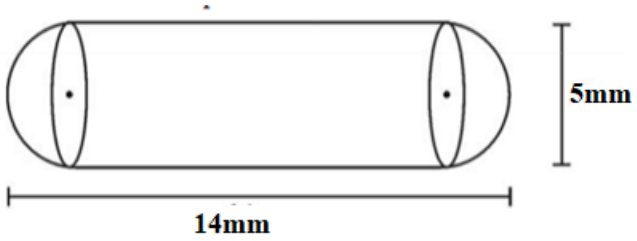
55. A milk tank is in the shape of a cylinder with hemispheres of same radii attached to both ends of it as shown in figure. If the total height of the tank is 6 m and the radius is 1 m, calculate the maximum quantity of milk filled in the tank in litres.

[June 2019 Average]

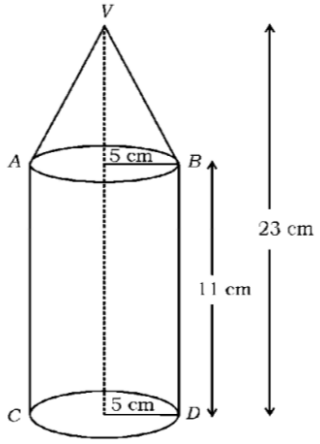


56. A medicine capsule is in the shape of a cylinder with hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.

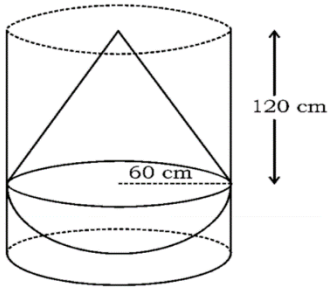
[, Sept 2020 Difficult]



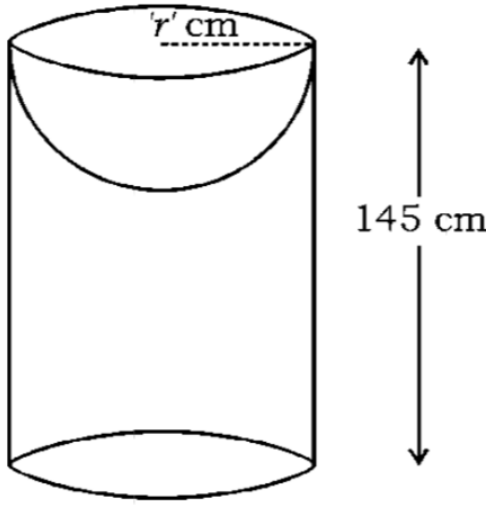
57. A solid is in the shape of a cone placed on the cylinder as shown in the figure. The radii of both the cylinder and the cone are equal to 5 cm. If the height of the cylinder is 11 cm and the total height of the solid is 23 cm, then find the curved surface area and volume of the solid. [June 2024 Average]



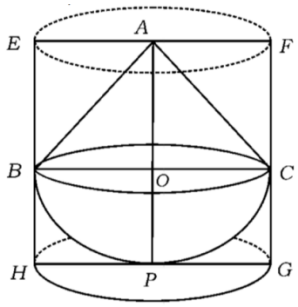
58. A solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm is placed upright in a right circular cylinder full of water such that it touches the bottom as shown in the figure. If the radius of the cylinder is 60 cm and height is 180 cm, then find the volume of water left in the cylinder in terms of π. [April 2025 Difficult]



59. A solid is made of a cylinder with a hemispherical depression having the same radius ('r' cm) as that of cylinder at the top end as shown in the figure. The volume of the hemispherical depression is 18000 π cm^3. If the height of the cylinder is 145 cm, then find the total surface area of the solid.
[April 2025 Difficult]



60. A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy as shown in the figure, find the difference of the volumes of the cylinder and the toy. [May 2025 Difficult]



61. From a solid cylinder whose height is 2·4 m and diameter is 1·4 m, a conical cavity of the same height and same diameter as that of the cylinder is hollowed out. Find the total surface area of the remaining solid.. [May 2025 Average]

62. A toy is made by attaching a hemisphere to one side and a cone on the other side of a cylinder. The diameter of these three solids are same. The diameter of cylinder is 10 cm and its height is 20 cm. If the slant height of the cone is 13 cm then find the surface area and volume of the toy. [Easy]

63. From a solid cylinder whose height is 2.8 cm and diameter is 4.2 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid.
[Difficult]

64.From a wooden cylinder of radius 6cm and height 27cm, a hemisphere and a cone of radius same as that of the cylinder are carved out from either bases of the cylinder. If the height of the cone is 8 cm then find the surface area and volume of the solid.

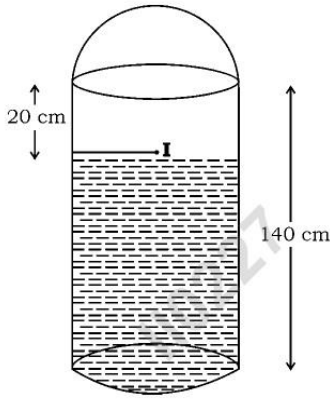
[Average]

65. The volume of a cylinder is 5 times the volume of a cone. The radius of the base and the slant height of the cone are 7 cm and 25 cm respectively. The radius of the base of the cylinder is 14 cm. Find the volume and lateral surface area of the cylinder.

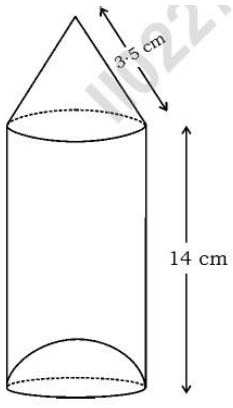
[Aug 2024 Difficult]

66. A water container is made by joining a cylinder and hemisphere of equal radii. The curved surface area of the hemisphere is $2772cm^2$. The height of the cylinder is $140cm$ and a water level indicator (I) is fixed at a height of $20cm$ below the top of the cylinder as shown in the figure. Water can be stored in the cylinder up to the level of the indicator. Find the maximum amount of water that can be stored in the container and also find the amount of air stored in the remaining portion of the container.

(SLP 2026-Difficult)



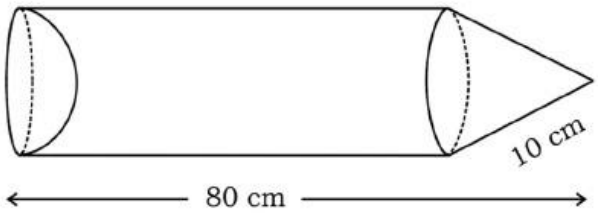
67. A solid is made by placing a cone on the top base of a cylinder and drilling out a hemisphere from the other base as shown in the figure. The radii of the cylinder, cone and hemisphere are equal. The slant height and curved surface area of the cone are $3.5cm$ and $23.1cm^2$ respectively. If the height of the cylinder is $14cm$ then, find the total volume of the solid.



(SLP 2026-Difficult)

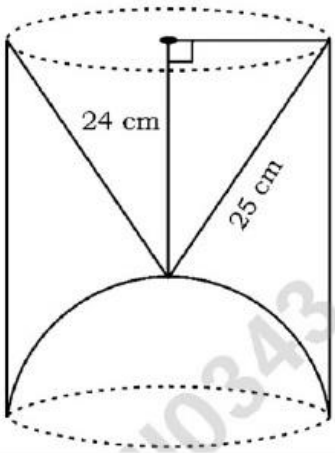
68. A carpenter makes a wooden model as shown in the figure by joining a cone to one end of a cylinder and scooping out a hemisphere from the other end. The radii of the cone, hemisphere and cylinder are equal. The total length of the model s $80cm$. the curved surface of the hemisphere is $\frac{1584}{7}cm^2$ and the slant heught of the cone is $10cm$. Find the volume of the model and calculate the ratio of the curved surface of the hemisphere to the curved surface of the cone.

(SLP 2026-Difficult)



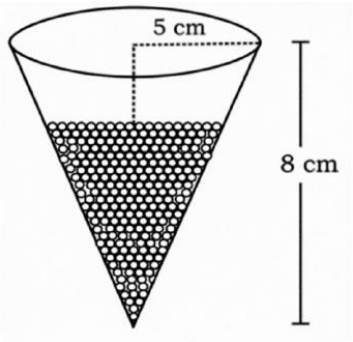
69. From a solid cylinder a hemisphere and a cone having same radius as that of the cylinder are carved out as shown in the figure. If the slant height and height of the cone are $25cm\ and\ 24cm$ respectively, then find the volume and curved surface area of the remaining solid.

(SLP 2026-Difficult)

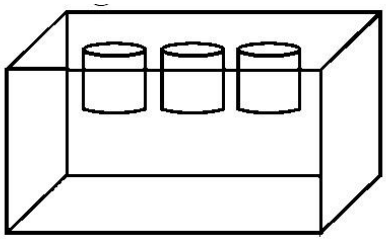


70. A vessel is in the form of an inverted cone. Its height is $8cm$ and the radius $5cm$. The vessel is filled with water up to the brim and when 100 lead shots of same size are dropped in it, $\frac{1}{4}th$ of the water from the vessel flows out. Find the radius and volume of each lead shot.

(MQP 2026- Difficult)

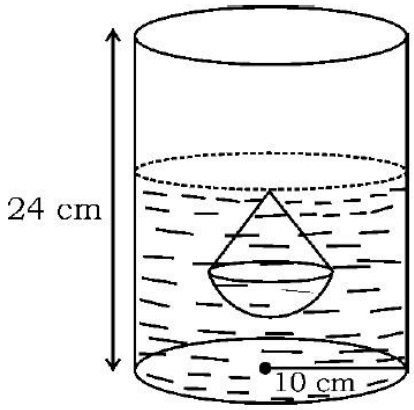


71. From a solid cuboidal metallic block of dimensions $15cm \times 10cm \times 8cm$, three cylindrical depressions each having diameter $4.2cm$ and height $6cm$ are drilled out as shown in the figure. Find the total surface area and volume of the remaining metallic block. (March 2026 – Difficult)

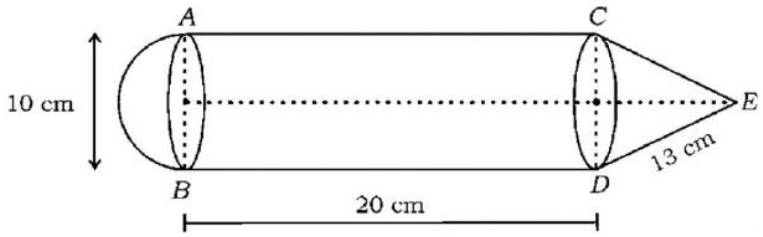


72. In a cylinder of height $24cm$ and radius $10cm$, water is filled up to the height of $14.4cm$. A solid is made by placing a cone of slant height $10cm$ and curved surface $60\pi cm^2$ on the hemisphere having the same radius as that of cone. If this solid is completely immersed in the cylinder as shown in the figure, then find the rise in the water level in the cylinder. Also find the amount of water still to be filled in the cylinder so that the water level rises up to the brim of the cylinder. (Take $\pi = 3.14$)

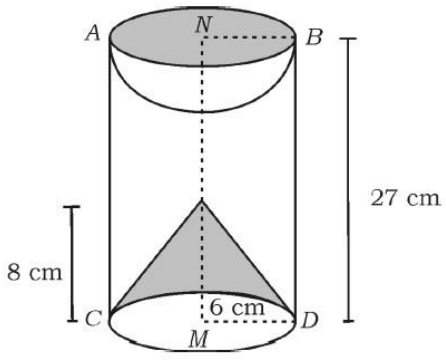
(March 2026 – Difficult)



73. A toy is made by attaching a hemisphere to one side and a cone on the other side of a cylinder as shown in the figure. The diameter of these three solids is same. The diameter of cylinder is $10cm$ and its height is $20cm$. If the slant height of the cone is $13cm$, then find the toal surface area and volume of the toy. (May 2026 – Difficult)



74. From a solid cylinder of base radius $6cm$ and height $27cm$, a hemisphere and a cone of radius same as that of the cylinder are carved out from the bases of the cylinder as shown in the figure. If the height of the cone is $8cm$ then find the total surface area and volume of the remaining solid. (Take $\pi = 3.14$). (, May 2026 – Difficult)



UNIT : 13 STATISTICS

LO's number	Learning outcomes	Question number
27	Calculate mean, median, and mode for different datasets arising from real-life situations	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 16,17,18,19,20,21,22,23,24,25,26,27, 28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48,49,50,51,52,53, 54,55,56,57,58,59,60,61

Number of questions	Easy	Average	Difficult
61	14	44	3

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. The most repeated score in the given dataset is, (April 2021 Easy)
   A) Mean B) Mode C) Median D) Range

2. The formula to find the midpoint of a class interval is, (Easy)
   A) $\frac{Upper\ class\ limit - Lower\ class\ limit}{2}$ B) $\frac{Upper\ class\ limit \times Lower\ class\ limit}{2}$
   C) $\frac{Upper\ class\ limit + Lower\ class\ limit}{2}$ D) $\frac{Upper\ class\ limit + Lower\ class\ limit}{3}$

3. The lower limit of the modal class in the given frequency distribution is (Easy)

Class Interval	10-20	20-30	30-40	40-50
Frequency	6	4	12	3

   A)10 B)20 C)30 D)50

4. If The mean of a data is 7.5 ,$\sum$ fixi = 120+3k and $\sum$ fi = 30 then the value of 'k' is, (Easy)
   A) 35 B) 3.5 C) 0.35 D) 3.05

5. Cumulative frequency is calculated to find (Easy)
   A) Mean B) Median C) Mode D) Deviation

6. The empirical relationship between the three measures of central tendency is,

(April 2024) (Easy)

A) 3 Median = 2 Mean + Mode B) 3 Mean = 2 Median + Mode

C) Mean = 3 Median + Mode D) Mode = 3 Mean +2 Median

7. In the formula to find the median, Median $= \mathrm{L} + \left(\frac{\frac{\mathrm{n}}{2} - \mathrm{Cf}}{\mathrm{f}}\right) \times \mathrm{h}$ 'h' refers to (Average)

A) Lower limit of the median class

B) frequency of median class

C) size of the class interval

D) cumulative frequency

8. The Mean and Mode of the given set of a data are 7.5 and 6. The median of the data is,

(Average)

A) 3 B) 5 C) 7 D) 9

9. The median of the heights of girls in a school is, 149.03cm. The interpretation of this statement is,

(Average)

A) The height of 25% of girls is more than149.03cm and the height of 75% of the girls is less than 149.03cm

B) The height of 50% of girls is more than149.03cm and the height of 50% of the girls is less than 149.03cm

C) The height of 75% of girls is more than149.03cm and the height of 25% of the girls is less than 149.03cm

D) The height of 60% of girls is more than149.03cm and the height of 40% of the girls is less than 149.03cm

10. The formula to find the mean by step deviation method is, (MQP -4 2025 EASY)

A) $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$ B) $\bar{x} = a + \frac{\sum f_i}{\sum f_i u_i} \times h$

C) $\bar{x} = a \times \frac{\sum f_i u_i}{\sum f_i} \times h$ D) $\bar{x} = a \div \frac{\sum f_i u_i}{\sum f_i} \times h$

II. Answer the following questions. (1 Mark)

11. Write the midpoint of the class interval10 – 24. (Easy)
12. In the given frequency distribution table write the median class interval.

(SLP -2024 – Easy)

Marks	Number of Students	Cumulative Frequency
0– 10	3	3
10 – 20	4	7
20 – 30	7	14
30 – 40	6	20
	n = 20	

13. In the given frequency distribution tables write the modal class. (March 2025 – Easy)

Class interval	Frequency
1-3	4
3-5	8
5-7	2
7-9	2

14. Write the formula to find the mean by direct method. (June 2021 Easy)
15. Find the upper limit of the modal class in the given frequency distribution table. (March2025 Easy)

Class Interval	0 -10	10 -20	20 -30	30 -40	40 -50
Frequency	5	8	7	12	6

16. If the Median of a data is 3 more than Mean, then by how much does the Mode exceed the Mean?

(Average)

17. Write the formula to find the median for grouped data. (Easy)
18. Write the formula to find the mode for grouped data. (Easy)
19. Find the Median of the data whose Mode is 12.4 andMean is 10.5 (Average)
20. Find the Mode of the data whose Mean is 27 and Median is 33

(Average)

21. If the ModeandMean of a given data is 7 and 8 respectively, then find the Median.

Average)

III. Answer the following questions. (2 Marks)

22. The Mode and Median of a given data are 50.5 and 45.5 respectively. Find the Mean using formula.

(Average)

23. Find the Mean for the given data by direct method.

(Average)

Class Interval	Frequency
1-5	2
6-10	3
11-15	4
16-20	1

IV. Answer the following questions. (3 Marks)

24. Find the Mean for the given data by direct method

(Average)

Class Interval	Frequency
45-55	3
55-65	10
65-75	11
75-85	8
85-95	3

25. Find the Mean for the given data by direct method

(Average)

Class Interval	Frequency
1 – 3	2
3 – 5	5
5 – 7	8
7 – 9	3
9 - 11	2

26. Find the Mean for the following frequency distribution table (Average)

Class Interval	Frequency
10 – 14	2
15 -19	3
20 -24	5
25 -29	3
30 – 34	2

27. Find the Mean for the following frequency distribution table (Average)

Class Interval	Frequency
0 – 10	4
10 – 20	9
20 – 30	15
30 – 40	14
40 – 50	8

28. The Mean for the given data is 18. Find the value of 'x' (Difficult)

Class Interval	Frequency
11 – 13	7
13 -15	6
15 – 17	9
17 -19	13
19 -21	x
21 – 23	5
23 – 25	4

29. Find theMean for the following grouped data. (Average)

Class Interval	15 – 25	25 -35	35 -45	45 -55	55 – 65
Frequency	5	8	12	15	9

30. Find theMean for the following grouped data. (April 2022, Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 - 60
Frequency	2	3	5	7	3

31. Find theMean for the following grouped data. (March 2025) (Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 - 60
Frequency	2	3	6	5	4

32. Find theMean for the following grouped data. (August 2024) (Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 – 60
Frequency	2	5	6	5	2

33. Find theMean for the following grouped data by direct method (June 2024) (Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 – 60
Frequency	4	6	5	4	1

34. Find theMean for the given frequency distribution table by direct method (July 2022) (Average)

Class Interval	5 -15	15 -25	25 -35	35-45	45 – 55
Frequency	1	3	5	4	2

35. Find theMean for the given frequency distribution table (june 2023) (Average)

Class Interval	5 -15	15 -25	25 -35	35-45	45 – 55
Frequency	4	6	5	6	4

36. Find the Mean for the given data by direct method. (April, July 2024) (Average)

Class Interval	2 -6	6 – 10	10 – 14	14 – 18	18 – 22
Frequency	4	8	2	1	5

37. Find theMean for the given data. (February 2022) (Average)

Class Interval	0 -10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	8	20	15	7

38. Find theMean for the given data. (April 2023) (Average)

Class Interval	Frequency
1 – 5	4
6 – 10	3
11 - 15	2
16 -20	1
21 – 25	5

39. Find theMedian for the following frequency distribution table. (Average)

Class Interval	100-150	150-200	200-250	250-300	300-350
Frequency	6	3	5	20	10

40. Find theMedian for the following frequency distribution table. (Average)

Class Interval	50 -60	60 -70	70 -80	80 -90	90 -100
Frequency	6	9	20	10	5

41. Find theMedian for the following frequency distribution table. (June 2024) (Average)

Class Interval	50 -60	60 -70	70 -80	80 -90	90 -100
Frequency	5	8	10	4	3

42. Find theMedian for the following frequency distribution table. (Average)

Class Interval	1 -10	11 -20	21 -30	31 -40	41 -50
Frequency	5	8	20	15	7

43. Find theMedian for the following frequency distribution table. (Average)

Class Interval	0 -20	20 -40	40 -60	60 -80	80 -100
Frequency	6	5	9	4	2

44. Find theMedian for the following frequency distribution table. (Average)

Class Interval	20-40	40 -60	60 -80	80 -100	100-120
Frequency	7	15	20	2	4

45. Find theMedian for the following frequency distribution table. (June 2020) (Average)

Class Interval	20-40	40 -60	60 -80	80 -100
Frequency	7	15	20	8

46. Find theMedian for the following frequency distribution table. (July 2022) (Average)

Class Interval	0 -20	20 -40	40 -60	60 -80	80 -100
Frequency	6	9	10	8	7

47. Find theMedian for the following frequency distribution table. (Average)

Class Interval	5 -15	15 -25	25 -35	35-45	45 – 55
Frequency	1	3	5	7	2

48. Find theMedian for the following frequency distribution table. (Average)

Class Interval	5 -15	15 -25	25 -35	35-45	45 – 55
Frequency	3	4	8	7	3

49. Find theMedian for the following frequency distribution table. (March 2025 Average)

Class Interval	15 -20	20 -25	25 -30	30-35	35-40
Frequency	4	5	10	5	6

50. Find theMedian for the following frequency distribution table. (Average)

Class Interval	50-52	53-55	56-58	59-61	62 – 64
Frequency	15	110	135	115	25

51. Find theMedian for the following frequency distribution table. (Average) (April 2019)

Class Interval	1 - 4	4 - 7	7 - 10	10 -13	13 - 16	16- 19
Frequency	6	30	40	16	4	4

52.

Find theMode for the following frequency distribution table. (Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 - 60
Frequency	6	4	12	3	5

53. Find theMode for the following frequency distribution table. (Average)

Class Interval	5-10	10-15	15-20	20-25	25-30
Frequency	3	5	8	4	5

54. Find theMode for the following frequency distribution table. (Average)

Class Interval	1-3	3-5	5-7	7-9	9-11
Frequency	7	8	2	2	1

55. Find theMode for the following frequency distribution table. (Average)

Class Interval	0 -20	20 -40	40 -60	60 -80	80 -100
Frequency	10	35	52	61	38

56. Find theMode for the following frequency distribution table. (Average)

Class Interval	0 -10	10 -20	20 -30	30 -40	40 -50
Frequency	6	9	15	9	1

57. Find theMode for the following frequency distribution table. (Average)

Class Interval	0 -10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	7	9	15	11	8

58. Find theMode for the following frequency distribution table. (Average)

Class Interval	0 -10	10 -20	20 -30	30 -40	40 -50
Frequency	7	8	2	2	1

59. Find theMode for the following frequency distribution table. (Average)

Class Interval	1-3	4-6	7-9	10-12	13-15
Frequency	7	8	2	2	1

60. Find theMode for the following frequency distribution table. (Average)

Class Interval	5 -15	15 -25	25 -35	35-45	45 - 55
Frequency	3	4	8	7	3

61. Find theMode for the following frequency distribution table. (Average)

Class Interval	10 -20	20 -30	30 -40	40 -50	50 - 60
Frequency	3	9	6	7	5

UNIT14: PROBABILITY

LO's number	Learning outcomes	Question number
28	Determine that the probability of an event is always between 0 and 1. Differentiate between Sure event and impossible event.	1,2,3,4,5,6,7,8,9,11,12,13,14,18,20,21, 22,23,25,26,27,28,29,30,31,32,35,36,37,
29	Write the sample space for a random event and apply the concept of probability to solve problems encountered in daily life.	10,,15,16,17,19,33,34,38,39,40,41,42,43, 44,45,46,47,48,49,50,51,52,53,54,55,56, 57,58,59,60

Number of questions	Easy	Average	Difficult
65	**14**	**40**	**11**

I. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.

(1 Mark)

1. 1. The probability of a sure event is, (June 2017, April 2024, Easy)
   A) 1 B) 0 C)-1 D) 1.5
2. The probability of an impossible event is, (April 2020, Easy)
   A) 1 B) 0 C)-1 D) 1.5
3. In an experiment of tossing a coin, the number of all possible outcomes is, (Easy)
   A) 1 B)2 C)3 D)4
4. In an experiment of tossing two coins, the number of all possible outcomes is, (Easy)
   A) 2 B) 3 C) 4 D) 5
5. A die is thrown once. The number of all possible outcomes is, (Average)
   A) 12 B)24 C)36 D)6
6. Which of the following cannot be the probability of an event?
   A) $\frac{2}{3}$ B) -1.5 C) 15% D) 0.7 (Easy)
7. Which of the following can be the probability of an event? (May-2025 Easy)
   A) $\frac{1}{5}$ B) 1.5 C)$\frac{5}{2}$ D) –5

8. A die numbered from 1 to 6 is thrown once. The probability of getting an odd number on the top is,
[April-2016, Average]

A)$\frac{3}{6}$ B) $\frac{1}{6}$ C)$\frac{2}{6}$ D)$\frac{4}{6}$

9. The probability of an event 'E' is 0.05, then the probability of 'not E' is, [March –2019 Average]
A) 0.59 B) 0.95 C) 1 D)1.05

10. The letters of English alphabet are written on cards without any repetition and are put inside a box. A card is randomly drawn from the box. The probability of getting an vowel is,

[Average]
A)$\frac{3}{26}$ B)$\frac{5}{26}$ C)$\frac{1}{26}$ D)$\frac{21}{26}$

11. If the probability of an event 'E' P(E) = 0.75 then the value of P($\overline{E}$) is, [March-2023Average]

A) 2.5 B) 0.25 C) 0.025 D) 0.75

12. A die is thrown twice. The number of all possible outcomes is,
[Average]
A) 12 B)24 C)36 D)6

13. The probability of winning a game is $\frac{3}{4}$, then the probability of losing the same game is,
[Sept-2023,Average]

A) $\frac{1}{2}$ B) $\frac{3}{4}$ C)$\frac{1}{4}$ D)$\frac{1}{3}$

14. The probability of getting a square number of the top when the die is thrown once is,
[Average]
A) $\frac{2}{6}$ B) $\frac{6}{8}$ C) $\frac{5}{8}$ D)$\frac{8}{5}$

15. There are 28 bulbs in a box. 7 bulbs are defective among them. The probability of getting a non-defective bulb when a bulb is drawn randomly from the box is,
[Difficult]
A)$\frac{7}{28}$ B)$\frac{21}{28}$ C)$\frac{27}{28}$ D)$\frac{28}{7}$

16. There are 3 red, 4 white and 5 blue balls. A ball is drawn at random from the bag. The probability of getting a white ball is,
[Average]

A) $\frac{3}{9}$ B)$\frac{4}{8}$ C) $\frac{4}{12}$ D)$\frac{8}{12}$

17. A andBare two friends. The probability that their birthday falls on the same day is, [Difficult]

A) $\frac{364}{365}$ B) $\frac{1}{365}$ C) 1 D) 0

18. If P(E) is the probability of an event then the correct statement is, [Easy]

A) $0 < P(E) < 1$ B) $0 \leq P(E) \leq 1$

C) $0 \leq P(E) < 1$ D)$0 < P(E) \leq 1$

19. Two dice are thrown simultaneously. The probability that the sum of the numbers appearing on the top of the faces is greater than 12 is, [Difficult]

A)$\frac{6}{36}$ B) $\frac{1}{36}$ C) 1 D)0

20. A die is rolled once. The probability of getting an even number on the top is, [Average]

A) $\frac{1}{6}$ B)$\frac{1}{3}$ C) 0.5 D) $\frac{6}{5}$

21. A die is rolled once. The probability of getting a prime number on the top is, [Average]

A) $\frac{1}{2}$ B)$\frac{1}{3}$ C) $\frac{1}{4}$ D)$\frac{2}{3}$

22. The probability of winning a game is 0.3, then the probability of losing the same game is, [Model QP-2017, Average]

A) 0.1 B) 0.3 C) 0.7 D) 1.3

23. The sum of all the elementary events of a random experiment is, [Model QP 2024, Preparatory QP 2025,Model QP-2025, May-2025, Easy]

A) 0 B) $\frac{1}{2}$ C) 1 D) -1

24. If the probability of a student scoring 100% in Mathematics examination is$\frac{4}{5}$, then the probability of the student not scoring100% in the same subject is, [Average]

A) $\frac{1}{5}$ B)$\frac{2}{5}$ C) $\frac{1}{4}$ D)$\frac{2}{3}$

25. The possible outcome of a random experiment is either win or loss. If the probability of winning is twice the probability of losing, then the probability of winning in the experiment is, [Difficult]

A) $\frac{1}{3}$ B)$\frac{2}{3}$ C) 1 D) 2

26. The probability of getting 53 Fridays or 53 Saturdays in a leap year is, [Difficult]

A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{3}{7}$ D) 1

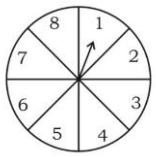
II. Answer the following questions. (1 Mark)

27. Find the probability of selecting a vowel from the word 'TRIANGLE' [Average]
28. Write the value of P(E) + $P(\overline{E})$ with reference to probability. [Model QP-2025, Easy]
29. If P (E) = 0.05, then find$P(\overline{E})$. [March-2019, Easy]
30. If the probability of raining at a specific time on a day is 0.75, then what is the probability of not raining on the same time? [Model QP-2023, Average]
31. If P(A)=$\frac{2}{3}$, then find the value of P($\overline{A}$) [Sept-2020, Average]
32. If the probability of an event 'B' is P(B)=0.65 then find the value of P($\overline{B}$) [Average]
33. Find the probability of getting the number 6 on the top, when a die is thrown once. [Easy]
34. A fair coin is tossed once. Find the probability of getting a head. [April-2017, Easy]
35. If the probability of winning a game is 0.8, then find the probability of losing the same game. March-2019,Easy]
36. If P(A)= 80%then prove that the probability of not'A'$\frac{1}{5}$. [Model QP-2024, Difficult]
37. A fair coin is tossed twice. What is the number of all possible outcomes? [Easy]

III. Answer the following questions. (2 Marks)

38. A coin is tossed once. Find the probability of getting i) one head only ii) at least one head on the top. [,Difficult]
39. Find the probability of getting a number between 2 and 6, when a die is rolled once. [Average]
40. Two dice are rolled simultaneously. Find the probability that the sum of the two numbers on the top is 5. (Average)
41. A die numbered from 1 to 6 is rolled twice. Find the probability that the sum of the two numbers on the top is 10. [April-2019, Average]
42. Two numbered from 1 to 6 are rolled once. Find the probability that the sum of the two numbers on the top is more than 7. [Average]
43. The probability of an event 'A' isP(A) andP(A) : P($\overline{A}$)=1:2. Find the value of P($\overline{A}$) [Difficult]

44. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and these are equally likely outcomes. Find the probability that it will point at an even number. [Sept-2020, Average]



45. A box contains cards numbered from 2 to 25 and is well-shuffled. A card is drawn at random. Find the probability that the card drawn is i) an even number ii) a perfect square. [Average]
46. A bag contains 6 red, 5 blue and 4 green balls. A ball is drawn at random from the bag. Find the probability that the ball drawn is i) not green ii) red [Average]
47. There are 36 mangoes in a basket. $\frac{1}{4}$ th of the mangoes are rotten and others are good. Find the probability of getting a good mango when one mango is drawn randomly from the basket. [April 2024 , Average]
48. 'A' is a random experiment. If P(A) : P($\overline{A}$)= 5: 11, then find P(A) and P($\overline{A}$) Average]
49. There are 500 watches in a box. 50 watches among them are defective. A watch is drawn at random from the box. Find the probability that the watch drawn is defective. [April-2018, Easy]
50. A die whose faces are numbered from 1 to 6 is rolled once. Find the probability of getting a prime number or the multiple of 5 on the top. [Average]
51. Two dice whose faces are numbered from 1 to 6 are rolled once. Find the probability that the sum of the numbers on their top is 6. [June 2018:Average]
52. A fair coin is tossed twice. Find the probability of getting i) two heads ii) tail in particular [March-2019:Average]
53. A die whose faces are numbered from 1 to 6 is rolled once. Find the probability of getting a) an even number b) a perfect square number [April 2020:Average]
54. The faces of a die are marked with letters A, B, C, D, E, I from English alphabet. Find the probability of getting a vowel on the top when the die is rolled once. [September 2020:Average]
55. There are 6 blue and some red marbles in a box. The probability of drawing a blue marble is $\frac{3}{8}$. Find the number of red marbles in the box and also find the probability of taking out a red marble. [May 2025:Difficult]
56. The six faces of a die show the given numbers: 1, 2, 3, 4, 1, 5. This die is rolled once. Find the probability of getting a perfect square number. [May 2025:Average]
57. There are 20 discs in a box which are numbered from 1 to 20. Find the probability of getting a perfect cube number when a disc is drawn at random from the box. [Average]

IV. Answer the following questions. (3 Marks)

58. When a die is rolled once, find the probability of getting a number on the top that is i) greater than 2 ii) less than or equal to 2 iii) not greater than 2

[Average]

59. Two coins are tossed simultaneously. Find the probability of getting a) at least one head b) both heads c) no head [Average]

60. A bag contains cards numbered from 5 to 30. A card is drawn at random from the bag. Find the probability that the card drawn is a) a multiple of 2 and 3 b) a square number c) a multiple of 3

[Average]

61. There are 3 red balls, 5 white balls and 8 blue balls. A ball is drawn at random from the bag. Find the probability that the ball drawn is a) a red ball b) not a white ball

[April-2020, Average]

62. A box contains 20 cards numbered from 1 to 20. One card is drawn randomly from the box. Find the probability of getting a card bearing i) a perfect square number ii) a number which is divisible by both 2 and 3.

[March-2025:Difficult]

63. A bag contains white, black and red balls only. A ball is taken out at random from the bag. The probability of taking out white ball is $\frac{3}{10}$ and the probability of taking out black ball is $\frac{2}{5}$. Find the probability of taking out the red ball. If the bag contains 20 black balls, find the total number of balls in the bag.

[Difficult]

64. The following table shows the marks obtained by 50 students for 100 marks.

Marks	0-34	35-50	51-70	71-90	91-100
Number of students	8	9	14	11	8

Find the probability of a student scoring i) less than 34 ii) between 71-90 iii) more than 90

[Average]

65. A box contains 20 discs with numbers 1 to 20 written on them. A disc is drawn at random from the box. Find the probability that the number obtained on the disc is
(i) a number divisible by 2 but not by 3,
(ii) a number which is both perfect square and perfect cube

[Average]

MODEL ANSWERS

UNIT:1 REAL NUMBERS

I. Multiple Choice Questions

1. B)irrational number
2. A**)** irrational number
3. A**)** 5
4. C) $\sqrt{9}$
5. B) $\sqrt{4}$
6. A) irrational number
7. B) composite number
8. B**)** 13 x 7
9. C) 4
10. C) Prime numbers
11. D) $2^3x3^1x5^1$
12. A) 2,3,5
13. D) 6
14. A) 1
15. B) 1
16. C) 1 A) 60
17. B) a×b
18. B) 2
19. (C) (a × b)
20. (A) 60
21. (A) 2×5
22. B) x y^2
23. (C) 4
24. (B) 1
25. B) 2
26. C) 300
27. C) 6p
28. B) 1000.

II. ONE MARKS QUESTIONS

29). 2 | 140
2 | 70
5 | 35
7 | 7
140 = 2 × 2 × 5 × 7 = 2^2x5x7

30. Every composite number can be expressed as a product of primes and this factorization is unique except for the order in which the prime factors occur.

31. $H \times L = A \times B$

$L = \frac{(A \times B)}{H} = \frac{24 \times 36}{12}$

LCM = 72

32. 2 | 96
2 | 48
2 | 24
2 | 12
2 | 6
| 3

$96 = 2^5 \times 3$

33. $156 = 2^2 \times 3 \times 13$

34. 2 | 200
2 | 100
2 | 50
5 | 25
| 5

$200 = 2^m \times 5^n$

$200 = 2^3 \times 5^2$

m = 3 , n = 2

35. 2|24
2|12
2|6
|3

$24 = 2^3 \times 3$,

2|36
2|18
3|9
|3

$24 = 2^3 \times 3$, $36 = 2^2 \times 3^2$

. HCF (24, 36) = 12

36. 21

37. x = 2 & y = 5

III. TWO/ Three MARKS QUESTIONS:

38 H × L = A × B

$L = \frac{(A \times B)}{H} = \frac{306 \times 657}{9}$

LCM = 22338

39 7 × 11 × 13 + 13

= 13(7 × 11 + 1)

= 13 × 78

∴ 7 × 11 × 13 + 13 is composite number

40. H × L = A × B

H = (A × B) / L

= (91 × 26) / 182

= 2366 / 182

HCF = 13

41. A Number which can be expressed as two or more its factors is know as composite number . composite number 24 = 2×2×2×3

42.

2 | 438

3| 219

| 73

438 = 2×3×73

2 | 606

3| 303

| 101

606 = 2×3×101

HCF = 2×3 = 6

43. Let as assume, $\sqrt{3} + 5$ is a rational numbers

$\sqrt{3} + 5 = \frac{a}{b}$ (a and b are co-prime, b ≠ 0)

$\sqrt{3} = \frac{a}{b} - 5$

$\sqrt{3} = \frac{a-5b}{b}$

$\sqrt{3}$ is a rational number ,

$\frac{a-5b}{b}$ is a rational

but $\sqrt{3}$ is not a rational number

this gives as contradiction

our assumption that $5 + \sqrt{3}$ is a rational number is wrong

$\sqrt{3} + 5$is an irrational number.

44. Let as assume $2 + \sqrt{5}$ is a rational numbers

$2 + \sqrt{5} = \frac{a}{b}$ (a and b are co-prime, b ≠ 0)

$\sqrt{5} = \frac{a}{b} - 2$

$\sqrt{5} = \frac{a-2b}{b}$

$\sqrt{5}$is a rational number$\frac{a-2b}{b}$ $is\ rational$ but $\sqrt{5}$ is not a rational number

our assumption that $2 + \sqrt{5}$ is a rational number is wrong

$2 + \sqrt{5}$ is an irrational numbers

45. Let as assume $6 + \sqrt{2}$ is a rational numbers

$6 + \sqrt{2} = \frac{a}{b}$(a and b are co-prime, b ≠ 0)

$\sqrt{2} = \frac{a}{b} - 6$

$\sqrt{2} = \frac{a-6b}{b}$

$\sqrt{2}$is a rational number$\frac{a-6b}{b}$ $is\ rational$ but $\sqrt{2}$ is not a rational number

our assumption that $6+ \sqrt{2}$ is a rational number is wrong

$6+ \sqrt{2}$ is an irrational numbers

46. Let as assume $5 - \sqrt{3}$ is a rational numbers

$5 - \sqrt{3} = \frac{a}{b}$ (a and b are co-prime, b ≠ 0)

$\sqrt{3} = 5 - \frac{a}{b}$

$\sqrt{3} = \frac{5b-a}{b}$

$\sqrt{3}$is a rational number$\frac{5b-a}{b}$ $is\ rational$ but $\sqrt{3}$ is not a rational number

our assumption that $5 - \sqrt{3}$ is a rational number is wrong

$5 - \sqrt{3}$ is an irrational numbers

47. Let us assume , to the contrary, that $2 + \sqrt{3}$ is rational.

That is we can find co prime a and b (b≠ 0) such that $2 + \sqrt{3} = \frac{a}{b}$

$\therefore \sqrt{3} = \frac{a}{b} - 2$

Rearranging this equation, we get

$\sqrt{3} = \frac{a-2b}{b}$

Since a and b are integers, we get $\frac{a-2b}{b}$ is rational, and so √3 is rational.

But this contradicts the fact that √3 is irrational.

This contradiction has arisen because of our incorrect assumption that 2 + √3 is rational.

So, we conclude that 2 + √3 is irrational.

48. Let us assume , to the contrary, that 3 + √2 is rational.

That is we can find co prime a and b (b≠ 0) such that $3 + \sqrt{2} = \frac{a}{b}$

$\therefore \sqrt{2} = \frac{a}{b} - 3$

Rearranging this equation, we get

$\sqrt{2} = \frac{a-3b}{b}$

Since a and b are integers, we get $\frac{a-3b}{b}$ is rational, and so √2 is rational.

But this contradicts the fact that √2 is irrational.

This contradiction has arisen because of our incorrect assumption that 3 + √2 is rational.

So, we conclude that 3 + √2 is irrational.

49. Let us assume , to the contrary, that 5 + √7 is rational.

That is we can find co prime a and b (b≠ 0) such that $5 + \sqrt{7} = \frac{a}{b}$

$\therefore \sqrt{7} = \frac{a}{b} - 5$

Rearranging this equation, we get

$\sqrt{7} = \frac{a-5b}{b}$

Since a and b are integers, we get $\frac{a-5b}{b}$ is rational, and so √3 is rational.

But this contradicts the fact that √7 is irrational.

This contradiction has arisen because of our incorrect assumption that 5 + √7 is rational.

So, we conclude that 5 + √7 is irrational.

50. Let us assume , to the contrary, that 5 + √2 is rational.

That is we can find co prime a and b (b≠ 0) such that $5 + \sqrt{2} = \frac{a}{b}$

$\therefore \sqrt{2} = \frac{a}{b} - 5$

Rearranging this equation, we get

$\sqrt{2} = \frac{a-5b}{b}$

Since a and b are integers, we get $\frac{a-5b}{b}$is rational, and so $\sqrt{3}$ is rational.

But this contradicts the fact that $\sqrt{2}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $5 + \sqrt{2}$ is rational.

So, we conclude that $5 + \sqrt{2}$ is irrational.

51. Let us assume , to the contrary, that $4 + \sqrt{3}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $4 + \sqrt{3} = \frac{a}{b}$

$\therefore \sqrt{3} = \frac{a}{b} - 4$

Rearranging this equation, we get

$\sqrt{3} = \frac{a-4b}{b}$

Since a and b are integers, we get $\frac{a-4b}{b}$ is rational, and so $\sqrt{3}$ is rational.

But this contradicts the fact that $\sqrt{3}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $4 + \sqrt{3}$ is rational.

So, we conclude that $4 + \sqrt{3}$ is irrational.

52. Let us assume , to the contrary, that $6 + \sqrt{11}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $6 + \sqrt{11} = \frac{a}{b}$

$\therefore \sqrt{11} = \frac{a}{b} - 6$

Rearranging this equation, we get

$\sqrt{11} = \frac{a-6b}{b}$

Since a and b are integers, we get $\frac{a-6b}{b}$ is rational, and so $\sqrt{11}$ is rational.

But this contradicts the fact that $\sqrt{11}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $6 + \sqrt{11}$ is rational.

So, we conclude that $6 + \sqrt{11}$ is irrational.

53. Let us assume , to the contrary, that $8 + \sqrt{5}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $8 + \sqrt{5} = \frac{a}{b}$

$\therefore \sqrt{5} = \frac{a}{b} - 8$

Rearranging this equation, we get

$\sqrt{5} = \frac{a-8b}{b}$

Since a and b are integers, we get $\frac{a-8b}{b}$ is rational, and so √3 is rational.

But this contradicts the fact that √5 is irrational.

This contradiction has arisen because of our incorrect assumption that 8 + √5 is rational.

So, we conclude that 8 + √5 is irrational.

54. Let us assume , to the contrary, that 7 + √5 is rational.

That is we can find co prime a and b (b≠ 0) such that 7 + √5 = $\frac{a}{b}$

∴√5 = $\frac{a}{b} - 7$

Rearranging this equation, we get

√5 = $\frac{a-7b}{b}$

Since a and b are integers, we get $\frac{a-7b}{b}$is rational, and so √3 is rational.

But this contradicts the fact that √5 is irrational.

This contradiction has arisen because of our incorrect assumption that 7 + √5 is rational.

So, we conclude that 7 + √5 is irrational.

55. Let us assume , to the contrary, that 2 + √7 is rational.

That is we can find co prime a and b (b≠ 0) such that 2 + √7 = $\frac{a}{b}$

∴√7 = $\frac{a}{b} - 2$

Rearranging this equation, we get

√7 = $\frac{a-2b}{b}$

Since a and b are integers, we get $\frac{a}{b} - 2$ is rational, and so √7 is rational.

But this contradicts the fact that √7 is irrational.

This contradiction has arisen because of our incorrect assumption that 2 + √7 is rational.

So, we conclude that 2 + √7 is irrational.

56. Let us assume , to the contrary, that 7 + √7 is rational.

That is we can find co prime a and b (b≠ 0) such that 7 + √7 = $\frac{a}{b}$

∴√7 = $\frac{a}{b} - 7$

Rearranging this equation, we get

$\sqrt{7} = \frac{a-7b}{b}$

Since a and b are integers, we get $\frac{a-7b}{b}$ is rational, and so $\sqrt{3}$ is rational.

But this contradicts the fact that $\sqrt{7}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $7 + \sqrt{7}$ is rational.

So, we conclude that $7 + \sqrt{7}$ is irrational.

57. Let us assume , to the contrary, that $2 - \sqrt{5}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $2 - \sqrt{5} = \frac{a}{b}$

$\therefore \sqrt{5} = 2 - \frac{a}{b}$

Rearranging this equation, we get

$\sqrt{5} = \frac{2b-a}{b}$

Since a and b are integers, we get $\frac{2b-a}{b}$ is rational, and so $\sqrt{5}$ is rational.

But this contradicts the fact that $\sqrt{5}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $2 - \sqrt{5}$ is rational.

So, we conclude that $2 - \sqrt{5}$ is irrational.

58. Let us assume , to the contrary, that $8 - \sqrt{3}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $8 - \sqrt{3} = \frac{a}{b}$

$\therefore \sqrt{3} = 8 - \frac{a}{b}$

Rearranging this equation, we get

$\sqrt{3} = \frac{8b-a}{b}$

Since a and b are integers, we get $\frac{8b-a}{b}$ is rational, and so $\sqrt{5}$ is rational.

But this contradicts the fact that $\sqrt{3}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $8 - \sqrt{3}$ is rational.

So, we conclude that $8 - \sqrt{3}$ is irrational.

59. Let us assume , to the contrary, that $6 - \sqrt{2}$ is rational.

That is we can find co prime a and b ($b \neq 0$) such that $6 - \sqrt{2} = \frac{a}{b}$

$\therefore \sqrt{2} = 6 - \frac{a}{b}$

Rearranging this equation, we get

$\sqrt{2} = \frac{6b-a}{b}$

Since a and b are integers, we get $\frac{6b-a}{b}$ is rational, and so $\sqrt{2}$ is rational.

But this contradicts the fact that $\sqrt{2}$ is irrational.

This contradiction has arisen because of our incorrect assumption that $6 - \sqrt{2}$ is rational.

So, we conclude that $6 - \sqrt{2}$ is irrational.

60. A =120

B = 135

H = 15

L = ?

$$L = \frac{A \times B}{H}$$

$$L = \frac{120 \times 135}{15}$$

L = 120 × 9

L = 1080

61. A =88

B = 128

H = 8

L = ?

$$L = \frac{A \times B}{H}$$

$$L = \frac{88 \times 128}{8}$$

L = 11 × 128

L = 140

62. A =136

B = 176

H = 8

L = ?

$$L = \frac{A \times B}{H}$$

$$L = \frac{136 \times 176}{8}$$

L = 17 × 176

L = 2992

63. A =336

B = 216

H = 24

L = ?

$$L = \frac{A \times B}{H}$$

$$L = \frac{336 \times 216}{24}$$

L = 14 × 216

L = 3024

64. A =224

B = 336

L = 672

H= ?

$$H = \frac{A \times B}{L}$$

$$H = \frac{224 \times 336}{672}$$

H = 112

65. A =112

B = 144

L = 1008

H= ?

$$H = \frac{A \times B}{L}$$

$$H = \frac{112 \times 144}{1008}$$

H = 16

66. A =96

B = 120

L = 480

H= ?

$$H = \frac{A \times B}{L}$$

$$H = \frac{96 \times 120}{480}$$

H = 24

67.

2	68
2	34
	17

2	72
2	36
2	18
3	9
	3

68 = 2 × 2 × 17

72 = 2 × 2 × 2 × 3 × 3

L.C.M = 2 × 2 × 2 × 3 × 3 × 17 = 1224

H.C.F = 2 × 2 = 4

A × B = L × H

68 × 72 = 1224 × 4

4896 = 4896

68.

2	36
2	18
3	9
	3

7	63
3	9
	3

36 = 2 × 2 × 3 × 3

63 = 7 × 3 × 3

L.C.M = 2 × 2 × 3 × 3 × 7 = 252

H.C.F = 3 × 3 = 9

A × B = L × H

36 × 63 = 252 × 9

2268 = 2268

69

2	38
	19

$38 = 2 \times 19$

3	57
	19

$57 = 3 \times 19$

L.C.M = $2 \times 3 \times 19 = 114$

H.C.F = 19

A × B = L × H

$38 \times 57 = 114 \times 19$

$2166 = 2166$

70.

2	66
3	33
	11

$66 = 2 \times 3 \times 11$

7	42
3	6
	2

$42 = 7 \times 3 \times 2$

L.C.M = $2 \times 3 \times 11 \times 7 = 462$

H.C.F = $2 \times 3 = 6$

A × B = L × H

$66 \times 42 = 462 \times 6$

$2772 = 2772$

71. The length and breadth of the first table are 84 cm and 42 cm. The length and breadth of the second table are 126 cm and 42 cm.

$84 = 2 \times 2 \times 3 \times 7 = 2^2 \times 3 \times 7$

$126 = 2 \times 3 \times 3 \times 7 = 2 \times 3^2 \times 7$

$42 = 2 \times 3 \times 7 = 2 \times 3 \times 7$

HCF(84,42,126)= $2 \times 3 \times 7 = 42$

Thus, the maximum length of the square glass slab is 42 cm.

Area of a square slab = 42×42 cm^2

Number of slabs for the first table = $\frac{area\ of\ first\ table}{area\ of\ a\ slab}$

$= \frac{84 \times 42}{42 \times 42} = \frac{84}{42} = 2$

2 glass slab

Number of slabs for the second table = $\frac{area\ of\ second\ table}{area\ of\ a\ slab}$

$= \frac{126 \times 42}{42 \times 42} = \frac{126}{42} = 3$

3 glass slab

72. $A \times B = 2366$

$H = 13$

$L = ?$

$L = \frac{A \times B}{H}$

$L = \frac{2366}{13}$

$L = 182$

$L = \frac{A \times B}{H}$

$$182 = \frac{91 \times B}{13}$$

$182 = 7 \times B$

$B = \frac{182}{7}$

$B = 26$

73. Length of the floor = 112 ft

Breadth of the floor = 72 ft

$112 = 2 \times 2 \times 2 \times 2 \times 7 = 2^4 \times 7$

$72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$

HCF(112, 72) $= 2 \times 2 \times 2 = 8$

Area of a square tile $= 8 \times 8 = 64$sq.ft

Total No. of tiles $= \frac{Area\ of\ the\ floor}{Area\ of\ one\ tile}$

$= \frac{112 \times 72}{8 \times 8}$

$= 126$

$\therefore No. of\ tiles = 126$

74. $L \times H = 2016$

$A = 42$

$B = ?$

$B = \frac{L \times H}{A}$

$B = \frac{2016}{42}$

$B = 48$

2	48
3	24
2	8
2	4
	2

7	42
3	6
	2

$48 = 2 \times 2 \times 2 \times 2 \times 3$ $42 = 7 \times 3 \times 2$

H.C.F (48,42) $= 2 \times 3 = 6$

75. $N_1 = 2^m \times 3^2$

$N_2 = 2^2 \times 3^n$

$N_1 = 2^1 \times 3^3$

$L = 3^4 \times 2^3$

$H = 3^y \times 2^x$

Given L.C.M $= 3^4 \times 2^3$

The powers for the base 2 are m,2,1 max(m,2,1) = 3

$\therefore$ m =3

For prime base 3 : The powers of 3 in the three numbers are 2 ,n and 3.

The highest power among them must equal to the power of 3 in the L.C.M which is 4

Max(2,n,3) = 4

$\therefore$n =4

Now the numbers are

$N_1 = 2^3 \times 3^2$

$N_2 = 2^2 \times 3^4$

$N_1 = 2^1 \times 3^3$

Given H.C.F $= 2^x \times 3^y$

For prime base 2 : The power of 2 are 3,2 and 1

The lowest power determines x

X = min(3,2,1)

$\therefore$x = 1

For prime base 3 : The powers of 3 are 2,4,and 3

Y = min(2,4,3)

$\therefore$y = 2

$\therefore$m = 3, n = 4 ,x y = 1, y = 2

76. $24 = 2 \times 2 \times 2 \times 3$

$60 = 2 \times 2 \times 3 \times 5$

L.C.M(24, 60) $= 2 \times 2 \times 2 \times 3 \times 5 = 120$

Minimum equal number of roses used 120

No. of garlands used by A $= \frac{120}{24} = 5$

No. of garlands used by B $= \frac{120}{60} = 2$

Total No. of garlands = 5 + 2 = 7

77. They meet again at the time by their value of the LCM

$18 = 2 \times 3 \times 3 = 2 \times 3^2$

$12 = 2 \times 2 \times 3 = 2^2 \times 3$

LCM .L= $2^2 \times 3^2 = 36$

LCM .L= $4 \times 9 = 36$

Therefore, They meet again after 36 minutes at the initial point

78. 2|40
2|20
2|10
5|5
|1

$\therefore x = 2$, y =3 & z = 5

79. 3|147
7|49
7|7
|1

$147 = 3 \times 7^2$

2|56
2|28
2|14
7|7
|1

$56 = 2^3 \times 7$ HCF(147,56) is 7

Maximum length of the rod = 7m. This rod is to use 21 times to measure the field

80. 2|420
2|210
3|105
5|35
7|7

|1

$420 = 2^2 \times 3 \times 5 \times 7$

2|130

5|65

13|13

|1

$130 = 2 \times 5 \times 13$

HCF(420,130) = 10

No. of barfis in each stack = 10

81. Let as assume that $\sqrt{2}$ is a rational numbers

$\sqrt{2} = \frac{a}{b}$(a and b are co-prime, b ≠ 0)

$2 = \frac{a^2}{b^2}$

$2b^2 = a^2$

a^2divisible by 2, then a is also divisible by 2

'a' have 2 as common factor

We can write up a =2k

$a^2 = 4k^2$

$2b^2 = 4k^2$

$b^2 = 2k^2$

b^2divisible by 2 then b is also divisible by 2

'b' have 2 as common factor

a and b have at least 2 as a common factor

but this contradicts the fact that a and b are co-prime

this contradiction has arisen because of our incorrect assumption that $\sqrt{2}$

$\sqrt{2}$ is a ir rational number

82. Let as assume that $\sqrt{3}$ is a rational numbers

$\sqrt{3} = \frac{a}{b}$(a and b are co-prime, b ≠ 0)

$3 = \frac{a^2}{b^2}$

$3b^2 = a^2$

a^2divisible by 3,, then a is also divisible by 3

'a' have 3 as common factor

We can write up a =3k

$a^2 = 9k^2$

$3b^2 = 9k^2$

$b^2 = 3k^2$

b^2 divisible by 3 then b is also divisible by 3

'b' have 3 as common factor

a and b have at least 3 as a common factor

but this contradicts the fact that a and b are co-prime

this contradiction has arisen because of our incorrect assumption that $\sqrt{3}$

$\sqrt{3}$ is a irrational number

83. Let as assume that $\sqrt{5}$ is a rational numbers

$\sqrt{5} = \frac{a}{b}$(a and b are co-prime, b ≠ 0)

$5 = \frac{a^2}{b^2}$

$5b^2 = a^2$

a^2 divisible by 5,, then a is also divisible by 5

'a' have 5 as common factor

We can write up a =5k

$a^2 = 25k^2$

$5b^2 = 25k^2$

$b^2 = 5k^2$

b^2 divisible by 5 then b is also divisible by 5

'b' have 5 as common factor

a and b have at least 5 as a common factor

but this contradicts the fact that a and b are co-prime

this contradiction has arisen because of our incorrect assumption that $\sqrt{5}$

$\sqrt{5}$ is a irrational number

84.

2	510
3	255
5	85
17	17
	1

2	92
2	46
23	23
	1

510 = 2×3×5×17

92 = 2×2×23

HCF of (510,92) = 2

LCM of (510,92) = 2^2×3×5×17×23

LCM = 23460

H × L = A × B

2×23460 = 510 ×92

46920 = 46920

LCM × HCF = Product of two integers

85. 336 = 2 × 2 × 2 × 2 × 3 × 7

54 = 2 × 3 × 3 × 3

LCM of (336, 54) = 2 × 3 × 2 × 2 × 2 × 7 × 3 × 3 =3024

HCF of (336, 54) = 2 × 3 = 6

LCM × HCF = A × B

336 × 54 = 3024 × 6

18144 = 18144

LHS = RHS

86. 26 = 2 × 13

91 = 7 × 13

HCF of (26, 91) = 13

LCM of (26, 91) = 2 x 7 x 13 = 182

HCF × LCM = A × B

13 × 182 = 26 × 91

2366 = 2366 LHS = RHS

87.

3	135
3	45
3	15
5	5
	1

510 = 3×3×3×5

3	75
5	25
5	5
	1

75 = 3×5×5

2	20
2	10
5	5
	1

20 = 2×2×5

HCF of (135,75) = 15

LCM of (15,20) = 2×2×5×3×5

LCM = 60

88. 12, 15 and 21

12 = 2 x 2 x 3

15 = 3 x 5

21 = 3 x 7

HCF of (12, 15, 21) = 3

LCM of (12, 15, 21) = 3 x 2 x 2 x 5 x 7 = 420

89. $6 = 2 \times 3$

$72 = 2x\ 2\times2\times3\times3$

$120 = 2x\ 2\times2\times3\times5$

HCF of (6, 72, 120) = $3\times2 = 6$

LCM of (6, 72, 120) = $2^2 \times 3^2 \times 5 = 360$

90.
2|616
2|308
2|154
7|77
11|11
|1 $616 = 2^3\times7\times11$

2|32
2|16
2|8
2|4
2|2
|1 $32 = 2^5$

HCF (616,32) = 8

Maximum number of column in which they march = 8

Unit : 02 POLINOMIALS

I. Multiple choice questions :

1) A) 3
2) B) 1
3) C) 3
4) D) 2
5) C) 3
6) C) 2
7) A)20
8) B)3
9) B)3
10) C) 3
11) C) 4
12) A) $x^2 + 2x + 8$
13) C) 2
14) C) -2 and -4
15) C) $\frac{c}{a}$
16) B) $\frac{-b}{a}$
17) B) - 2
18) B) $\frac{-2}{3}$
19) D) $p(x) = x^2 - 4x + 5$
20) B) 2
21) D) -3 and 2

II. ONE MARKS QUESTIONS:

22) 3
23) 4
24) 3
25) 4
26) 3
27) 3
28) 4
29) 3
30) 4
31) 5
32) Product of zeros $= \frac{10}{2} = 5$
33) - 7
34) 6
35) $x^2 + 3x + 2$
36) $p(x) = x^2 - 3$,
P(x) = 0, x = $-\sqrt{3}$ & x = + $\sqrt{3}$

37) P(x) = 0,

$x^2 - 25 = 0$

$x^2 = 25$

x = -5 & x = + 5

38) $P(1) = 2(1)^3 + 3(1)^2 - 11(1) + 6$

$= 2 + 3 - 11 + 6$

$= 0$

39) -1 and 4

40) $P(x) = x^2 - (\alpha + \beta) + \alpha\beta$

III. TWO MARKS QUESTIONS:

41) Linear polynomials = bx +c

Quadratic polynomials = $ax^2 + bx + c$

42) $p(x) = 6x^2 - 7x - 3$

$p(x) = 6x^2 - 9x + 2x - 3$

$p(x) = 3x(2x - 3) + 1(2x - 3)$

$p(x) = (2x - 3)(3x + 1)$

$2x - 3 = 0$ or $3x + 1 = 0$

$x = \frac{3}{2}$ or $x = \frac{-1}{3}$

$-18x^2 \rightarrow -9x, +2x$

$-7x$

43) $p(x) = 4x^2 - 4x - 3$

$p(x) = 4x^2 - 6x + 2x - 3$

$p(x) = 2x(2x - 3) + 1(2x - 3)$

$p(x) = (2x - 3)(2x + 1)$

$2x - 3 = 0$ or $2x + 1 = 0$

$x = \frac{3}{2}$ or $x = \frac{-1}{2}$

$-12x^2 \rightarrow -6x, +2x$

$-4x$

44) $\alpha + \beta = \frac{-b}{a} = \frac{-3}{1} \rightarrow b = 3a \quad \rightarrow (1)$

$\alpha \times \beta = \frac{c}{a} = \frac{2}{1} = 2 \rightarrow c = 2a \quad \rightarrow (2)$

add (1) and (2)

b + c = 5a

45) Sum of polynomials $= \alpha + \beta = \frac{-b}{a} = \frac{-12}{3} = 4$

Product of polynomials $= \alpha \times \beta = \frac{c}{a} = \frac{-15}{3} = 5$

$\boldsymbol{\alpha^2 + \beta^2} = (\boldsymbol{\alpha} + \boldsymbol{\beta})^2 - 2(\alpha \times \beta)$

$= 4^2 - 2(5)$

$= 16 - 10 = 6$

46) $P(x) = x^2 + 3x + 1$

Sum of polynomials $= \alpha + \beta = \frac{-b}{a} = -3$

Product of polynomials = α x β = $\frac{c}{a}$ = 1

$\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha x \beta}=\frac{-3}{1}$ = -3

47) P(x) = x^2 + 3x + 1

a=1 , b= 3 , c= 1

Sum of polynomials= α + β= $\frac{-b}{a}$= -3

Product of polynomials= α x β = $\frac{c}{a}$ = 1

$\alpha^2\beta + \beta^2\alpha$ = αβ (α + β)= 1(- 3)= - 3

48) P(x) = $2x^2 - 6x$ + k

$\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are zeros of P(x) ,

From data $\boldsymbol{\beta}$ = 2 $\boldsymbol{\alpha}$

Sum of polynomials = α + β= $\frac{-b}{a}$

α + 2 $\boldsymbol{\alpha}$ = $\frac{-(-6)}{1}$

3 $\boldsymbol{\alpha}$ = 6

$\boldsymbol{\alpha}$ = 2

Product of polynomials = α x β = $\frac{c}{a}$

α (2 $\boldsymbol{\alpha}$) = $\frac{k}{1}$

2 $\boldsymbol{\alpha}^2$ = k

2 $(2)^2$ = k

∴ K = 8

49) P(x) = $ax^2 + bx - 4$

Sum of polynomials = α + β= $\frac{-b}{a}$ = $\frac{1}{4}$

Product of polynomials = α x β = $\frac{c}{a}$ = -1 c = -4

∴Product of polynomials = $\frac{-4}{a}$ = -1

a = 4

Sum of polynomials= $\frac{-b}{a}$ = $\frac{1}{4}$

= $\frac{-b}{4}$ = $\frac{1}{4}$

b= -1

50) p(x) = x^2 - 5x + 6

p(x) = x^2 - 6x + x – 6

p(x) = x (x -6)+ 1(x – 6)

p(x) = (x - 6)(x + 1)

x - 6=0 and x + 1=0

x = 6 and x = -1

51) α =$\sqrt{3}$β = $-\sqrt{3}$

α + β = $\sqrt{3}$+ ($-\sqrt{3}$) = $\sqrt{3}$ $-\sqrt{3}$ = 0

$\alpha \times \beta = \sqrt{3}\,(-\sqrt{3}) = -\sqrt{9} = -3$

$p(x) = x^2 - 0x - 3$

$p(x) = x^2 - 3$

IV. THREE MARKS QUESTIONS:

52) $p(x) = x^2 - 2x - 8$

$p(x) = x^2 - 4x + 2x - 8$

$p(x) = x(x-4) + 2(x-4)$

$p(x) = (x-4)(x+2)$

$x - 4 = 0$ and $x + 2 = 0$

$x = 4$ and $x = -2$

Sum of polynomials $= \alpha + \beta = \frac{-b}{a} = -(-2) = 2$

$(4) + (-2) = 2$

Product of polynomials $= \alpha \times \beta = \frac{c}{a} = -8$

$(4)\ (-2) = -8$

53) $p(x) = x^2 + 7x + 10$

$p(x) = x^2 + 5x + 2x + 10$

$p(x) = x(x+5) + 2(x+5)$

$p(x) = (x+5)(x+2)$

$x + 5 = 0$ and $x + 2 = 0$

$x = -5$ and $x = -2$

$+10x^2 \rightarrow +5x, +2x$

$+7x$

Sum of polynomials $= \alpha + \beta = \frac{-b}{a} = -7$

$(-5) + (-2) = -7$

Product of polynomials $= \alpha \times \beta = \frac{c}{a} = 10$

$(-5)(-2) = 10$

54. $p(x) = 6x^2 - 7x - 3$

$6x^2 - 7x - 3 = 0$

$6x^2 - 9x + 2x - 3 = 0$

$3x(2x-3) + 1(2x-3) = 0$

$(3x+1)(2x-3) = 0$

$3x + 1 = 0$ and $2x - 3 = 0$

$x = \frac{-1}{3}$ and $x = \frac{3}{2}$

$\therefore$ zeros of polynomials $\alpha = \frac{-1}{3}$ and $\beta = \frac{3}{2}$

sum of the zeros of polynomials $= \alpha + \beta = \frac{-b}{a} = \frac{-(-7)}{6} = \frac{7}{6}$

$\frac{-1}{3} + \frac{3}{2} = \frac{7}{6}$

$\frac{-2+9}{6} = \frac{7}{6}$

$\frac{7}{6} = \frac{7}{6}$

product of the zeros of polynomials= α x β = $\frac{c}{a} = \frac{-3}{6} = \frac{-1}{2}$

$(\frac{-1}{3})(\frac{3}{2}) = \frac{-1}{2}$

$\frac{-3}{6} = \frac{-1}{2}$

$\frac{-1}{2} = \frac{-1}{2}$

55. $p(x) = x^2 + 6x + 8$

a=1 b=6 c=8 If p(x)=0

$x^2+6x+8 = 0$

$x^2 + 4x + 2x + 8 = 0$

$x(x + 4)+2(x + 4)=0$

$(x + 4)(x + 2) = 0$

$x + 4 = 0$ and $x + 2 = 0$

$x = -4$ and $x = -2$

∴zeros of polynomials α = -4 and β = -2

sum of the zeros of polynomials = α + β= $\frac{-b}{a} = \frac{-4}{-2} = 2$

-(-4) + (-2) = 2

4 – 2 = 2

2 = 2

product of the zeros of polynomials= α x β = $\frac{c}{a} = \frac{8}{1} = 8$

(-4) (-2) = 8

8 = 8

56. $p(x) = x^2 + 6x + 5$

a=1 b=6 c=5 If p(x)=0

$x^2+6x+5=0$

$x^2 + 5x + x + 5 = 0$

$x(x + 5)+1(x + 5)=0$

$(x + 5)(x + 1) = 0$

$x + 5 = 0$ and $x + 1 = 0$

$x = -5$ and $x = -1$

∴zeros of polynomials α = -5 and β = -1

sum of the zeros of polynomials = α + β= $\frac{-b}{a} = \frac{-6}{1} = -6$

(-5) + (-1) =- 6

- 5 – 1 = - 6

-6 = -6

product of the zeros of polynomials = α x β = $\frac{c}{a}$ = $\frac{5}{1}$ = 5

(-5) (-1) = 5

5 = 5

57. $p(x) = x^2 + 3x + 2$

a=1 b=3 c=2 If p(x)=0

$x^2+3x+2=0$

$x^2 + 2x + x + 2 =0$

x (x + 2)+1 (x + 2)=0

(x + 2)(x + 1) =0

x + 2= 0 and x + 1 =0

x = - 2 and x = -1

∴ಶೂನ್ಯತೆಗಳುα = - 2 and β = -1

sum of the zeros of polynomials = α + β= $\frac{-b}{a}$ =$\frac{-(3)}{1}$ = -3

(-2) + (-1) =- 6

- 2 – 1 = - 3

- 3 = -3

product of the zeros of polynomials = α x β = $\frac{c}{a}$ = $\frac{2}{1}$ = 2

(-2) (-1) = 2

2 = 2

58. $p(x) = x^2 + x – 12$

a=1 b=1 c=-12 If p(x)=0

$x^2+x-12=0$

$x^2 + 4x - 3x - 12 =0$

x (x + 4) ¯3 (x + 4)=0

(x + 4)(x - 3) =0

x + 4= 0 and x -3 = 0

x = - 4 and x = 3

∴zeros of polynomialsα = - 4 and β = 3

sum of the zeros of polynomials = α + β= $\frac{-b}{a}$ =$\frac{-1}{1}$ = -1

(-4) + 3 =- 1

- 4 +3 = -1

- 1 = - 1

product of the zeros of polynomials= α x β = $\frac{c}{a}$ = $\frac{-12}{1}$ =-12

(-4) (3) = 2

-12 = -12

59. $p(x) = x^2 - 6x + 9$

a=1 b=- 6 c=9 If p(x)=0

x^2-6x +9=0

x^2 - 3x -3x + 9 =0

x (x - 3)- 3 (x - 3)=0

(x - 3)(x - 3) =0

x - 3= 0 and x - 3 =0

x = 3 and x = 3

∴zeros of polynomials α = 3 and β = 3

sum of the zeros of polynomials = α + β= $\frac{-b}{a}$ =$\frac{-(-6)}{1}$ = 6

3 + 3 = 6

6 = 6

product of the zeros of polynomials = α x β = $\frac{c}{a}$ = $\frac{9}{1}$ = 9

(3) (3) = 9

9 = 9

60. $p(x) = x^2 - 2x - 15$

a=1 b= -2 c=-15 If p(x)=0

x^2-2x -15=0

x^2 - 5x + 3x - 15 =0

x (x - 5)+ 3 (x - 5)=0

(x - 5)(x + 3) =0

x - 5= 0 and x + 3 =0

x = 5 and x = - 3

∴zeros of polynomials α = 5 and β = -3

sum of the zeros of polynomials = α + β= $\frac{-b}{a}$ =$\frac{-(-2)}{1}$ = 2

5 + (-3) = 2

5 – 3 = 2

product of the zeros of polynomials= α x β = $\frac{c}{a}$ = $\frac{-15}{1}$ = -15

(5) (- 3) = - 15

- 15 = - 15

61. $p(x) = x^2 - 5x - 14$

a=1 b=- 5 c=- 14 If p(x)=0

$x^2 - 5x - 14 = 0$

$x^2 - 7x + 2x - 14 = 0$

$x(x - 7) + 2(x - 7) = 0$

$(x - 7)(x + 2) = 0$

$x - 7 = 0$ and $x + 2 = 0$

$x = 7$ and $x = -2$

∴zeros of polynomials are $\alpha = 7$ and $\beta = -2$

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-(-5)}{1} = 5$

$7 - 2 = 5$

$5 = 5$

product of the zeros of polynomials= $\alpha \times \beta = \frac{c}{a} = \frac{-14}{1} = -14$

$(7)(-2) = -14$

$-14 = -14$

62. $p(x) = x^2 - 2x + 1$

a=1 b= - 2 c= 1 If p(x)=0

$x^2 - 2x + 1 = 0$

$x^2 - 1x - 1x + 1 = 0$

$x(x - 1) - 1(x - 1) = 0$

$(x - 1)(x - 1) = 0$

$x - 1 = 0$ and $x - 1 = 0$

$x = 1$ and $x = 1$

∴zeros of polynomials are $\alpha = 1$ and $\beta = 1$

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-(-2)}{1} = 2$

$1 + 1 = 2$

$2 = 2$

product of the zeros of polynomials= $\alpha \times \beta = \frac{c}{a} = \frac{1}{1} = 1$

$(1)(1) = 1$

$1 = 1$

63) Sum of polynomials = $\alpha + \beta = \frac{-b}{a} = -3$

Product of polynomials = $\alpha \times \beta = \frac{c}{a} = 2$

expected polynomial $p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$p(x) = x^2 - (-3)x + 2$

$p(x) = x^2 + 3x + 2$

$p(x) = 0$

$x^2 + 3x + 2 = 0$

$x^2 + 2x + x + 2 = 0$

$x(x + 2) + 1(x + 2) = 0$

$(x + 1)(x + 2) = 0$

$x + 1 = 0$ and $x + 2 = 0$

$x = -1$ and $x = -2$

$\therefore$ zeros $\alpha = -1$ and $\beta = -2$

64. $\alpha + \beta = 7$, $\alpha \times \beta = 12$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - 7x + 12$

$a=1$ $b=-7$ $c=12$ If $p(x)=0$

$x^2 - 4x - 3x + 12 = 0$

$x(x - 4) - 3(x - 4) = 0$

$(x - 4)(x - 3) = 0$

$x - 4 = 0$ and $x - 3 = 0$

$x = 4$ and $x = 3$

$\therefore$zeros of polynomials are $\alpha = 4$ and $\beta = 3$

65. $\alpha + \beta = 7$, $\alpha \times \beta = 6$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - 7x + 6$

$a=1$ $b=-7$ $c=6$ If $p(x)=0$

$x^2 - 6x - 1x + 6 = 0$

$x(x - 6) - 1(x - 6) = 0$

$(x - 6)(x - 1) = 0$

$x - 6 = 0$ and $x - 1 = 0$

$x = 6$ and $x = 1$

$\therefore$zeros of polynomials$\alpha = 6$ and $\beta = 1$

66. $\alpha + \beta = -4$, $\alpha \times \beta = 4$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - 4x + 4$

$a=1$ $b=-4$ $c=4$ If $p(x)=0$

$x^2 - 2x - 2x + 4 = 0$

$x(x - 2) - 2(x - 2) = 0$

$(x - 2)(x - 2) = 0$

x - 2= 0 and x – 2 =0

x = 2 and x = 2

∴zeros of polynomials are α = 2 and β = 2

67. α + β = 6, α x β = 8

quadratic equation $P(x) = x^2 – (\alpha + \beta) x + \alpha\beta$

$P(x) = x^2 – 6x + 8$

a=1 b= - 6 c= 8 If p(x)=0

x^2 - 4x - 2x + 8 = 0

x (x - 4)- 2 (x - 4)= 0

(x - 4)(x - 2) =0

x - 4= 0 and x - 2 =0

x = 4 and x = 2

∴zeros of polynomials are α = 4 and β = 2

68. α + β = 3 , α x β = -10

quadratic equation $P(x) = x^2 – (\alpha + \beta) x + \alpha\beta$

$P(x) = x^2 – 3x - 10$

a=1 b= - 3 c= -10 If p(x)=0

x^2 - 5x + 2x -10 =0

x (x - 5)+ 2 (x - 5)=0

(x - 5)(x + 2) =0

x - 5= 0 and x + 2 =0

x = 5 and x = -2

∴zeros of polynomials are α = 5 and β = - 2

69. α + β = 2 , α x β = -15

quadratic equation $P(x) = x^2 – (\alpha + \beta) x + \alpha\beta$

$P(x) = x^2$ - 2x - 15

a=1 b= - 2 c= - 15 If p(x)=0

x^2 - 5x + 3x - 15 =0

x (x - 5)+ 3 (x - 5)=0

(x - 5)(x + 3) =0

x - 5= 0 and x + 3 =0

x = 5 and x = - 3

∴zeros of polynomials are α = 5 and β = - 3

70. $\alpha + \beta = 5$, $\alpha \times \beta = -6$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - 5x - 6$

$a=1$ $b=-5$ $c=-6$ If $p(x)=0$

$x^2 - 6x + 1x - 6 = 0$

$x(x - 6) + 1(x - 6) = 0$

$(x - 6)(x + 1) = 0$

$x - 6 = 0$ and $x + 1 = 0$

$x = 6$ and $x = -1$

$\therefore$zeros of polynomials are $\alpha = 6$ and $\beta = -1$

71. $\alpha + \beta = 9$, $\alpha \times \beta = 14$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - 9x + 14$

$a=1$ $b=-9$ $c=14$ If $p(x)=0$

$x^2 - 7x - 2x + 14 = 0$

$x(x - 7) - 2(x - 7) = 0$

$(x - 7)(x - 2) = 0$

$x - 7 = 0$ and $x - 2 = 0$

$x = 7$ and $x = 2$

$\therefore\therefore$zeros of polynomials are$\alpha = 7$ and $\beta = 2$

72. $\alpha = -1$ $\beta = 4$

$\alpha + \beta = -1 + 4 = 3$

$\alpha \times \beta = (-1)4 = -4$

$p(x) = x^2 - 3x - 4$

zeros of polynomials $p(x) = 0$

$x^2 - 4x + x - 4 = 0$

$x(x - 4) + 1(x - 4) = 0$

$(x + 1)(x - 4) = 0$

$x + 1 = 0$ and $x - 4 = 0$

$x = -1$ and $x = 4$

73. $\alpha + \beta = -6$, $\alpha \times \beta = 8$

quadratic equation $P(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

$P(x) = x^2 - (-6)x + 8$

$P(x) = x^2 + 6x + 8$

$a=1$ $b=6$ $c=8$ If $p(x)=0$

$x^2 + 4x + 2x + 8 = 0$

$x(x+4) + 2(x+4) = 0$

$(x+4)(x+2) = 0$

$x + 4 = 0$ and $x + 2 = 0$

$x = -4$ and $x = -2$

$\therefore\therefore$zeros of polynomials are $\alpha = -4$ and $\beta = -2$

74 .p(x) = x^2+3x+2 compare to $P(x) = ax^2 + bx + c$

a=1 b=3 c=2

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-3}{1} = -3$

product of the zeros of polynomials = $\alpha \times \beta = \frac{c}{a} = \frac{2}{1} = 2$

i) $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} = \frac{-3}{2}$

ii) $\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha+\beta) = 2(-3) = -6$

75.p(x) = x^2+3x+2 compare to $P(x) = ax^2 + bx + c$

a=1 b=3 c=2

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-3}{1} = -3$

product of the zeros of polynomials = $\alpha \times \beta = \frac{c}{a} = \frac{2}{1} = 2$

i) $(\alpha+\beta)^2 = \alpha^2 + \beta^2 + 2\alpha\beta$

ii) $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$

$= (-3)^2 - 2(2) = 9 - 4 = 5$

76. p(x) = x^2+3x+2 compare to $P(x) = ax^2 + bx + c$

a=1 b=3 c=2

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-3}{1} = -3$

product of the zeros of polynomials = $\alpha \times \beta = \frac{c}{a} = \frac{2}{1} = 2$

$\alpha^3\beta + \alpha\beta^3 = \alpha\beta(\alpha^2 + \beta^2)$

$= \alpha\beta\,[(\alpha+\beta)^2 - 2\alpha\beta]$

$= 2\,[(-3)^2 - 2(2)] = 2[9 - 4] = 2[5] = 10$

77. $p(x) = 2x^2 - 8x + (k+1)$

a=2 b=-8 c=(k + 1)

sum of the zeros of polynomials = $\alpha + \beta = \frac{-b}{a} = \frac{-(-8)}{2} = \frac{8}{2} = 4$

product of the zeros of polynomials = $\alpha \times \beta = \frac{c}{a} = \frac{k+1}{2}$

$\alpha = \alpha$ and $\beta = 7\alpha$

$\alpha + \beta = 4$

$\alpha + 7\alpha = 4$

$8\alpha = 4$

$\alpha = \frac{1}{2}$

$\alpha\beta = \frac{k+1}{2}$

$(\frac{1}{2}) \times 7(\frac{1}{2}) = \frac{k+1}{2}$

$\frac{14}{4} = k+1$

$\frac{7}{2} - 1 = k$

$k = \frac{7-2}{2} = \frac{5}{2}$

Unit : 03 PAIR OF LINIEAR EQUATIONS WITH TWO VARIABLES

I. Multiple Choice Questions :

1) A) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

2) C) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

3) B) equations have unique solution

4) A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

5) D) Co-incident lines

6) B) Parallel lines

7) C) A unique solution

8) A) Intersecting lines

9) C) parallel lines

10) C) parallel lines

11) C) Parallel lines

12) C) 6

13) C) $\frac{15}{4}$

14) B) 2x+3y=9
4x+6y=18

15) B) If the lines are perpendicular to each other, there is no solution

16) A) x=5, y=2

II. One mark questions

17) $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$

18) No solution

19) unique solution

20) Many solutions

21) 2 (l+b) =32

22) x=1+2y

23) a=3, b=6

24) p=4

25) Equations have unique solution

26) Co-incident lines

27) One solution

28) One solution

29) One solution

30) x – 3y + 10 =0

31) No solution

III. Two mark questions

32) $2x+y=10$,
$x - y= 2$

$3x = 12$
$x=4$

substitute the value of x in equation (1)

$2x+y=10$
$2(4)+y=10$
$8+y=10$
$y=10 - 8$
$y= 2$

33) $3x-y=15$,
$2x-y=5$

$5x=20$
$x=4$

substitute the value of x in equation (1)

$3x+y=15$
$3(4)+y=15$
$12+y=15$
$y=15-12$
$y=3$

34) $2x+y=8$
$x-y=1$

$3x=9$
$x=3$

substitute the value of x in equation (1)

$2x+y=8$
$2(3)+y=8$
$6+y=8$
$y=8-6$
$y=2$
$y=1$

35) x+y=14 -----(1)
x-y= 4 -----(2)

x+y=14
y=14 - x

substitute the value of y in equation (2)
x-y= 4
x- (14- x) = 4
x- 14+ x = 4
2x = 4+14
2x = 18
x = 9
substitute the value of x in equation (1)
x+y=14
9+y =14
y = 14-9
y= 5

36) x+2y=8 -----(1)
x- y= -1 -----(2)

x+2y=8
x = 8 -2y
substitute the value of x in equation (2)
x – y = -1
(8-2y) – y = -1
8 – 2y – y = -1
8 -3y = -1
-3y = -1 -8
-3y = -9
y = 3
substitute the value of y in equation (1)
x+2y=8
x+2 (3) =8
x = 8-6
x= 2

37) $2x + y = 8$

$3x - y = 7$

$5x = 15$

$x = 3$

substitute the value of x in equation (1)

$2x + y = 8$

$2(3) + y = 8$

$6 + y = 8$

$y = 8 - 6$

$y = 2$

38) $2x + y = 10$

$x + y = 6$

(-) (-) (-)

$x = 4$

Substitute the value of x in equation (2)

$x + y = 6$

$(4) + y = 6$

$y = 6 - 4$

$y = 2$

39) $3x + y = 9$

$x + y = 5$

(-) (-) (-)

$2x = 4$

$x = 2$

Substitute the value of 'x' in equation (2)

$x + y = 5$

$(2) + y = 5$

$y = 5 - 2$

$y = 3$

40) $x + 2y = 6$

$x + y = 5$

(-) (-) (-)

$y = 1$

Substitute the value of 'y' in equation (2)

$x + y = 5$

$x + 1 = 5$

$x = 5 - 1$

$x = 4$

41) $2x + y = 2$

$x + y = 4$

(-) (-) (-)

$x = -2$

Substitute the value of 'x' in equation (2)

$x + y = 5$

$x + y = 4$

$(-2) + y = 4$

$y = 4 + 2$

$y = 6$

42) $x + 3y = 10$

$x + y = 6$

(-) (-) (-)

$2y = 4$

$y = 2$

Substitute the value of 'y' in equation (2)

$x + y = 6$

$x + 2 = 6$

$y = 6 - 2$

$y = 4$

43) $2x - y = 8$

$x + y = 7$

$3x = 15$

$x = 5$

Substitute the value of 'x' in equation (2)

$x + y = 7$

$(5) + y = 7$

$y = 7 - 5 \qquad y = 2$

44) $3x - y = 4$

$x + y = 8$

$4x = 12$

$x = 3$

Substitute the value of 'x' in equation (2)

$x + y = 8$

$(3) + y = 8$

$y = 8 - 3$

$y = 5$

45) $4x + y = 13$

$x - y = 2$

$5x = 15$

$x = 5$

Substitute the value of 'x' in equation (2)

$x - y = 2$

$(5) - y = 2$

$-y = 2 - 5$

$-y = -3$

$y = 3$

46) $x + y = 13$

$x - y = 1$

$2x = 14$

x =7

Substitute the value of 'x' in equation (1)

x + y = 13

(7) + y = 13

y= 13 - 7

y = 6

47) x + 4y = 14

x – y = -1

(-) (+) (+)

5y = 15

y = 3

Substitute the value of 'y' in equation (1)

x + 4y = 14

x + 4(3) = 14

x + 12 = 14

x = 14 -12

x = 2

48) 2 x - y = 5

x – y = 1

(-) (+) (-)

---

x = 4

Substitute the value of 'x' in equation (1)

2x - y = 5

2 (4) - y = 5

8 - y = 5

- y = 5 – 8

- y = -3

y = 3

49) 5 x - y = 14

x – y = -2

(-) (+) (+)

4x = 16

x = 4

Substitute the value of 'x' in equation (2)

x – y = -2

4 – y = -2

– y = -2 -4

– y = -6

y = 6

50) 2x + y = 10 ----(1)

x + y = 6 ----(2)

x + y = 6

y = 6- x ------(3)

Substitute the value of 'y' in equation (1)

2x + y = 10

2x + (6 - x) = 10

2x +6 –x =10

x = 10 -6

x = 4

Substitute the value of 'x' in equation (3)

y = 6- x

y = 6 – 4

y = 2

51) 3x + y = 10 ----(1)

x + y = 4 ----(2)

x + y = 4

y = (4 – x) -----(3)

Substitute the value of 'x' in equation (1)

3x + y = 10

3x + (4 – x) = 10

3x +4 – x = 10

2x = 10 -4

2x = 6

x = 3

Substitute the value of 'x' in equation (3)

y = (4 – x)

y = 4 – 3

y =1

52) x +2 y = 13 -----(1)

x - y = - 2 -----(2)

x – y = - 2

x = (- 2 + y) -------(3)

Substitute the value of 'x' in equation (1)

x +2 y = 13

(-2 + y) + 2y =13

-2 + y + 2y = 13

3y = 13 + 2

3y = 15

y = 5

53) Let the numbers be x&y

x+y =10

x-y =2

2x =12

X = 6

substitute the value of x in equation (1)

x+y 10

6+y = 10
y = 10-6
y = 4

54) Let the numbers be x&y
x+y = 15 & x+1 =y
x+y= 15
x-y = -1

2x = 14
x = 7
substitute the value of x in equation (1)
x+y = 15
7+y = 15
y = 15-7
y = 8

55) Multiply eqn (1) by 1 and eqn (2) by 2
(3x+2y = 5) 1
(x –y = 1) 2
3x + 2y = 5
2x -2 y = 2

5x = 7
x =7
x = 7/5
(3x+2y = 5) 1
(x –y = 1) 3
3x+2y = 5
3x- 3y = 3

5y = 2
y =2/5

56) Multiply eqn (1) by 5 and eqn (2) by 2
(2x+5y = 7)5
(5x+2y = 7)2

10x + 25y = 35
10x + 4y = 14
(-) (-) (-)

21x = 21
x = 1

substitute the value of x in equation (1)

2x+5y = 7
2(1) +5y =7
2 + 5y = 7
5y = 7-2
5y = 5
y = 1

IV. Three mark questions

57) Let the fraction be x/y

According to the equation

$$\frac{x+3}{y+2}=\frac{9}{11}$$

11x+22 = 9y+18
11x - 9y = -4 ---------- (1)

$$\frac{x+3}{y+3}=\frac{5}{6}$$

6x+18=5y=15
6x-5y=15-18
6x+5y=-3 ---------- (2)

From equation (1) & (2)

(11x-9y=-4) 5
(6x+5y=-3) 9
55x - 45y = -20
54x - 45y = -27
(-) (+) (+)
---
x=7

Substitute value of x in equation

11x - 9y = -4
11(7) - 9y= -4
77 - 9y = -4
-9y = -4 -77
-9y = -81

9y = 81

y=9

x=7, y=9

The required fraction is $^{7}/_{9}$.

58) From given

x+10 = 2(y+10)

x+10 = 2y=20

x-2y = 10 ---------- (1)

From given

x-10 = 6(y-10)

x-10 = 6y – 60

x-6y = -60+10

x-6y = -50 ---------- (32)

subtract equation (2) from equation (1)

x-2y=10

x-6y=-50

(-) (+) (+)

4y=60

y=15

Substitute value of y in equation (1)

x-2y=10

x-2(15)=10

x-30=10

x=10+30

x=40

Present age of x is 40

Present age of y is 15

59) Let speed of boat is still water = x km/hr

Speed of current = y km/hr

Now speed of Ritu during down

Stream = (x+y) km/hr

Upstream = (x-y) km/hr

As per the questions given

2(x+y)=20

x+y=10 -------- (1)

2(x-y)=4

x-y=2 --------- (2)

adding equation (1) and (2)

x+ y=10

x - y=2

2x = 12

x=6

putting the value of x in equation (1)

x+y=10

6+y=10

y=10-6

y=4

Speed of Ritu in still water 6 km/hr

Speed of current = 4 km/hr

60) Let in comes and expenditure of persons be x & y

Income – expenditure = saving

(9x-4y = 2000) 3

(7x-3y) = 2000) 4

27x - 12y = 6000

28x – 12y = 8000

-1x = -2000

x = 2000

putting the value of x in equation (1)

9x-4y=2000

9(2000)– 4y = 2000

18000 – 4y = 2000

-4y = - 16000

y = 4000

Now we can find monthly income.

Income of first person = 9x

= 9 (2000)

= 18000

Income of second person = 7 (2000)

= 14000

61) Let age of A be = x

Son age be = y

According to question after five year

x+y = 3(y+5)
x+y = 3y+15
x-3y = 15-5
x-3y = 10 --------- (1)

Five years age their ages be
x-y = 7(y-5)
x-5 = 7y-35
x-7y = -35+5
x-7y = -30 --------- (2)

Subtract equation (2) from (1)
x-3y = 10
x-7y = - 30
(-) (+) (+)

4y = 40
y = 10
substitute value of y in equation (1)
x-3y = 10
x-3(10) = 10
x-30 = 10
x = 40

* Present age of A is 40 years
* Present age of his son is 10 years.

V. Four mark questions

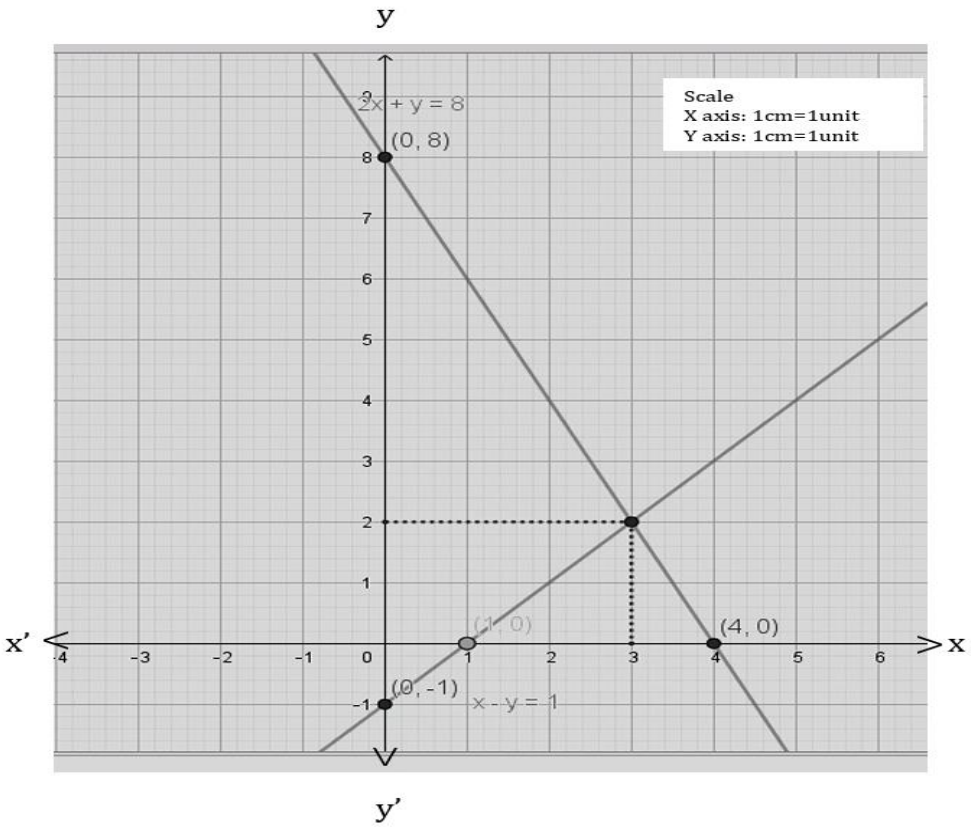
62. $2x + y = 8$, $x - y = 1$

$2x + y = 8$

X	0	4
Y	8	0
(x,y)	(0,8)	(4,0)

$x - y = 1$

X	0	1
Y	-1	0
(x,y)	(0,-1)	(1,0)



From the graph x=3 & y = 2

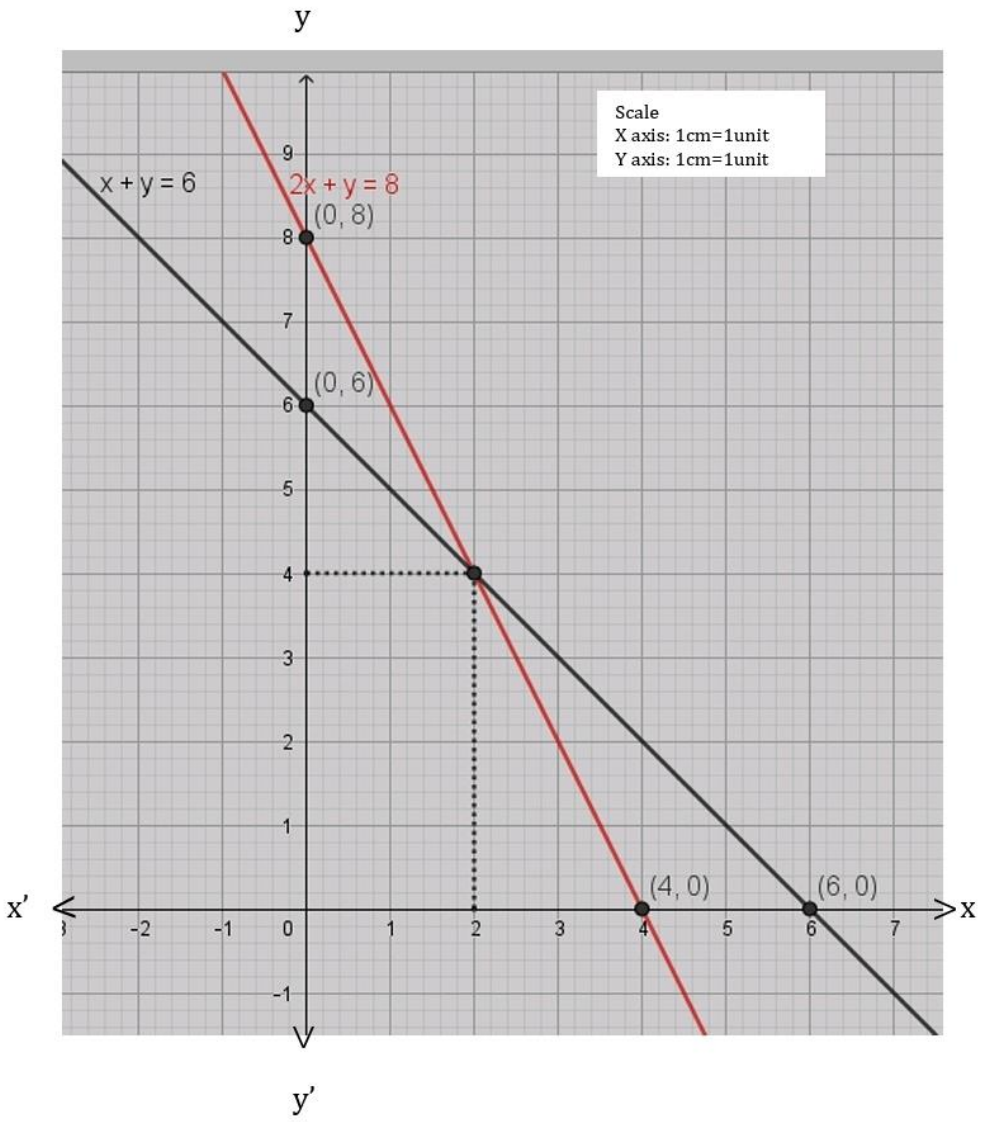
63. 2x + y = 8 x + y = 6

2x + y = 8

X	0	4
Y	8	0
(x,y)	(0,8)	(4,0)

x + y = 6

X	0	6
Y	6	0
(x,y)	(0,6)	(6,0)



From the graph x= 2 & y = 4

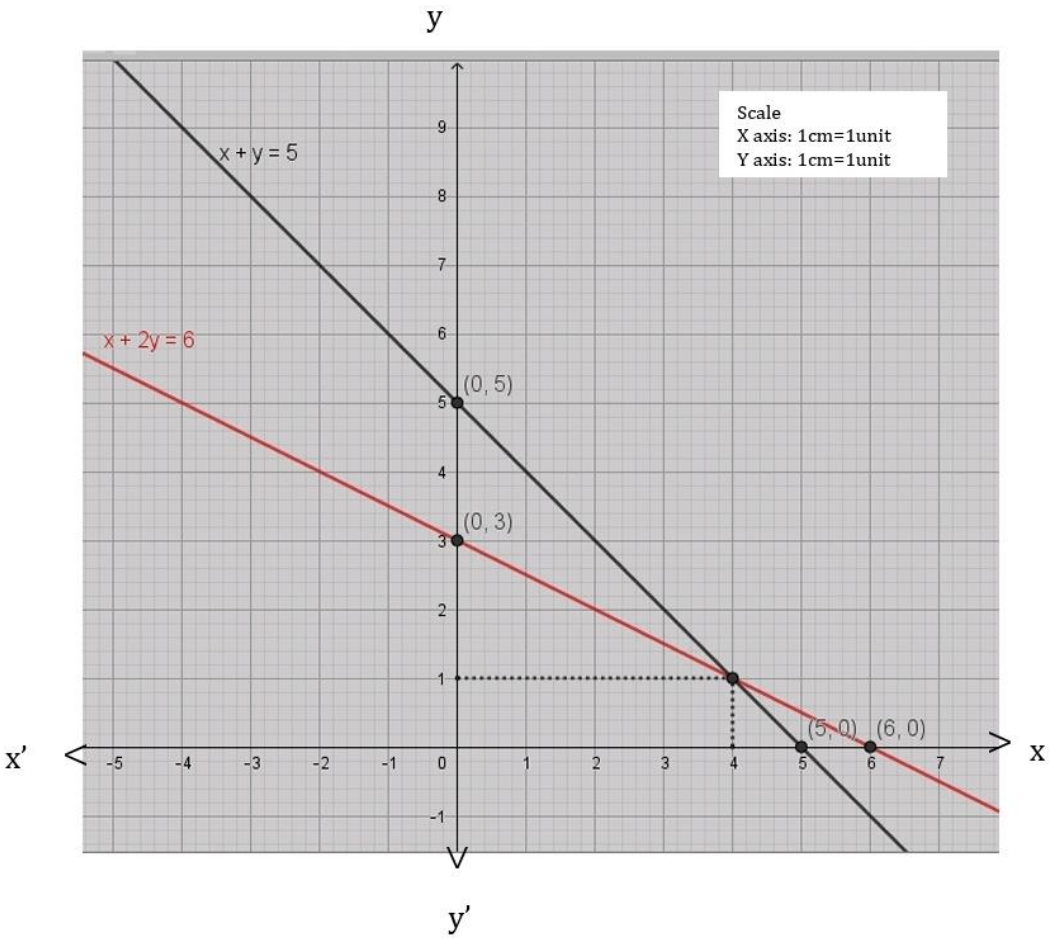
64. x+ 2y = 6 x + y = 5

x + 2y = 6

X	0	6
Y	3	0
(x,y)	(0,3)	(6,0)

x + y = 5

X	0	5
Y	5	0
(x,y)	(0,5)	(5,0)



From the graph x= 4 & y = 1

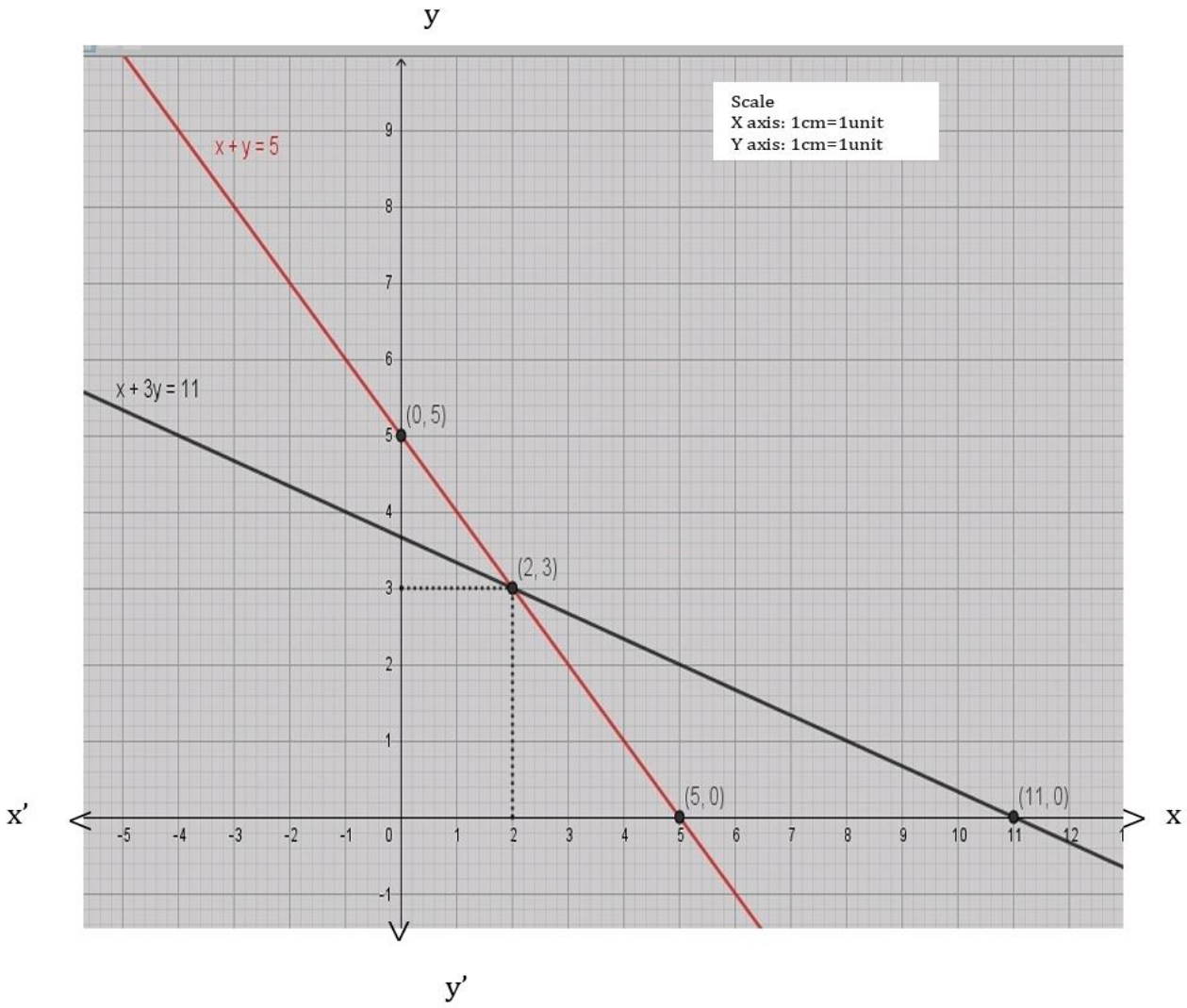
65. x+ 3y = 11 x + y = 5

x + 3y = 11

X	2	11
Y	3	0
(x,y)	(2,3)	(11,0)

x + y = 5

X	0	5
Y	5	0
(x,y)	(0,5)	(5,0)



From the graph x= 2 & y = 3

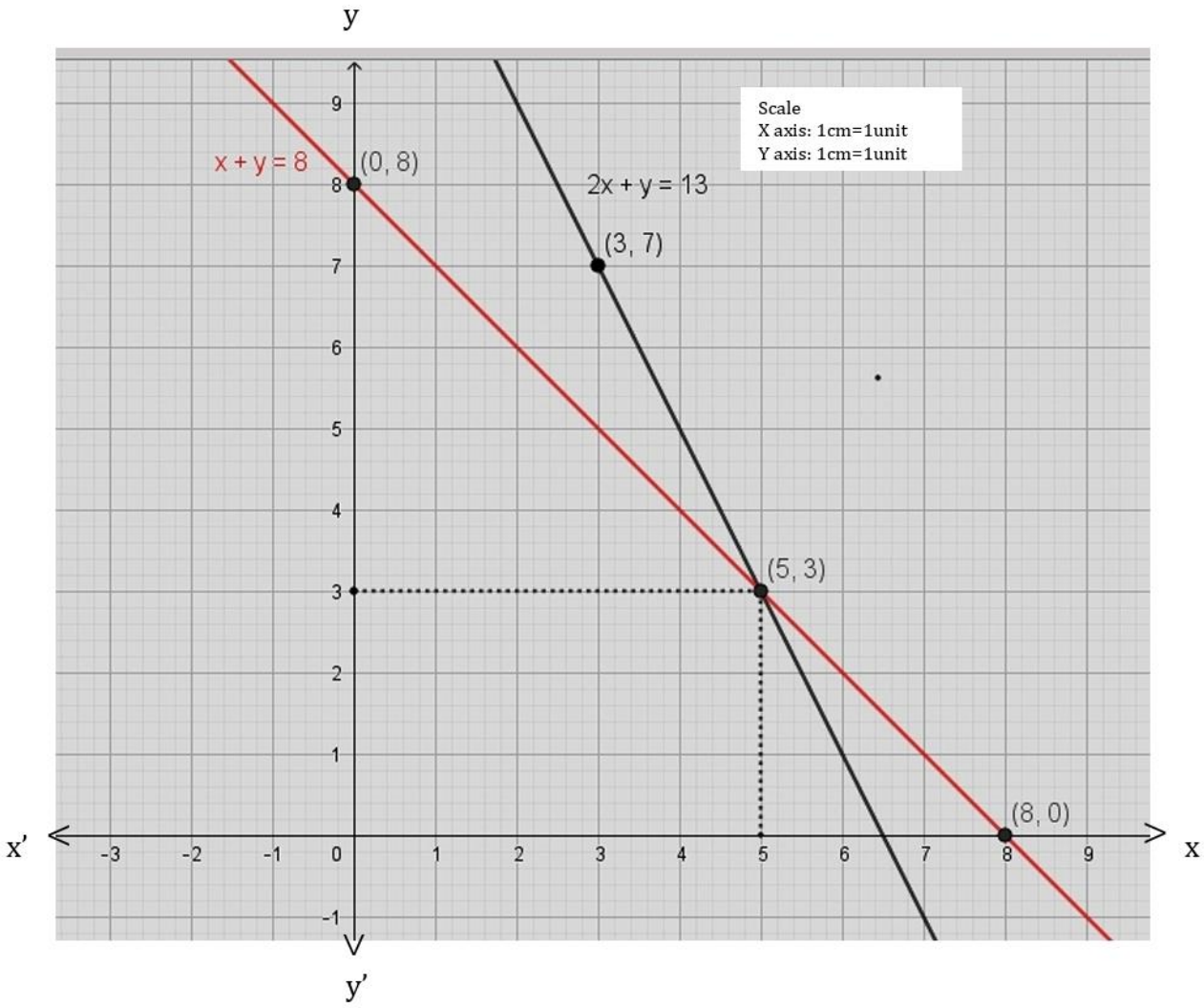
66. 2x+ y = 13 x + y = 8

2x + y = 13

X	3	5
Y	7	3
(x,y)	(3,7)	(5,3)

x + y = 8

X	0	8
Y	8	0
(x,y)	(0,8)	(8,0)



From the graph x= 5 & y = 3

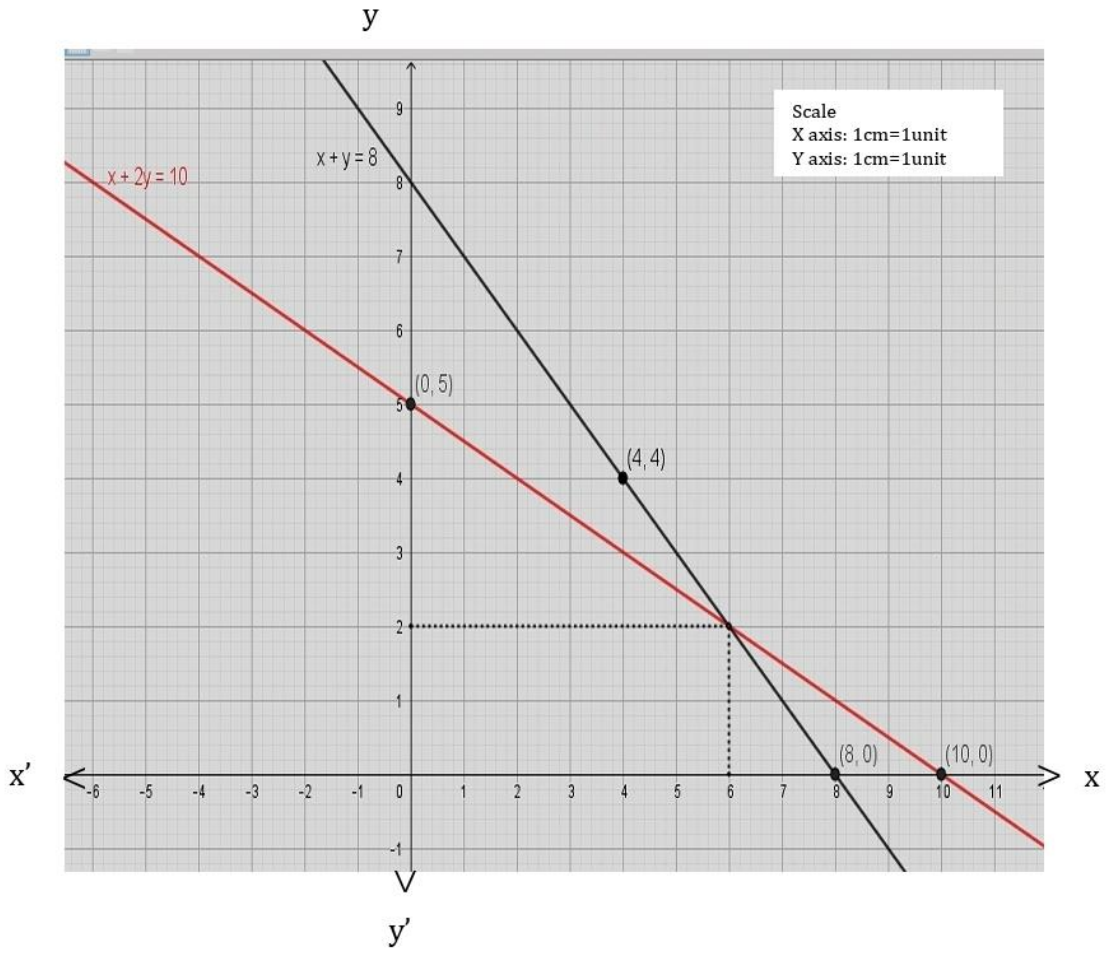
67. x+2y = 10 x + y = 8

x + 2y = 10

X	0	10
Y	5	0
(x,y)	(0,5)	(10,0)

x + y = 8

X	4	8
Y	4	0
(x,y)	(4,4)	(8,0)



From the graph x= 6 & y = 2

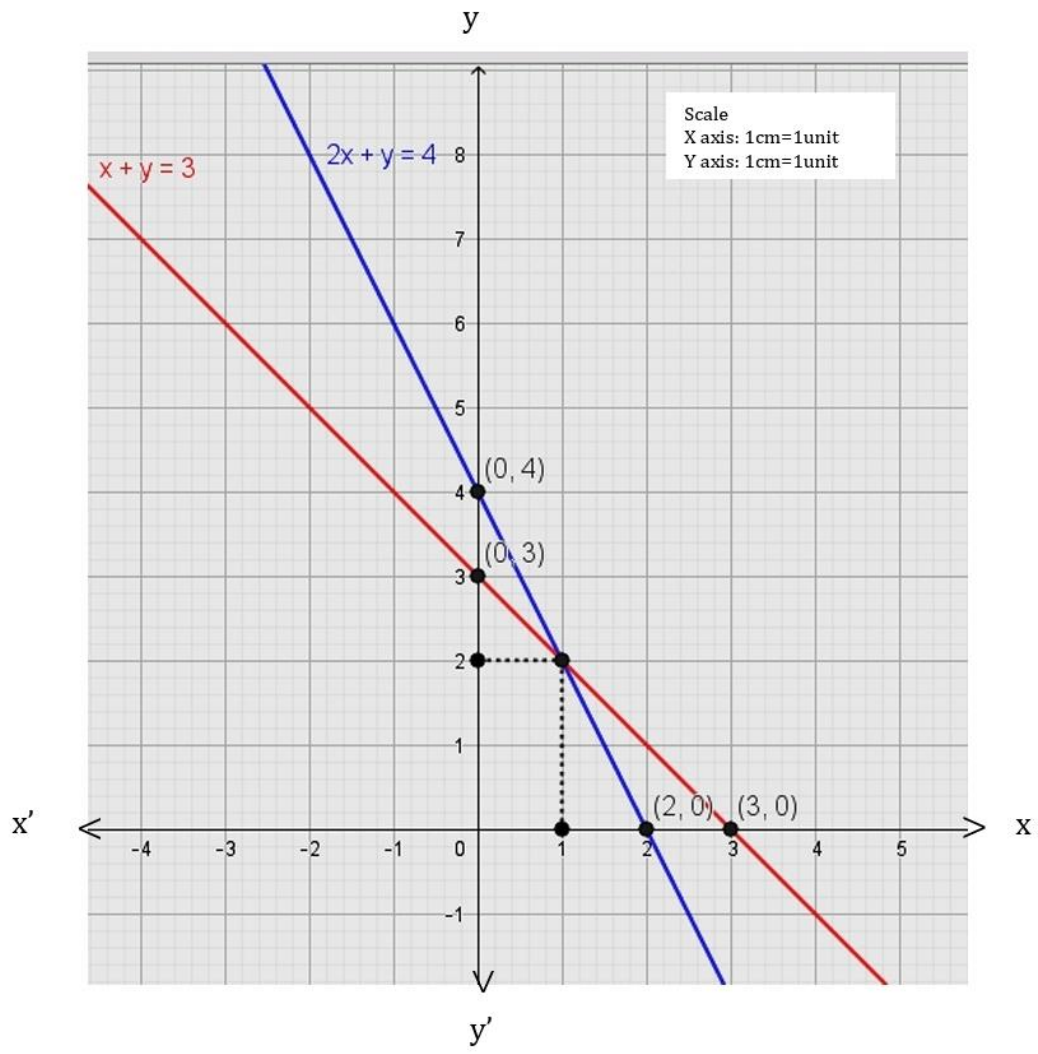
68. 2x+y = 4 x + y = 3

2x + y = 4

X	0	2
Y	4	0
(x,y)	(0,4)	(2,0)

x + y = 3

X	0	3
Y	3	0
(x,y)	(0,3)	(3,0)



From the graph x= 1 & y = 2

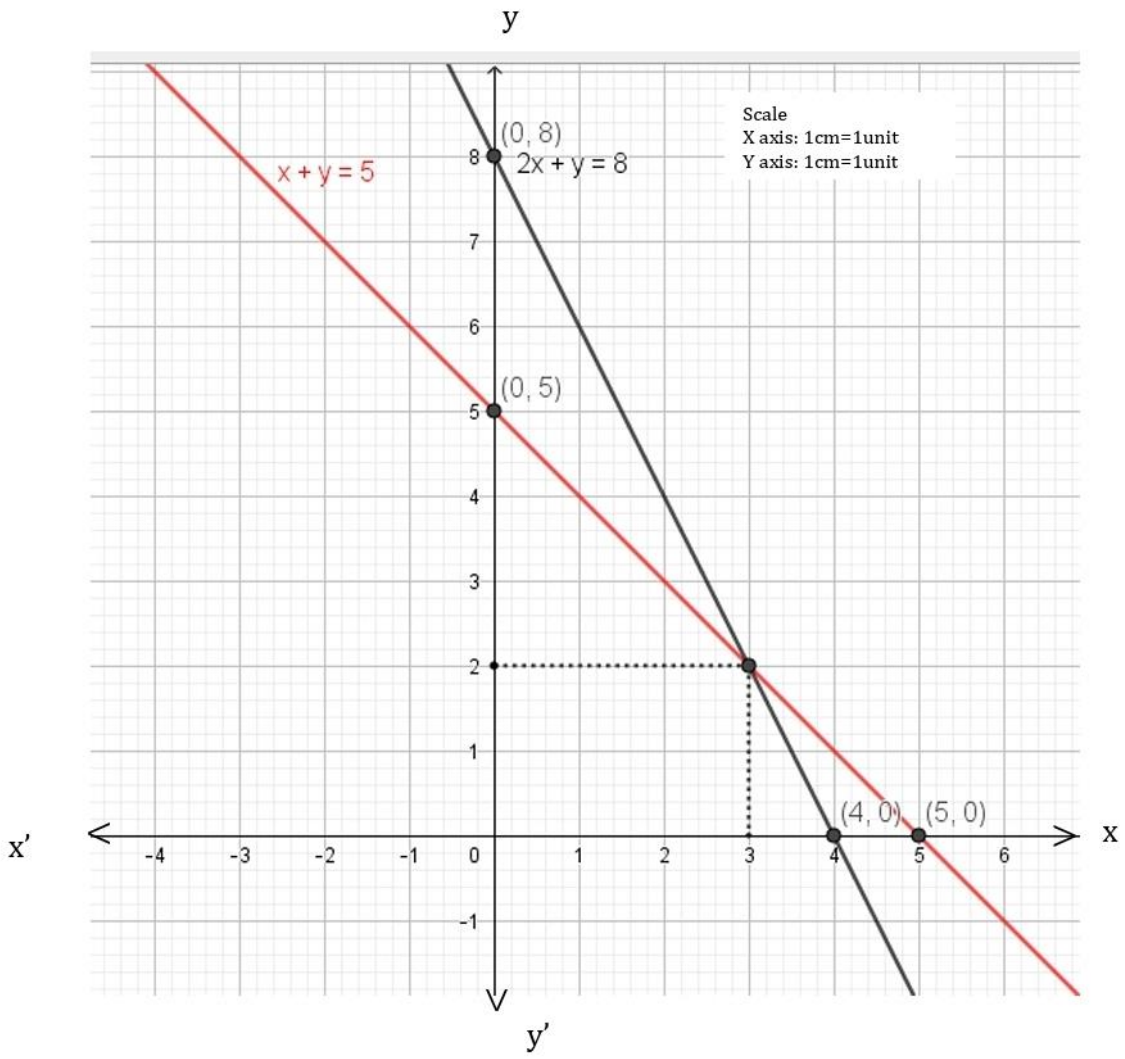
69. 2x+y = 8 x + y = 5

2x + y = 8

X	0	4
Y	8	0
(x,y)	(0,8)	(4,0)

x + y = 5

X	0	5
Y	5	0
(x,y)	(0,5)	(5,0)



From the graph x= 3 & y =2

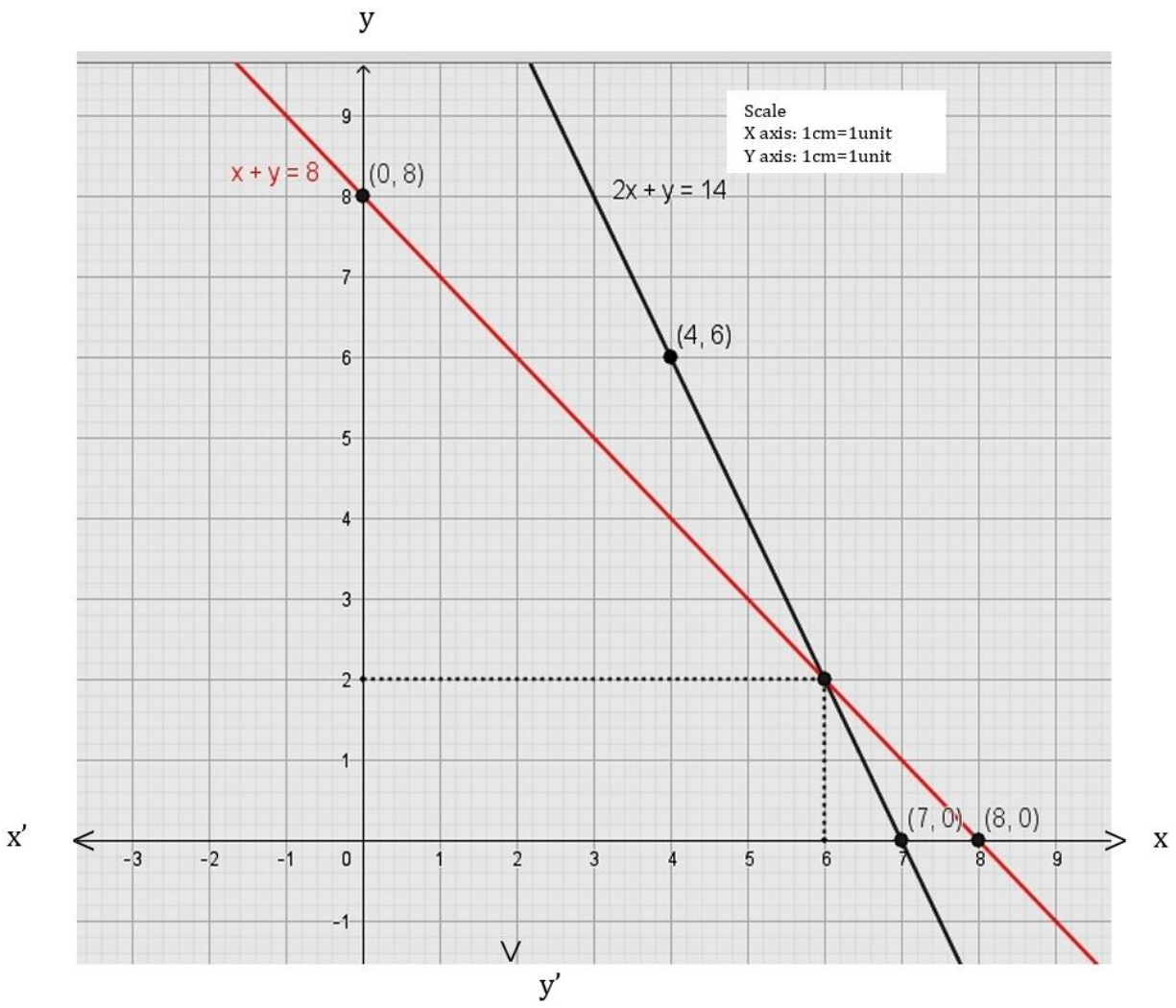
70. x+2y = 14 x + y = 8

x + 2y = 14

X	4	7
Y	6	0
(x,y)	(4,6)	(7,0)

x + y = 8

X	0	8
Y	8	0
(x,y)	(0,8)	(8,0)



From the graph x= 6 & y =2

Unit – 04 QUADRATIC EQUATIONS

I. Multiple Choice Questions :

1. B) ax^2+bx+c=0

2. D) x^2+3x+4=0

3. C) $x^2 - 5x + 6 = 0$

4. D) -6

5. B) Quadratic equation

6. D) $2x^2 - 3x + 5 = 0$

7. D) x (x+1)=30

8 A) $b^2 - 4ac$

9. A) 0

10. B) Real and Equal

11. A) it has two equal real roots

12 A) 9 .

13. .D) $b^2 - 4ac > 0$

14 B) 3,-2

15 C) $\frac{3}{2}$

16. C) -7

II. One Mark Questions

17. x(2+x)=3

    $2x+x^2 = 3$

    $2x+x^2 -3 = 0$

18. $\frac{x+1}{2} = \frac{1}{x}$

    x(x+1) = 2

    $x^2+x = 2$

    $x^2+x-2=0$

19. px^2 +qx-r = 0

$\Delta = b^2 - 4ac$

$\Delta = q^2$+4pr

20. $2x^2 - 4x + 3 = 0$

$\Delta = b^2 - 4ac$

$\Delta = (-4)^2 - 4 \times 2 \times 3$

Δ = 16-4

Δ = -8

21. (x+3) = 0

x= -3

22. x = 1 ,x= -3

23. $x^2 - 5x + 1 = 0$

$\Delta = b^2 - 4ac$

$\Delta = (-5)^2 - 4 \times 1 \times 1$

Δ = 25- 4

Δ = 21

24. $x^2 - 9 = 0$

x^2=9

x = ±3

Roots are Real and Distinct

25. $2m^2 = 2 - m$

$2m^2 + m$ -2 =0

26. . $x^2 - x$=0

x(x-1) = 0

x = 0 , x= 1

27. x(x+2) = 0

x=0, x+2=0

x=0, x= -2

28. $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

29. $x^2 + x - 306 = 0$

III. Two Marks Questions

30. $x^2 + 7x + 12 = 0$

$x^2 + 4x + 3x + 12 = 0$

$x(x + 4) + 3(x + 4) = 0$

$(x+4)(x + 3) = 0$

$x + 4 = 0$, $x + 3 = 0$

$x = -4$, $x = -3$

31. $x^2 + 4x - 60 = 0$

$$x^2 + 10x - 6x - 60 = 0$$
$$x(x + 10) - 6(x + 10) = 0$$
$$(x + 10)(x - 6) = 0$$
$$(x + 10) = 0 , \quad (x - 6) = 0$$
$$x = -10 , \ x = 6$$

32. $x^2 + 3x + 2 = 0$

$$x^2 + 1x + 2x + 2 = 0$$
$$x(x + 1) + 2(x + 1) = 0$$
$$(x + 1)(x + 2) = 0$$
$$(x + 1) = 0 , \quad (x + 2) = 0$$
$$x = -1 , \ x = -2$$

33. $2x^2 + x - 6 = 0$

$$2x^2 + 4x - 3x - 6 = 0$$
$$2x(x + 2) - 3(x + 2) = 0$$
$$(x + 2)(2x - 3) = 0$$
$$(x + 2) = 0 , \quad (2x - 3) = 0$$
$$x = -2 , \ x = \frac{3}{2}$$

34. $x^2 + 8x + 12 = 0$

$$x^2 + 6x + 2x + 12 = 0$$
$$x(x + 6) + 2(x + 6) = 0$$
$$(x + 6)(x + 2) = 0$$
$$(x + 6) = 0 , \quad (x + 2) = 0$$
$$x = -6 , \ x = -2$$

35. $3x^2 - 6x + 3 = 0$

$3x^2 - 3x - 3x + 3 = 0$

$3x(x-1) - 3(x-1) = 0$

$(x-1)(3x-3) = 0$

$x - 1 = 0$ and $3x - 3 = 0$

$x = 1$ $\quad 3x = 3 \Rightarrow x = \frac{3}{3} = 1$

Roots are : $x = 1$ and $x = 1$

36. $x^2 - 3x - 10 = 0$

$x^2 - 5x + 2x - 10 = 0$

$x(x-5) + 2(x-5) = 0$

$(x-5)(x+2) = 0$

$x - 5 = 0$ and $x + 2 = 0$

$x = 5$ $\quad x = -2$

Roots are : $x = 5$ and $x = -2$

37. $x^2 + 6x + 8 = 0$

$x^2 + 4x + 2x + 8 = 0$

$x(x+4) + 2(x+4) = 0$

$(x+4)(x+2) = 0$

$x + 4 = 0$ and $x + 2 = 0$

$x = -4$ $\quad x = -2$

Roots are : $x = -4$ and $x = -2$

38. $2x^2 + 4x + 2 = 0$

$2x^2 + 2x + 2x + 2 = 0$

$2x(x+1) + 2(x+1) = 0$

$(x+1)(2x+2) = 0$

$x + 1 = 0$ and $2x + 2 = 0$

$x = -1$ $\quad 2x = -2$

$x = \frac{-2}{2} = -1$

Roots are : $x = -1$ and $x = -1$

39. $x^2 + 5x + 6 = 0$

$x^2+3x+2x+6 = 0$

$x(x+3)+2(x+3) =0$

$(x+3)(x+2)=0$

$x+3=0$ and $x+2 =0$

$x = -3$ $x=-2$

Roots are : $x = -3$ and $x =-2$

40. $x^2 + 5x + 4 = 0$

$x^2+4x+x+4 = 0$

$x(x+4)+1(x+4) =0$

$(x+4)(x+1)=0$

$x+4=0$ and $x+1 =0$

$x = -4$ $x=-1$

Roots are : $x = -4$ and $x =-1$

41. $2x^2 + 3x - 7 = 0$

This is in the form of $ax^2+bx+c =0$

$a = 2,$ $b =3,$ $c=-7$

Discriminant $\Delta = b^2-4ac$

$\Delta = 3^2 - 4(2)(-7)$

$\Delta = 9 +56 =65 > 0$

The given quadratic equation has two distinct real roots.

42. $x^2 + 5x +6 = 0$

This is in the form of $ax^2+bx+c =0$

$a = 1,$ $b =5,$ $c=6$

Discriminant $\Delta = b^2-4ac$

$\Delta = 5^2 - 4(1)(6)$

$\Delta = 25 -24 =1 > 0$

The given quadratic equation has two distinct real roots.

43. $-2x^2 + 7x +1 = 0$

This is in the form of $ax^2+bx+c =0$

$a = -2,$ $b =7,$ $c=1$

Discriminant $\Delta = b^2-4ac$

$\Delta = 7^2 - 4(-2)(1)$

$\Delta = 49 + 8 = 57 > 0$

The given quadratic equation has two distinct real roots.

44. $3x^2 + 5x - 3 = 0$

This is in the form of $ax^2+bx+c = 0$

$a = 3, \quad b = 5, \quad c = -3$

Discriminant $\Delta = b^2-4ac$

$\Delta = 5^2 - 4(3)(-3)$

$\Delta = 25 + 36 = 61 > 0$

The given quadratic equation has two distinct real roots.

45. $-x^2 + 4x - 7 = 0$

This is in the form of $ax^2+bx+c = 0$.

$a = -1, \quad b = 4, \quad c = -7$

Discriminant $\Delta = b^2-4ac$

$\Delta = 4^2 - 4(-1)(-7)$

$\Delta = 16 - 28 = -12 < 0$,

The given quadratic equation has no real roots.

46. $2x^2 + 8x + 8 = 0$

This is in the form of $ax^2+bx+c = 0$.

$a = 2, \quad b = 8, \quad c = 8$

Discriminant $\Delta = b^2-4ac$

$\Delta = 8^2 - 4(2)(8)$

$\Delta = 64 - 64 = 0$,

The given quadratic equation has two equal real roots .

47. $(x + 2)^3 = x^3 - 4$ $\qquad (a+b)^3 = a^3+b^3+3ab(a+b)$

$x^3+2^3+3(x)2(x+2) = x^3-4$

$8+6x(x+2) = -4$

$8+4+6x^2+12x = 0$

$6x^2+12x+12 = 0$

48. $(2x+3)\,x = x^2+1$

$2x^2+3x = x^2+1$

$2x^2 - x^2+3x -1 = 0$

$x^2+3x -1 = 0$

49. $2x^2 - 5x + 3 = 0$

a= 2 , b = -5 , c = 3

$\Delta = b^2 - 4ac$

$\Delta = (-5)^2 - 4\times2\times3$

$\Delta = 25 - 24 = 1 > 0$

Roots are real and distinct

50. $4x^2 - 4x + 1 = 0$

a= 4 , b = -4 , c = 1

$\Delta = b^2 - 4ac$

$\Delta = (-4)^2 - 4\times4\times1$

$\Delta = 16 - 16 = 0$

Roots are real and equal

51. $2x^2 - 6x + 3 = 0$

a= 2 , b = -6 , c = 3

$\Delta = b^2 - 4ac$

$\Delta = (-6)^2 - 4\times2\times3$

$\Delta = 36 - 24 = 12 > 0$

Roots are real and distinct

52. $x^2 + 4x + 4 = 0$

a= 1 , b = 4 , c = 4

$\Delta = b^2 - 4ac$

$\Delta = (4)^2 - 4\times1\times4$

$\Delta = 16 - 16 = 0$

Roots are real and equal

53. $2x^2 - 5x - 1 = 0$

a= 2 , b = -5 , c = -1

$\Delta = b^2 - 4ac$

$\Delta = (-5)^2 - 4\times2\times-1$

$\Delta = 25 + 8 = 33 > 0$

Roots are real and distinct

54. $x^2 + ax - 4 = 0$

a= 1 , b = a , c = -4

$\Delta = b^2 - 4ac$

$\Delta = (a)^2 - 4\times1\times-4$

$\Delta = a^2 + 16 > 0$

Roots are real and distinct

55. $kx^2 + 6x + 1 = 0$

a= k , b = 6 , c = 1

$\Delta = b^2 - 4ac = 0$

$\Delta = (6)^2 - 4\times k\times1 = 0$

$36 - 4k = 0$

$4k = 36$

$k = 9$

56. $x^2 + bx + 9 = 0$

a= 1 , b = b , c = 9

$b^2 - 4ac = 0$

$(b)^2 - 4\times1\times9 = 0$

$b^2 - 36 = 0$

$b^2 = 36$

$b = \sqrt{36}$

$b = \pm6$

Quadratic Equation $x^2 - 6x + 9 = 0$

57. $2x^2 + kx + 3 = 0$

a= 2 , b = k , c = 3

$b^2 - 4ac = 0$

$(k)^2 - 4\times2\times3 = 0$

$k^2 - 24 = 0$

$k^2 = 24$

$k = \sqrt{24}$

$k = \sqrt{4 \times 6}$

$k = \pm2\sqrt{6}$

58. $x^2 + 4x + 5 = 0$

a= 1 , b = 4 , c = 5

$\Delta = b^2 - 4ac$

$\Delta = (4)^2 - 4\times1\times5$

$\Delta = 16 - 20 = -4 < 0$

No Real roots

59. $3x^2 - 5x + 2 = 0$

$3x^2 - 3x - 2x + 2 = 0$

$$3x(x-1) - 2(x-1) = 0$$

$$(x-1)(3x-2) = 0$$

$$(x-1) = 0\,, \quad (3x-2) = 0$$

x = 1 , x = $\frac{2}{3}$

60. $3x^2 - 6x + 3 = 0$

$$3x^2 - 3x - 3x + 3 = 0$$

$$3x(x-1) - 3(x-1) = 0$$

$$(x-1)(3x-3) = 0$$

$$(x-1) = 0\,, \quad (3x-3) = 0$$

x = 1 , x = $\frac{3}{3} = 1$

IV. Three /Four Marks Questions

61. Length of the first side of the square be x mts.
Length of the second side of the square be y mts

Area of the first square x^2 & area of second square be y^2
Perimeter of the first square 4x and perimeter of the second square is 4y

$$4x - 4y = 64$$
$$x-y = 16$$
$$x = (y+16).....(1)$$
$$x^2 + y^2 = 640$$
$$(y+ 16)^2 + y^2 = 640$$
$$y^2 + 32y + 256 + y^2 = 640$$
$$2y^2 + 32y - 384 = 0$$
$$y^2 + 16y - 192 = 0$$
$$y^2 + 24y - 8y - 192 = 0$$
$$y(y + 24) - 8(y + 24) = 0$$
$$(y + 24)(y - 8) = 0$$
$$(y + 24) = 0 , \quad (y - 8) = 0$$
$$y= -24 , \ y = 8$$

Length of the second side of the square y = 8 mts
Length of the first side of the square be x = 8+16 = 24 mts

62. Let the two consecutive odd integers be x and x+2

$$x^2 + (x + 2)^2 = 290$$
$$x^2 + x^2 + 4x + 4 = 290$$
$$2x^2 + 4x - 286 = 0$$
$$x^2 + 2x - 143 = 0$$
$$x^2 + 13x - 11x - 143 = 0$$
$$x(x+13) - 11(x+13) = 0$$
$$(x+13)(x-11) = 0$$
$$x+13 = 0 , \quad x-11 = 0$$
$$x = -13 , \ x = 11$$

Two consecutive odd integers are 11 & 13

63. Present age of mother be x years and present age of son be y years

$$x = 2y^2$$

Age of mother after 8 years (x+8) years and that of son is (y+8) years

$$x+8 = 3(y+8) + 4$$
$$2y^2 +8 = 3y+24 +4$$
$$2y^2 +8 = 3y+28$$
$$2y^2 – 3y -20 = 0$$
$$2y^2 -8y +5y -20 =0$$
$$2y(y-4) +5(y-4) = 0$$
$$(y-4)(2y+5) = 0$$
$$y-4 = 0 \ , \ 2y +5 =0$$
$$y = 4 \ , y = \frac{-5}{2}$$

Present age of mother x = 32 years

Present age of son y = 4 years

64. Let Base = x cm, Altitude = (x – 5) cm

$$\frac{1}{2} \times x \times (x-5) =150$$
$$x^2-5x-300 = 0$$
$$x^2-20x+15x-300 = 0$$
$$x(x-20) +15(x-20) = 0$$
$$(x-20)(x+15) = 0$$
$$x-20 = 0 \ , \ x+15 = 0$$
$$x = 20 \ , x = -15$$

base = x =20 cm

Altitude= (x-5) = 20-5 = 15 cm

65. Let two consecutive even positive integers be x and (x + 2)

$$x^2 + (x+2)^2 = 164$$
$$x^2 +x^2 +4x +4 =164$$
$$2x^2+4x-160 = 0$$
$$x^2+2x-80 = 0$$
$$x^2+10x-8x-80 = 0$$
$$x(x+10)-8(x+10) = 0$$
$$(x+10)(x-8) = 0$$
$$x+10 = 0 \ , \quad x-8 = 0$$
$$x = -10 \ , \ x = 8$$

Two consecutive even positive integers 8 & 10

66. Let the numbers be x and y

$$x+y = 27$$
$$y = 27 - x$$
$$x(27-x) = 182$$
$$27x - x^2 = 182$$
$$x^2 - 27x + 182 = 0$$
$$x^2 - 14x - 13x + 182 = 0$$
$$x(x-14) - 13(x-14) = 0$$
$$(x-14)(x-13) = 0$$
$$x-14 = 0 \quad , \quad x-13 = 0$$
$$x = 14 \, , \; x = 13$$

The numbers are 14 & 13

67. Let Base = x cm, height = (x – 7) cm

$$x^2 + (x-7)^2 = 13^2$$
$$x^2 + x^2 - 14x + 49 = 169$$
$$2x^2 - 14x + 49 - 169 = 0$$
$$x^2 - 7x - 60 = 0$$
$$x^2 - 12x + 5x - 60 = 0$$
$$x(x-12) + 5(x-12) = 0$$
$$(x-12)(x+5) = 0$$
$$x-12 = 0 \quad , \quad x+5 = 0$$
$$x = 12 \, , \; x = -5$$

base= x = 12 cm & height = (x – 7) = 12 – 7 = 5 cm

68.

No. of books	Cost of each book (in Rs.)
x	$\frac{60}{x}$
x+5	$\frac{60}{x+5}$

$$\frac{60}{x} - \frac{60}{x+5} = 1$$
$$\frac{60(x+5)-60x}{x(x+50} = 1$$
$$\frac{60x+300-60x}{x^2+5x} = 1$$
$$\frac{300}{x^2+5x} = 1$$
$$x^2 + 5x = 300$$
$$x^2 + 5x - 300 = 0$$

x^2+20x-15x-300 = 0

x(x+20)-15(x+20) = 0

(x+20)(x-15) = 0

x+20 = 0 , x-15 = 0

x = -20 , x = 15

Number of books = 15

69. Let the age of son be x years and that of father is (x + 30) years

After 5 years, The age of son is (x+5) years and age of father is (x+35) years

(x+5) (x+35) = 400

x^2 +40x +175 =400

x^2 +40x -225 = 0

x^2+45x-5x-225 = 0

x(x+45)-5(x+45) = 0

(x+45)(x-5) = 0

x+45 = 0 , x-5 = 0

x = -45 , x = 5

Age of son is 5 years and age of father is 35 years

70. Let the first number be x then the second number is (x – 3)

x^2 + $(x-3)^2$ = 29

x^2 +x^2 -6x +9 =29

2x^2-6x-20 = 0

x^2-5x+2x-10 = 0

x(x-5)+2(x-5) = 0

(x-5)(x+2) = 0

x-5 = 0 , x+2 = 0

x = 5 , x = -2

First number = x = 5 & second number = x-3 = 5-3 = 2

71. Let the base be 2x + 4 cm and height = x cm

$\frac{1}{2}$ × x × (2x+4) =48

x^2+2x-48 = 0

x^2+8x-6x-48 = 0

x(x+8) -6(x+8) = 0

(x+8)(x-6) = 0

x+8 = 0 , x-6 = 0

$x = -8 , x = 6$

Base $= 2(6) + 4 = 16$ cm and height $= 6$ cm

72. Let the number of students went for picnic be x

$$\frac{900}{x-10} - \frac{900}{x} = 15$$

$900x-900(x-10) = 15x(x-10)$

$900x-900x+ 9000 = 15x^2-150x$

$15x^2-150x-9000 = 0$

$x^2-10x-600 = 0$

$x^2-30x+20x-600= 0$

$x(x-30) +20(x-30) = 0$

$(x-30)(x+20) = 0$

$x-30 = 0 , x+20 = 0$

$x = 30 , x = -20$

Number of students went for picnic = 30 – 10 = 20

73.

Let the Length =x , Breadth = y

Perimeter of the rectangular field = $2x +2y = 32$

$x+y = 16$

$y = 16 – x$

Area of the field = $xy = 60$

$x(16-x) = 60$

$16 - x^2 = 60$

$x^2-16x+60 = 0$

$x^2-10x-6x+60 = 0$

$x(x-10) -6(x-10) = 0$

$(x-10)(x-6) = 0$

$x-10= 0 , x-6 = 0$

$x = 10 , x = 6$

Length = x = 10 m , Breadth = y = 6 m

74. Speed of the train be x km/h

$$\frac{480}{x} - \frac{480}{x+10} = 4$$

$$480(x+10) - 480x = 4(x+10)x$$

$$480x + 4800 - 480x = 4x^2 + 40x$$

$$4x^2 + 40x - 30x - 12000 = 0$$

$$x(x+40) - 30(x+40) = 0$$

$$(x+40)(x-30) = 0$$

$$x+40 = 0 \ , \quad x-30 = 0$$

$$x = -40 \ , \ x = 30$$

Speed of train x = 30 km/h

75.

Let the Length =x , Breadth = y

Perimeter of the rectangular field = 2x +2y = 80

$$x+y = 40$$

$$y = 40 - x$$

Area of the rectangular field = xy = 400

$$x(40-x) = 400$$

$$40x - x^2 = 400$$

$$x^2 - 40x + 400 = 0$$

$$x^2 - 20x - 20x + 400 = 0$$

$$x(x-20) - 20(x-20) = 0$$

$$(x-20)(x-20) = 0$$

$$x-20 = 0 \ , \ x-20 = 0$$

$$x = 20 \ , \ x = 20$$

Length =x = 20 m , Breadth = y = 40 – x = 40-20 =20 m

76. Let the cycling speed of A be x km/h

Time taken by A to reach the office $= \frac{distance}{Speed} = \frac{12}{x}$ hrs

The Cycling speed of B is more than A hence the cycling speed of B = (x+2) km/h

Time taken by B to reach the office = $\frac{12}{x+2}$ hrs

$\frac{12}{x} - \frac{12}{x+2} = \frac{1}{2}$, 30 min = $\frac{1}{2}$ hr

$\frac{12}{x} - \frac{12}{x+2} = \frac{1}{2}$

$\frac{12(x+2)-12x}{x(x+2)} = \frac{1}{2}$

$\frac{24}{x^2+2x} = \frac{1}{2}$

x^2 +8x- 6x- 48 = 0

x^2 +2x- 48 = 0

x(x+8) – 6(x+8) = 0

(x+8)(x-6) = 0

x = - 8 , x = 6

Speed of A = 6 km/h & speed of B = 6+2 = 8 km/h

Time taken by A to reach the office = $\frac{distance}{Speed}$ =$\frac{12}{6}$ = 2 hrs

B = $\frac{distance}{Speed}$ =$\frac{12}{8}$ = 1.5 hrs

77. Let the Cost price of the article be Rs. x

Selling price = Rs. 24

Percentage Gain = x + $\frac{x^2}{100}$ = 24

x^2 +100x – 2400 = 0

x^2 +120x – 20x - 2400 = 0

$$x(x + 120) - 20(x + 120) = 0$$

(x+120)(x-20) = 0

x = - 120 , x = 20

Therefore cost price of the article x = Rs. 20

78. Let the Cost price of the article be Rs. x

Selling price = Rs 24

Loss = C.P. – S.P

Loss Percentage $\frac{x}{100}$ × x = x -24

$\frac{x^2}{100}$ - x = 24

x^2 - 100x - 2400 = 0

x^2 - 120x +20x - 2400 = 0

$x(x - 120) + 20(x - 120) = 0$

(x-120)(x+ 20) = 0

x = 120 , x = - 20

Therefore Cost price of the article = Rs. 120

79. $(1+m^2)x^2$ +2mcx+c^2 - a^2 = 0

a = $(1+m^2)$, b = 2mc , c = $c^2 - a^2$

If roots are equal, $\Delta = b^2 - 4ac = 0$

$(2mc)^2$ - $4(1+m^2)(c^2 - a^2) = 0$

$4m^2c^2 - 4(c^2 - a^2 + m^2c^2 - a^2m^2) = 0$

$m^2c^2 - c^2 + a^2 - m^2c^2 + a^2m^2 = 0$

$-c^2 + a^2(1+m^2) = 0$

$c^2 = a^2(1+m^2) = 0$

80. (b-c)x^2+(c-a) x +(a-b) = 0

ax^2+bx+c = 0

a = (b-c) b = (c-a) c = (a-b)

$b^2 - 4ac = 0$

$(c-a)^2 - 4[b-c)(a-b)]$

c^2 - 2ac + a^2 - 4 $(ab - ac - b^2 + ab) = 0$

c^2 - 2ac + a^2 – 4ab + 4ac + $4b^2$ - 4cb = 0

$a^2 + 4b^2 + c^2 - 4ab - 4bc + 2ac = 0$

$(a - 2b + c)^2 = 0$

$$a - 2b + c = 0$$

a + c = 2b

2b = a + c

81. Let the Speed of Stream = x km/h

Speed of motor boat in still water = 11 km/h

Speed upstream = (11-x) km/h

Speed downstream = (11+x) km/h

Time taken by the boat to travel upstream = $t_1 = \frac{12}{11-x}$ hrs

Time taken by the boat to travel downstream = $t_2 = \frac{12}{11+x}$ hrs

$t_1 + t_2 = 2\frac{3}{4}$

$\frac{12}{11-x} + \frac{12}{11+x} = 2\frac{3}{4}$

$\frac{12(11+x)+12(11-x)}{(11-x)(11+x)} = \frac{11}{4}$

48(11+x)+48(11-x) = 11(11-x)(11+x)

528+48x+528 -48x = 11(121-x^2)

1056 = 1331- 11x^2

11x^2 = 1331-1056

11x^2 = 275

$x^2 = \frac{275}{11}$

x^2 = 25

x = ±5

Speed of Stream = x= 5 km/h

82. Let the age be x years

(19+x)(15+x) = 480

x^2-34x-195 = 0

x^2+39x-5x-195= 0

x(x+39) -5(x+39) = 0

(x+39)(x-5) = 0

x+39= 0 , x-5 = 0

x = -39 , x = 5

Product of their ages becomes 480 after 5 years

83. Let the speed of motor boat in still water = x km/h

Speed of motor boat upstream = (x-5) km/h

Speed of motor boat downstream = (x+5) km/h

Time taken by the motor boat to travel upstream = $t_1 = \frac{30}{x-5}$ hrs

Time taken by the motor boat to travel downstream = $t_2 = \frac{30}{x+5}$ hrs

$t_1 + t_2 = \frac{9}{2}$

$\frac{30}{x-5} + \frac{30}{x+5} = \frac{9}{2}$

$\frac{30(x+5)+30(x-5)}{(x-5)(x+5)} = \frac{9}{2}$

30(x+5)2 +30(x-5)2 = 9(x+5)(x-5)

60x+300+60x-300 = 9x^2-225

120x = 9x^2 – 225

$3x^2 - 40x - 75 = 0$

$3x^2 - 40x + 5x - 75 = 0$

$3x(x-15) + 5(x-15) = 0$

$(x-15)(3x+5) = 0$

$x - 15 = 0 \ , \ 3x + 5 = 0$

$x = 15 \ , \ x = \frac{-5}{3}$

Speed of Motor boat in still water = x =15 km/h

84. Let speed of Passenger train be x km/h

Speed of express train = (x+11) km/h

Time = $\frac{distance}{speed}$

Time taken by the passenger train to travel 132 km = $t_1 = \frac{132}{x}$ hrs

Time taken by the express train to travel 132 km = $t_2 = \frac{132}{x+11}$ hrs

$$\frac{132}{x} - \frac{132}{x+11} = 1$$

$$\frac{132(x+11)-132x)}{x(x+11)} = 1$$

$$12 + 1452 - 132x = x^2 + 11x$$

$x^2 + 11x - 1452 = 0$

$3x^2 - 33x + 44x - 1452 = 0$

$x(x-33) + 44(x-33) = 0$

$(x-33)(x+44) = 0$

$x - 33 = 0 \ , \ x + 44 = 0$

$x = 33, \ x = -44$

Speed of Passenger train x = 33 km/h

Speed of Express Train = (x+11) = 33+11 = 44 km/h

Average Speed = $\frac{33+44}{2} = \frac{77}{2}$ = 38.5 km/h

85. Present age of B be x years

Present age of A = (x +26) years

Age of A after 3 years is (x+29) , B is (x+3) years

$(x+29)(x+3) = 360$

$x^2 + 3x + 2x + 87 = 360$

$x(x+39) - 7(x+39) = 0$

$(x+39)(x-7) = 0$

$x + 39 = 0 \ , \ x - 7 = 0$

$x = -39, \ x = 7$

Present age of B x = 7 years

Present age of A = x +26= 7+26 = 33 years

86. Let the Length and breadth of rectangle respectively be AB = x mts , BC = y mts , CD be the length of wall

Length of fence= 30m

x^2 = 4y

$$y + x + y = 30$$

x +2y = 30

y = $\left(\frac{30-x}{2}\right)$ .....(1)

Area of rectangular field 100m^2

xy = 100

$x\left(\frac{30-x}{2}\right)$ = 100

$$30x - x^2 = 200$$

x^2 -30x +200 = 0

x^2-10x- 20x+200 = 0

x(x-10) -20(x-10) = 0

(x-10)(x-20) = 0

x-10= 0 , x-20 = 0

x = 10, x = 20

Substitute x = 10 in(1) y = $\left(\frac{30-10}{2}\right)$ = 10

Length and breadth of rectangular field

AB = 10m , BC = 10m

87. Let the numerator of the fraction be x

Denominator = 2x+1

Fraction = $\frac{Numerator}{Dinominator} = \frac{x}{2x+1}$

Reciprocal of the fraction = $\frac{2x+1}{x}$

$\frac{x}{2x+1} + \frac{2x+1}{x} = \frac{29}{10}$

$\frac{x^2+(2x+1)^2}{(x2x+1)} = \frac{29}{10}$

$$\frac{5x^2 + 1 + 4x}{2x^2 + x}$$

$10(5x^2 + 1 + 4x = 29\ (2x^2 + x)$

$50x^2$ +10 +40x - $58x^2$ -29x = 0

$8x^2$-16x +15x -10 = 0

8x(x-2) + 5(x-2) = 0

(x-2) (8x+5) = 0

x= 2 , x = $\frac{-5}{8}$

x = 2

Numerator = 2

Denominator = 2x+1 = 2(2) +1 = 5

Fraction = $\frac{2}{5}$

88.

Number of Students	Amount that each student secure
x	$\frac{1500}{x}$
x+5	$\frac{1500}{x+5}$

$$\frac{1500}{x} - \frac{1500}{x+5} = 25$$

$$\frac{1500(x+5)-1500x}{x(x+5)} = 25$$

$$\frac{7500}{x^2+5x} = 25$$

$$25(x^2+5x) = 7500$$

$$x^2 + 5x - 300 = 0$$

$$x^2 + 20x - 15x - 300 = 0$$

$$x(x+20) -15(x+ 20) = 0$$

$$(x +20) (x- 15) =0$$

$$x+20 = 0 \ , \ x- 15 = 0$$

$$x = -20 \ , \ x = 15$$

Number of students who secured A+ grade after examination = 15 +5 =20

89. Let first positive integer be 'x'

Next positive integer = (x+1)

$x^2 + (x+1)^2 = 365$

$x^2 + x^2 + 1 + 2(X)(1) = 365$

$2x^2+2x +1-365=0$

$2x^2+2x -364=0$ (÷ 2)

$x^2 + x - 182 = 0$

$x^2 + 14x - 13x - 182 = 0$

$x(x+14) - 13(x+14) = 0$

$(x+14)(x-13) = 0$

$x + 14 = 0$ and $x - 13 = 0$

$x = -14$ $\quad\quad$ $x = 13$

Consider only positive integer : $x = 13$

First positive integer = $x = 13$

Next positive integer = $(x+1) = (13+1) = 14$

90. Let the number of articles produced in a day be 'x'

The cost of production of each article = $(2x+3)$

(The number of articles) (The cost of production of each article) = Rs.90

$x(2x+3) = 90$

$2x^2 + 3x = 90$

$2x^2 + 3x - 90 = 0$

$2x^2 + 15x - 12x - 90 = 0$

$x(2x+15) - 6(2x+15) = 0$

$(2x+15)(x-6) = 0$

$2x + 15 = 0$ and $x - 6 = 0$

$2x = -15$ $\quad\quad$ $x = 6$

$x = \frac{-15}{2}$

As articles cannot be negative : $x = 6$

Number of articles produced in a day = 'x' = 6

The cost of production of each article = Rs. $(2x+3) = 2(6) + 3 = $Rs.15

91. Let the spacewalk duration of astronauts 'B' be 'x' hours

The spacewalk duration of astronauts 'A' be (x + 6) hours

Space walk for 4 more hours,

Duration of astronauts 'B' = (x+4) hours

Duration of astronauts 'A ' = (x + 6 + 4) = (x + 10) hours.

(The spacewalk duration of astronauts 'A') (The spacewalk duration of astronauts 'B') =720hours

(x + 4) (x + 10) =720

x^2+ 10x + 4x + 40 = 720

x^2+ 14x + 40 -720 = 0

x^2+ 14x -680 = 0

x^2+34x -20x -680 = 0

x(x+34) -20(x+34) =0

(x+34)(x-20)=0

x+34=0 ಮತ್ತು x-20 =0

x = -34 x = 20

Consider only positive integer, x = 20

The spacewalk duration of astronauts 'B' = 'x' = 20 hours

The spacewalk duration of astronauts 'A' =(x +6) = (20 + 6) = 26 hours

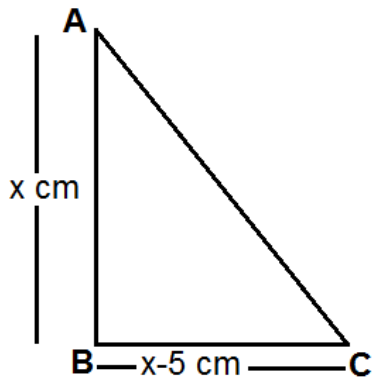
92. The height of the right angle triangle be x cm,

The base of the right angle triangle = (x – 5) cm

Area of the triangle = 150 cm^2

$\frac{1}{2}$ ×base ×height = 150cm^2

$\frac{1}{2}$ × (x-5) × x = 150



$x^2 - 5x = 300$

$x^2 - 5x - 300 = 0$

$x^2 - 20x + 15x - 300 = 0$

$x(x-20) + 15(x-20) = 0$

$(x-20)(x+15) = 0$

$x - 20 = 0$ and $x + 15 = 0$

$x = 20$ $\quad\quad$ $x = -15$

Consider only positive integer, $x = 20$

The height of the right angle triangle = x cm = 20cm

The base of the right angle triangle = $(x - 5) = (20 - 5) = 15$ cm

93.

The length of the square PQRS be 'y' m

The perimeter of the square PQRS = '4y' m

The length of the square ABCD be 'x' m

The perimeter of the square ABCD = '4x' m

The perimeter of the square ABCD = The perimeter of the square PQRS – 12 m

$4x = 4y - 12 \quad (\div 4)$

$x = y - 3$

$y = x + 3$

The sum of the areas of these two squares = $117 m^2$

The area of the square PQRS + The area of the square ABCD = 117

$y^2 + x^2 = 117$

$(x + 3)^2 + x^2 = 117$

$x^2 + 9 + 6x + x^2 = 117$

$2x^2 + 6x + 9 - 117 = 0$

$2x^2 + 6x - 108 = 0 \quad (\div 4)$

$x^2 + 3x - 54 = 0$

$x^2 + 9x - 6x - 54 = 0$

$x(x+9) - 6(x+9) = 0$

$(x+9)(x-6) = 0$

$x + 9 = 0$ and $x - 6 = 0$

$x = -9$ $\qquad$ $x = 6$

Consider only positive integer, $x = 6$

The length of the square ABCD $= x = 6$ m

The area of the square ABCD $= (6 \times 6) = 36$ m^2

The length of the square PQRS $= y = (x + 3) = 6 + 3 = 9$ m

The area of the square PQRS $= (9 \times 9) = 81$ m^2

The area of the square ABCD : The area of the square PQRS $= 36 : 81 = 4 : 9$

94. Let the number of days taken by A to complete the work be 'x' Days

The number of days taken by B to complete the same work $= (x-3)$

After working 4 more days ,

The product of working days = 130

$(x+4)(x-3+4) = 130$

$(x + 4)(x + 1) = 130$

$x^2 + x + 4x + 4 = 130$

$x^2 + 5x + 4 - 130 = 0$

$x^2 + 5x - 126 = 0$

$x^2 + 14x - 9x - 126 = 0$

$x(x+14)-9(x+14)=0$

$(x+14)(x-9)=0$

$x+14=0$ and $x-9=0$

$x=-14$ $x=9$

Consider only positive integer, $x=9$

The number of days taken by A to complete the work = 'x' = 9 days The number of days taken by B to complete the same work = $(x-3)=(9-3)=6$ days

Unit : 05 ARITHMETIC PROGRESSION

I. Multiple Choice Questions :

1. D) 5, 9, 13,17
2. B) -2
3. A) -7
4. B) $a_n = a + (n-1)d$
5. B) 18
6. D) 25
7. A) 18
8. B) 7
9. C) 3n + 7
10. C) 2
11. A) 10
12. A) 17
13. A) 48
14. D) m + 27
15. A) 4
16. A) 10 , 16
17. C) 2,6,10
18. A) a_n = 4n - 1
19. A) $s_n = \frac{n}{2}(a + l)$
20. B) $a_n = s_n - s_{n-1}$

II. One Mark Questions :

21. $a_n = \frac{n}{2}[a + a_n]$
22. $b_n = b + (n-1)d$
23. $a_n = l - (n-1)d$

24. Let the first three terms of the A.P

$$a - d, \quad a, \quad a + d$$

$a - d + a + a + d = 21$

$3a = 21$

$a = 7$

25. $d=\frac{a_p - a_p}{p-q}$

$d=\frac{a_5 - a_2}{5-2}$

$d=\frac{19-7}{3}$

$d=\frac{12}{3}$

$d=4$

26. $a_n = s_n - s_{n-1}$

$a_4 = s_4 - s_3$

$a_4 = 12 - 8$

$a_4 = 4$

27. $d = a_4 - a_3 = 11 - 7 = 4$

28. $a + 2d = 13$ ..... (1)

$a + d = 8$ .....(2)

(1) – (2)

$d = 5$

Substitute value of d in eqation (2)

$a + d = 8$

$a + 5 = 8$

$a = 8 - 5$

$a = 3$

29. $a_n = a + (n - 1) d$

30 $x = \frac{28+4}{2}$

$x = \frac{32}{2}$

$x = 16$

31. $a_1 = [7 - 4(1)]$ $a_2 = [7 - 4(2)]$

$a_1 = 3$ $a_2 = -1$

$d = a_2 - a_1$

$= -1 - 3$

$d = -4$

32. $a_n = 4n + 1$

$a_1 = 4(1) + 1$ $a_2 = 4(2) + 1$ $a_3 = 4(3) + 1$

$= 4 + 1$ $= 8 + 1$ $= 12 + 1$

$a_1 = 5$ $a_2 = 9$ $a_3 = 13$

III. TWO MARKS QUESTIONS:

33. a=2, d=7-2=5, n= 15, a_n=?

$a_n = a + (n - 1)d$

$$a_{15} = 2 + (15 - 1)5$$

$$a_{15} = 2 + (14)5$$

$$a_{15} = 2 + 70$$

$$a_{15} = 72$$

34. . a=100, d=96-100= -4, a_n=12, n= ?

$$a_n = a + (n - 1)d$$

$$12 = 100 + (n - 1)(-4)$$

$$12 = 100 - 4n + 4$$

$$4n = 92$$

$$n = \frac{92}{4} = 23$$

35. $a_{10} = a + 9d$

$34 = a + 9(3)$

$34 = a + 27$

$a = 34 - 27$

$a = 7$

36 . $a = -1,\ d = 3 - (-1) = 4,\ a_n = 95,\ n = ?$

$a_n = a + (n - 1)d$

$95 = -1 + (n - 1)4$

$95 = -1 + 4n - 4$

$4n = 100$

$n = \frac{100}{4} = 25$

The 25th term of an A.P is 95

37 . $a = 1, d = 5 - 1 = 4, a_n = 77$

$a_n = a + (n - 1)d$

$77 = 1 + (n - 1)4$

$77 = 1 + (4n - 4)$

$77 = 1 + 4n - 4$

$4n = 80$

$n = \frac{80}{4} = 20$

77 is an term of an A.P.

38 . 5,8,11, ...

here a = 5, d= 8-5 = 3 and n = 26

$a_n = a + (n-1)d$

$a_{26} = 5 + (26 - 1)3$

$a_{26} = 5 + 25 \times 3$

$= 5 + 75$

$a_{26} = 80$

39. 2, 5,8,……

Here a =2, d= 5 – 2 = 3 and n = 30

$a_n = a + (n-1)d$

$a_{30} = 2 + (30 – 1)3$

$a_{30} = 2 + 29 \times 3$

$= 2 + 87$

$a_{30} = 89$

40. a=2 ; d=4 ; n=23 : a_{23} = ?

$a_{23} = a + (n-1)\ d$

$= 2 + (23-1)4$

$= 2 + 22x4$

$= 2 + 88$

$= 90$

41. a=4 ; d=5 ; n=40 : a_{40} = ?

$a_{40} = a+(n-1)d$

$= 4+(40-1)5$

$= 4+39x5$

$= 4+195$

$= 199$

42. a=3 ; d=3 ; n=35 : a_{35} = ?

$a_{35} = a+ (n-1)d$

$= 3+(35-1)3$

$= 3+34x3$

$= 3+102$

$= 105$

43. a=6 ; d=4; n=18 ; a_{18}=?

$a_{18} = a+(n-1)d$

$= 6+(18-1)4$

$= 6+17x4$

$= 6+68$

= 74

44. a=11 ; d=3 ; n=20; a_{20}=?

a_{20} = a+(n-1)d

= 11+(20-1)3

= 11+19x3

= 11+57

= 68

45. a=3; d=4; n=25; a_{25}=?

a_{25}= a+(n-1)d

= 3+(25-1)4

= 3+24x4

= 3+96

= 99

46. a=3; d=5; n=78; a_n=78

a_n = a+(n-1)d

78 = 3+(n-1)5

= 3+5n-5

= 5n-2

80 = 5n

16 = n

78 is the 16^{th} term

47. a=7; d=6; n=? a_n=205

a_n =a+(n-1)d

205= 7+(n-1)6

205= 7+6n-6

205= 6n+1

204=6n

34 = n

34 terms are in given progression

48. a17= a+(17-1)d= a+16d

a10= a+(10-1)d= a+9d

a17= a10+7

$a+16d=a+9d+7$

$16d-9d= 7$

$7d=7$

$d=1$

49. First 3 digits 7's multiple = 105

Last 3 digits 7's multiple = 994

$a=105$; $d=7$; $a_n=994$; $n=?$

$a_n= a+ (n-1)d$

$994= 105+(n-1)7$

$994= 105+7n-7$

$994= 7n+98$

$7n= 994-98$

$7n=896$

$n =128$

128 numbers are divisible by 7.

50. $a=12$; $d=4$; $a_n=248$; $n=?$

$a_n = a+(n-1)d$

$248 = 12+(n-1)4$

$248 = 12+4n-4$

$248 = 4n+8$

$4n = 248-8$

$4n = 240$

$n = 60$

51. Given progression = 23,21,19,.....5

$a=23$; $d = -2$; $a_n=5$; $n=?$

$a_n=a+(n-1)d$

$5 = 23+(n-1)(-2)$

$5 = 23-2n+2$

$5 = 25-2n$

$2n= 25-5$

$2n= 20$

$n = 10$

52. a= 2: d=5; a_n=47; n=?

a_n=a+(n-1)d

47=2+(n-1)5

47=2+5n-5

47=5n-3

47+3=5n

5n=50

n= 10

53. a=1; a_{14}= 53; n=?

a_n=a+(n-1)d

a_{14}=1+(14-1)d

53 = 1+13d

53-1=13d

13d= 52

d= 4

a_n= 1+(n-1)d

a_n= 1+(n-1)4

a_n= 1+4n-4

a_n= 4n-3

54. S_{20}= 820; a_{20}=79; a=?

$S_n = \frac{n}{2}$ (a+an)

820 = $\frac{20}{2}$ (a+79)

820 = 10 (a+79)

820 = 10a + 790

10a = 30

a=3

55. a= 204; a_n=396; d=6: a_n=?

a_n= a+(n-1)d

396 = 204+(n-1)6

396 = 204+6n-6

396 = 6n+198

6n = 198

n= 33

56. a=11; d=4; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x11+(20-1)4]

= 10 [22+19x4]

= 10 [22+76]

= 10 x 98

S_{20} = 980

57. a=6; d=4; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x6+(20-1)4]

= 10 [12+19x4]

= 10 [12+76]

= 10 x 88

S_{20} = 880

58. a=5; d=3; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x5+(20-1)3]

= 10 [10+19x3]

= 10 [10+57]

= 10 x 67

S_{20} = 670

59. a=3; d=4; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x3+(20-1)4]

= 10 [6+19x4]

= 10 [6+76]

= 10 x 82

S_{20} = 820

60. a=3; d=4; n=10; s_{10}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{10} = \frac{10}{2}$ [2x3+(10-1)4]

= 5 [6+9x4]

= 5 [6+36]

= 5 x 42

S_{10} = 210

61. a=11; d=3; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x11+(20-1)3]

= 10 [22+19x3]

= 10 [22+57]

= 10 x 79

S_{20} = 790

62. a=2; d=3; n=20; s_{20}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{20} = \frac{20}{2}$ [2x2+(20-1)3]

= 10 [4+19x3]

= 10 [4+57]

= 10 x 61

S_{20} = 610

63. a=4; d=4; n=30; s30=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{30} = \frac{30}{2}$ [2x4+(30-1)4]

= 15 [8+29x4]

= 15 [8+116]

= 15 x 124

S_{30} = 1860

64. a=5; d=5; n=10; s_{10}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{10} = \frac{10}{2}$ [2x5+(10-1)5]

= 5 [10+9x5]

= 5 [10+45]

= 5 x 55

S_{10} = 275

65. progression : 6,12,18,24,...

a=6; d=6; n=40; s_{40}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{40} = \frac{40}{2}$ [2x6+(40-1)6]

= 20 [12+39x6]

= 20 [12+234]

= 20 x 246

S_{10} = 4920

66. progression: 8,16,24,32,...

a=8; d=8; n=15; s_{15}=?

$S_n = \frac{n}{2}$ [2a+(n-1)d]

$S_{15} = \frac{15}{2}$ [2x8+(15-1)8]

= 7.5 [16+14x8]

= 7.5 [16+112]

= 7.5 x 128

S_{10} = 960

3 Mark questions

67. $S_n = \frac{n}{2}$ [2a + (n-1) d]

114 = $\frac{6}{2}$ [2a + (6 – 1) d]

228 = 6 [2a + 5d]

38 = 2a + 5d .....(1)

34 = a + 5d

a = 4

substitute value of a in equation (1)

38 = 2 (4) + 5d

5d = 38 – 8

5d = 30

d = $\frac{30}{5}$

d = 6

A.P a , a + d, a + 2d

4, 4 + 6 , 4 + 2(6)

4 , 10, 16

$a_n = S_n – S_{n-1}$

a6 = 114 - 80

a + 5d =34 .....(2)

68. $a_7 = 4a_2$

a + 6d = 4 (a + d)

a + 6d = 4a + 4d

6d – 4d = 4a – a

2d = 3a

$a_{12} = 3(a_4) + 2$

a + 11d = 3 (a + 3d) + 2

a + 11d = 3a + 9d + 2

11d – 9d = 3a – a + 2

2d = 2a + 2 .....(ii)

substitute equation (2) in equation(1)

3a =2a +2

3a – 2a = 2

a = 2

2d = 3a .....(i)

2d = 3(2)

2d = 6

d =3

The required sequence

a. a+d, a+2d
2, 2+3, 2+2(3)
2, 5, 8

69. a + 2d =16
$a_7 = a_5 + 12$
a + 6d = a + 4d + 12
2d = 12
d = 6
a + 2 (6) = 16
a + 12 = 16
a = 16 – 12
a = 4
Arithmetic Progression is
a , a + d ,a + 2d
4 , 4 + 6 , 4 + 2 (6)
4, 10 , 16

70. First term = a , common difference = 3 a
$a_5 = a + (5 – 1) d$
26 = a + 4(3a)
13a = 26
a = $\frac{26}{13}$ = 2
d = 3a = 3 x 2 = 6

$$Sn = \frac{n}{2} [2a + (n-1)d]$$

$Sn = \frac{20[2(2)+(20-1)6\,]}{2}$
$S_{20} = \frac{20(4+114)}{2}$
$= \frac{20\ X\ 118}{2}$
= 1180

71The 3 digits of an number are (a – d),a,(a + d)
 a – d + a + a+ d = 15
 a = 5
Original number = 100 (5 – d) + 10 (5) + (5 + d)

New number = 100(5 + d) + 10(5) + (5 - d)

= 500 – 100d + 50 + 5 + d

500 - 100d + 50 + 5 + d = 500 + 100d + 50 + 5 – d + 594

= - 200d + 2d = 594

-198d = 594

d = -3

 original number = (5 + 3) , 5 , (5 – 3) = 8, 5, 2

72. Four parts are a – 3d, a – d , a + d, a + 3d

a – 3d + a – d + a +d + a + 3d = 56

4a = 56

a = $\frac{56}{4}$ = 14

$\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{5}{6}$

= $\frac{a2-9d2}{a2-d2}$ = $\frac{5}{6}$

= $6a^2 – 54d^2 = 5a^2 – 5d^2$

$d^2 = \frac{14\ X\ 14}{49}$

d = 2

Four parts

a – 3d = 14 – 3 (2) = 14 – 6 = 8

a – d = 14 – 2 = 12

a + d = 14 + 2 = 16

a + 3d = 14 + 3(2) = 20

73. Five parts are a – 2d, a – d, a, a+d, a+2d

a – 2d + a – d + a + a + d + a + 2d = 25

5a = 25 ⇒a = 5

$(a – 2d)^2 + (a – d)^2 + a^2 +(a + d)^2 + (a + 2d)^2 = 135$

$a^2 - 4ad + 4d^2 + a^2 - 2ad + 2^2 + a^2 + a^2 + 2ad + d^2 + a^2 + 4ad + 4d^2 = 135$

$5a^2 + 10d^2 = 135$

$5(25) + 10d^2 = 135$

$10d^2 = 135 - 125$

$10d^2 = 10$

$d = \pm 1$

74. $a_9 = 1 + 5a_2$ $\qquad$ $a_{12} = 7 + 2a_5$

$a + 8d = 1 + 5(a + d)$ $\qquad$ $a + 11d = 7 + 2(a + 4d)$

$a + 8d = 1 + 5a + 5d)$ $\qquad$ $a + 11d = 7 + 2a + 8d)$

$4a - 3d = -1 - - - - - - \rightarrow (1)$ $\qquad$ $a - 3d = -7 - - - - - - \rightarrow (2)$

By (1) and (2)

$4a - 3d = -1$

$a - 3d = -7$

(-) (+) (+)

$3a = 6$

$a = 2$

$3d = a + 7$

$d = \frac{2+7}{3} = 3$

Arithmetic progression is 2,5, 8, 11, ...

75. $S_n = 6 + 11 + 16 \ldots \ldots \ldots \ldots + 96$

$$a_n = a + (n-1)d$$
$$96 = 6 + (n-1)5$$
$$96 = 6 + 5n - 5$$
$$95 = 5n$$
$$n = \frac{95}{5} = 19$$

$$S_n = \frac{n(a+l)}{2}$$

$$S_{19} = \frac{19(6+96)}{2} = \frac{19 \times 102}{2} = 969$$

76. Numbers are $a - d, a, a + d$

$$a - d + a + a + d = 216$$
$$3a = 216$$
$$a = 72$$
$$a + d = 7(a - d)$$
$$72 + d = 7(72 - d)$$
$$72 + d = 504 - 7d$$
$$8d = 432$$

$$d = \frac{432}{8} = 54$$

$Numbers(72 - 54), \quad 72, \quad (72 + 54)$

$18 \quad 72, \quad 126$

77 . $a + 3d + a + 7d = 24 \quad a + 5d + a + 9d = 44$

$2a + 10d = 24 \qquad 2a + 14d = 44$

$a + 5d = 12a + 7d = 22$

$a + 5d = 12$

$a + 7d = 22$

(-) (-) (-)

$-2d = -10$

$d = 5$

$a + 5d = 12$

$a + 5(5) = 12 \Rightarrow a = 12 - 25 = -13$

Three terms are $-13, -8, -3$.

78.

Let angles be $a - d$, a, $a + d$

$a - d + a + a + d = 180 \Rightarrow 3a = 180^0 \Rightarrow a = 60^0$

$2(a - d) = a + d \Rightarrow 2a - 2d = a + d \Rightarrow a = 3d$

$3d = 60^0 \Rightarrow d = 20^0$

Angles be 40^0, 60^0, 80^0

79. $a_m = \frac{1}{n}$, $a_n = \frac{1}{m}$

$\frac{1}{n} = a + (m - 1)\, d$ .....(1)

$\frac{1}{m} = a + (n - 1)\, d$ .....(2)

(1) – (2) $\Rightarrow \frac{1}{n} - \frac{1}{m} = d[(m -) - (n + 1)]$

$\Rightarrow \frac{m-n}{mn} = d\,(m - n)$

$\square\ d = \frac{m-n}{mn(m-n)} = \frac{1}{mn}$ ..... (3)

$\frac{1}{n} = a + (m - 1)\frac{1}{mn}$

$\Rightarrow a = \frac{1}{n} - (m - 1)\frac{1}{mn}$

$= \frac{m-m+1}{mn} = \frac{1}{mn}$ ..... (4)

$a_{mn} = a + (mn - 1)\, d$

$= \frac{1}{mn} + (mn - 1)\frac{1}{mn}$

$= \frac{1}{mn}(1 + mn - 1)$

$= \frac{1}{mn}(mn)$

$a_{mn} = 1$

80. $a = a + (p - 1)\,d$ ..... (1)

$b = a + (q - 1)\,d$ ..... (2)

$c = a + (r - 1)\,d$ .....(3)

Multiply equation (1) by (q-r) euation (2) by (r-p) and euation (3) by (p – q)

(1) + (2) + (3)

$= a(q - r) + b(r - p) + c(p - q) = d[(p - 1)(q - r) + (q - 1)(r - p) + (r - 1)(p - q)]$

$= a(q - r) + b(r - p) + c(p - q) = dpq + pr - q + r + qr - pq - r + p + rp - rp - p + q$

$= a(q - r) + b(r - p) + c(p - q) = d(0)$

$= a(q - r) + b(r - p) + c(p - q) = 0$

81. $S_n = \frac{n}{2}[2a + (n - 1)\,d]$

$S_9 = \frac{9}{2}[2a + (9 - 1)\,d]$

$144 = \frac{9}{2}[2a + (9 - 1)\,d]$

$288 = 18a + 72d$ (divide by 18)

$16 = a + 4d$ ..... (2)

$28 = a + 8d$ ..... (1)

$a + 8d = 28$ ..... (1)

(1) – (2)

$12 = 4d$

$d = \frac{12}{4}$

$d = 3$

substitute value of d in equation (2)

$16 = a + 4d$

$16 = a + 4(3)$

$16 = a + 12$

$a = 16 - 12$

$a = 4$

82. 11^{th} term : $a11 = a + 10d = 38$ --→ (1)

16^{th} term : $a16 = a + 15d = 73$ --→ (2)

(2)-(1) gives $5d = 35$

d= 7

substitute the value of d in (1) we get

a+70=38

a = 38-70

a= -32

31st term : a_n = a+(n-1)d

a_{31} = -32 + (31-1)7

= -32 + 30x 7

= -32 +210

a_{31} = 178

83. a=3 ; d=12 ; n=54 ; a_{54}=?

a_n = a+(n-1)d

a_{54} = 3 + (54-1)12

= 3 + 53 x 12

= 3 + 636

a_{54} = 639

Required term = 639+132= 771

a_n = a+(n-1)d

= 3+ (n-1)12

= 12n - 9

12n-1 = 771

12n = 780

n = 65

84. a_3 = a+2d

16 = a+2d

a= 16-2d-→(1)

a_7 = a+6d ; a5 = a+4d

a_7= a5+12

(a+6d) = (a+4d)+12

2d = 12

d=6

from (1) we get

a = 16-12 = 4

progression = 4,10,16,22

85. a= 9; d=8 : s_n =636 n=?

$S_n = \frac{n}{2}[2a+(n-1)d]$

$636 = \frac{n}{2}[18+(n-1)8]$

$= \frac{n}{2}[8n+10]$

$1272 = n(8n+10)$

$8n^2+10n-1272=0$ by solving this we get

n=12

86. a_{22}= a+21d=149

a+147 =149

a = 2

$S_n = \frac{n}{2}[2a+(n-1)d]$

$S_{22} = \frac{22}{2}[4+(22-1)7]$

= 11 [4+21x7]

= 11 [4+147]

= 11x151

S_{22} = 1661

87. progression: 1,3,5,7….49

a=1; d=2 ; a_n=49 ; n=?

a_n = a+(n-1)d

49 = 1+(n-1)2

49 = 2n-1

2n = 50

n = 25

$s_n = \frac{n}{2}[a+l]$

$= \frac{25}{2}[1+49]$

= 25x25

S_{25} = 625

V. FOUR MARKS QUESTIONS:

88 . $a = 22,\ l = -11$ ಮತ್ತು $\frac{n}{2}(a + l) = 66$

$$S_n = \frac{n}{2}(a + l)$$

$$66 = \frac{n}{2}(22 - 11)$$

$$66 = \frac{n}{2}(11)$$

$11n = 132 \Rightarrow n = \frac{132}{11} = 12$

Number of terms =12

$$a_n = a + (n - 1)d$$

$-11 = 22 + (12 - 1)d \Rightarrow 11d + 22 = -11$

$11d = -33 \Rightarrow d = -3$

89. Let the five terms of an A.P be $a - 2d,\ a - d,\ a,\ a + d,\ a + 2d$

$(a + 2d)^2 - (a - 2d)^2 = 192,$ $\quad a - d + a + d = 16 \Rightarrow 2a = 16 \Rightarrow a = 8$

$a^2 + 4ad + 4d^2 - a^2 + 4ad - 4d^2 = 192 \Rightarrow 8ad = 192$

$$d = \frac{192}{8a} = \frac{192}{8 \times 8} = 3$$

The terms of an A.P $(8 - 6),\ (8 - 3),\ 8,\ (8 + 3),\ (8 + 6)$

2, 5, 8, 11, 14

90. $a_n = S_n - S_{n-1}$

$a + (n - 1)d = 210 - 171$

$a_n = 39$

$S_n = \frac{n}{2}[a + a_n]$

$210 = \frac{n}{2}[3 + 39]$

$210 = \frac{n}{2}[42]$

$210 = 21n$

$n = \frac{210}{21}$

$n = 10$

$a_n = a + (n - 1)\, d = 39$

$3 + 9d = 39$

$9d = 39 - 3$

$9d = 36$

$d = \frac{36}{9}$

$d = 4$

 A.P is a, a+d , a+2d .....

3, 3+4, 3+2(4).....

3, 7,11.....

$a_{20} = a + 19\, d$

$= 3 + 19 \times 4$

$= 3 + 76$

$= 79$

91. The angles of a pentagon are a ,a+d, a+2d, a + 3d, a + 4d

The sum of Interior angles of pentagon are $= (n - 2)\, 180^0$

$= (5 - 2)180^0$

$= 3 \times 180^0$

$= 540^0$

$a, a + d, a + 2d, a + 3d, a + 4d = 540^0$

$72, 72 + d, 72 + 2d, 72 + 3d, 72 + 4d = 540^0$

$360^0 + 10d = 540^0$

$10d = 540^0 - 360^0$

$10d = 180^0$

$d = \frac{180}{10}$

$d = 18^0$

Angles of pentagon are a, a+d, a+2d, a+3d, a+4d

72, 72 + 18, 72 + 2(18) , 72 + 3(18), 72 + 4(18)

72^0, 90^0, 108^0, 126^0, 144^0

92. The earnings from Monday to Saturday

a, a + d, a+2d ,a + 3d, a + 4d, a + 5d

From the data a + a + d + a+2d = 525

3a + 3d = 525 (divide by 3)

a + d = 175 ..... (1)

a + 4d = a + 100

4d = 100

$d = \frac{100}{4}$

d = 25

substitute the value of 'd' in equation (1)

a + d = 175
a + 25 = 175
a = 175 – 25
a = 150
Daily earnings of a man =

a, a + d, a+2d ,a + 3d, a + 4d, a + 5d

150, 150 + 25, 150 + 2 x 25 , 150 + 3 x 25 , 150 + 4 x 25, 150 + 5 x 25

150 , 175 , 200 , 225 , 250 , 275

93. angles of quadrilateral be a, a+d ,a, a + 2d, a + 3d

 a+ a + d + a + a + 2d + a + 3d = 360^0 .

$4a + 6d = 360^0$ (divide by 2)

$2a + 3d = 180^0$

sum of opposite angles = 130^0

$a + a + 2d = 130^0$ $a + d + a + 3d = 130^0$

$2a + 2d = 130^0$ (divide by 2) $2a + 4d = 130^0$

$a + 2d = 65^0$

$a + d = 65^0$.....(2)

$2a + 3d = 180^0$ .....(1) x 1

$a + d = 65^0$.....(2) x 2

$2a + 3d = 180^0$

$2a + 2d = 130^0$

(-) (-) (-)

$d = 50^0$

substitute value of d in equation (2)

$a + d = 65^0$

$a + 50^0 = 65^0$

$a = 65^0 - 50^0$

$a = 15^0$

 angles of a quadrilateral a, a+d ,a, a + 2d, a + 3d

$15^0 , 15^0 + 50^0, 15^0 + 2(50^0) , 15^0 + 3 (50^0)$

$15^0 , 65^0 , 115^0 , 165^0$

94. n = 16

S_{16} =768

a_n = l = 93

$S_n = \frac{n}{2} [a + a_n]$

$768 = \frac{16}{2} [a + 93]$

$= 8 [a + 93]$

$\frac{768}{8}$ = a + 93

a + 93 = 96

a = 96 – 93

a = 3

a_n = a + (n – 1)d

93 = 3 + (16 – 1)d

93 = 3 + 15d

93 – 3 = 15d

90 = 15d

$\frac{90}{15}$ = d

d = 6

A.P is 3,9,15,21,27 .....

S_{16} = 3+9+15+21+27 ..... 16 terms

= 3 (1+3+5+7..... 16 terms)

= 3 x 16^2 [$S_n=n^2$] { the sum of first n odd numbers}

= 3 x 256

768 = 768

95. a_n = a + (n – 1)d

a_7 = 5 x a_2

a + 6d = 5 (a + d)

a + 6d = 5a + 5d

6d – 5d = 5a – a

d = 4a ..... (1)

a_5 = 2a_3 – 1

a + 4d = 2(a+2d) – 1

a + 4d = 2a +4d – 1

1 = 2a +4d - 4d - a

a = 1

from equation (1) d = 4a = 4 x 1

d = 4

Arithmetic progression is

= a, a + d, a + 2d .....

= 1, 1 + 4 , 1 + 2(4) .....

= 1, 5, 9 .....

a_{15} = a +(n – 1) d

= 1 + (15 – 1) 4

= 1 + 14 x 4

= 1 + 56

a_{15} = 57

96. $\frac{S8}{S11} = \frac{3}{2}$

2 [S_8] = 3 [S_{11}]

2 [4 (3a + 7d] = 3 [$\frac{11}{2}$ (2a + 10d]

2 [12a + 28 d] = 3 [11a + 55d]

24 a +56 d = 33 a +165 d

9a + 109d = 0

97. $a_7 = 4a_2$

a + 6d = 4(a + d)

a + 6d = 4a + 4d

3a = 2d .....(1)

$a_{12} = 3a_4 + 2$

a + 11d = 3(a + 3d) + 2

a + 11d = 3a + 9d +2

2a -2d = - 2

a – d = -1

a = d – 1 .....(2)

substitute equation (2) in equation (1)

3 (d – 1) = 2d

3d – 3 = 2d

d = 3

substitute the value of 'd' in equation (2)

a = 3 – 1

a = 2

Arithmetic Progression is

a , a + d , a + 2d…….

2 , 2 +3 , 2 + 2 (3)

2 , 5, 8…..

98. $a_p = q, \quad a_q = p, \; a_r = ?$

$q = a + (p-1)d$ $\qquad\qquad$ $p = a + (q-1)d$

$q - p = a + (p-1)d - [a + (q-1)d] = a + d(p - 1 - q + 1) - a = d(p - q)$

$d = \frac{q-p}{p-q} = -1$ $\qquad\qquad$ $\ldots\ldots(1)$

$a = q + p - 1$ $\qquad\qquad$ $\ldots\ldots(2)$

$a_r = a + (r-1)d = q + p - 1 + (r-1)(-1)$

$= q + p - 1 - r + 1 = p + q - r$

99. $S_5 = \frac{5}{2}$ [2a + (5 – 1) d] $\qquad$ a_4 = (a1 + a2) + 5

$S_5 = \frac{5}{2}$ [2a + 4d] $\qquad$ a + 3d = (2a + d) +5

S_5 = 5 (a + 2d) $\qquad$ a – 2d = -5 …… (2)

55 = 5 (a + 2d)

11 = a + 2d ……. (1)

-5 = a – 2d ……. (2)

(1) + (2)

2a = 6

a = 3

substitute the value of a in equation in (1)

11 = 3 + 2d

8 = 2d

d = 4

Let the five terms of an A.P be

a , a+d, a+2d , a+3d , a+4d

3 , 3+4 , 3+2(4) , 3+3(4) ,3+4(4)

3,7.3+8,3+12,3+16

3 , 7 , 11, 15, 19

100. $a+(6-1)d = 2(a+(3-1)d)+1$

$a + 5d = 2a + 4d + 1$

$d - a = 1$ or $a = d - 1$ .....(1)

$a_4 + a_5 = 5a_2$

$(a+(4-1)d) + (a + (5-1)d) = 5(a + d)$

$a + 3d + a + 4d = 5a + 5d$

$2a + 7d = 5a + 5d$

$2d = 3a$ .....(2)

substitute equation (1) in equation (2)

$2d = 3a$

$2d = 3(d - 1)$

$2d = 3d - 3$

$d = 3$

substitute value of d in equation (2)

$2d = 3a$

$2(3) = 3a$

$a = 2$

$a_{10} = a + 9d$

$a_{10} = 2 + 9(3)$

$a_{10} = 2 + 27$

$a_{10} = 29$

101. $S_n = 5n - n^2$

$S_1 = 5(1) - (1)^2 = 5 - 1 = 4$ $\quad a_1 = 4$

$S_2 = 5(2) - (2)^2 = 10 - 4 = 6$ $\quad a_2 = S_2 - S_1 = 6 - 4 = 2$

$S_3 = 5(3) - (3)^2 = 15 - 9 = 6$ $\quad a_3 = S_3 - S_2 = 6 - 6 = 0$

$S_4 = 5(4) - (4)^2 = 20 - 16 = 4$ $\quad a_4 = S_4 - S_3 = 4 - 6 = -2$

$S_{21} = 5(21) - (21)^2 = 105 - 441 = -336$

$a_{21} = a + 20d = 4 + 20(-2) = 4 - 40 = -36$

102. $a = b + 3$ .....(i)

$a_7 = 28$

$a + 6d = 28$ ..... (ii)

$b_8 = 29$

$b + 7d = 29$ .....(iii)

substitute equation (2) in equation (1)

$b + 3 + 6d = 28$

$b + 6d = 25$ .....(iv)

(iii) - (iv)

$b + 7d = 29$

$b + 6d = 25$

(-) (-) (-)

$d = 4$

substitute the value of d = 4 in equation (ii)

a + 6d = 28
a + 6(4) = 28
a + 24 = 28
a = 28 – 24
a = 4

substitute d = 4 in equation (iii)

b + 7d = 29

b + 7(4) = 29

b = 29 – 28

b = 1

First A.P is

a , a+d, a+2d.....

4, 4+4, 4+2(4).....

4, 8, 12 .....

Second A.P is

b , b+d, b+2d.....

1, 1 + 4, 1 + 2(4).....

1, 5, 9 .....

103. $a_{17} = 3a_5 + 4$ $a_{10} = 31$ $a_{30}, a_{29}, a_{28} = ?$ A.P = ?

a + 16d = 3 (a + 4d) + 4 a + 9d = 31 .....(2)

a + 16d = 3a + 12d +4

a – 3a + 16d – 12d = 4

-2a + 4d = 4 (Divide by 2)

- a + 2d = 2 ..... (1)

(1) + (2) =

-a +2d = 2

a +9d = 31

11d = 33

d = $\frac{33}{11}$

d = 3

substitute value of d in equation (2)

a + 9d = 31

a + 9(3) = 31

a + 27 = 31

a = 31 – 27

a = 4

The last three terms of an A.P be

a_{30} , $a_{29,}$ a_{28}

a + 29d, a+ 28d, a+ 27d

4 + 29(3) , 4 + 28 (3) , 4 + 27 (3)

4 + 87, 4 + 84, 4 + 81

91, 88, 85

Arithmetic Progression = a, a+d, a+2d ……

4, 4 + 3, 4 + 2(3)……

4, 7, 10……

104. Sum of the first 8 positive integers = 1+2+3+4+5+6+7+8 = 36

First term a_1 = 36 + a_{14} = 111

36 + a_{14}= 111

a_{14}= 75

$a_{14} = a_1 + 13d$

$75 = 36 + 13d$

$13d = 39$

$d = 3$

last three terms are

$a_{12} = a_1 + 11d = 36 + 33 = 69$

$a_{13} = a_1 + 12d = 36 + 36 = 72$

$a_{14} = 75$

105. total number of terms n=37

Sum of three terms : $a_{35}+a_{36}+a_{37}=429$

Middle term : a19=75

$a+18d=75 \rightarrow (1)$

last terms a37=a+36d

$a_{35}+a_{36}+a_{37}=(a+34d)+(a+35d)+(a+36d)=429$

$3a+105d = 429$

$a+ 35d = 143 \rightarrow (2)$

(2)-(1) $17d = 68$

$d = 4$

from (1) $a = 75-72 = 3$

$a_{33} = 131 ; a_{28} = 111$

the 33rd term is 20 more than its 28th term

106. $a_{10} = 3a + 2$

$a + 9d = 3a + 2$

$9d - 2a = 2$ ...(1)

$a_8 = 2a + 6$

$a + 7d = 2a + 6$

$7d - a = 6$ ...(2)

From (2)

$a = 7d - 6$

from (1) we get

$9d - 2(7d - 6) = 2$

$9d - 14d + 12 = 2$

$-5d = -10$

$d = 2$

$a = 7(2) - 6 = 8$

now,

$S_n = n/2\ [2a + (n - 1)d]$

$540 = n/2\ [16 + 2(n - 1)]$

$540 = n/2\ (2n + 14)$

$540 = n(n + 7)$

$n^2 + 7n - 540 = 0$

$(n + 27)(n - 20) = 0$

$n = 20$

sum of the first 20 terms is 540

107. $a : d = 3 : 2$

$a = 3k,\ d = 2k$

$S_{26} = 1456$

As per the formula

$1456 = 26/2\ [2(3k) + 25(2k)]$

$1456 = 13\ (6k + 50k)$

$1456 = 13 \times 56k$

$1456 = 728k$

$k = 2$

therefore

$a = 6$

$d = 4$

progression : 6, 10, 14, 18, 22, ...

now,

$a_n = 62$

$6 + (n - 1)4 = 62$

$4(n - 1) = 56$

$n - 1 = 14$

$n = 15$

62 is the 15^{th} term

108. Sum of the first 6 terms is : $S_6 = 42$

$10^{th} : 30^{th} = 1 : 3$

$S_6 = n/2\ [2a + (n-1)d]$

$42 = 6/2\ [2a + (6-1)d]$

$3[2a + 5d] = 42$

$2a + 5d = 14$ .....(1)

Now,

$a_{10} = a + 9d$

$a_{30} = a + 29d$

As per the given ratio

$(a + 9d)/(a + 29d) = 1/3$

$3(a + 9d) = a + 29d$

$3a + 27d = a + 29d$

$2a = 2d$

$a = d$ .....(2)

substitute (2) in (1)

$2d + 5d = 14$

$7d = 14$

$d = 2$

therefore

$a = 2$

now 13^{th} term is

$a_{13} = a + 12d$

$= 2 + (12 \times 2)$

$= 2 + 24$

$= 26$

13^{th} term of the progression is 26

109. Given ;

$a_4 + a_8 = 24$

$a_6 + a_{10} = 44$

to find 1. AP=? 2. 25^{th} term =?

$a_4 = a + 3d$

$a_8 = a + 7d$

$(a + 3d) + (a + 7d) = 24$

$2a + 10d = 24$

$a + 5d = 12$ .....(1)

now,

$a_6 = a + 5d$

$a_{10} = a + 9d$

$(a + 5d) + (a + 9d) = 44$

$2a + 14d = 44$

$a + 7d = 22$ .....(2)

(2) − (1)

$2d = 10$

$d = 5$

substitute d=5 in (1)

$a + 25 = 12$

$a = -13$

therefore AP is

−13, −8, −3, 2, 7, 12, ...

Now, 25^{th} term is

$a_{25} = a + 24d$

$= -13 + (24 \times 5)$

$= -13 + 120$

$= 107$

110. Given :

Sum of 4 terms = 32

$(1^{st} \times \text{last}) : (2^{nd} \times 3^{rd}) = 7 : 15$

Tofind :

Consider the 4 terms are $(a-3d), (a-d), (a+d), (a+3d)$

Sum of the 4 terms is

$(a-3d)+(a-d)+(a+d)+(a+3d) = 32$

$4a = 32$

$a = 8$

therefore the terms are

$(8-3d), (8-d), (8+d), (8+3d)$

As per the given ratio,

$[(8-3d)(8+3d)] / [(8-d)(8+d)] = 7/15$

$(64-9d^2)/(64-d^2) = 7/15$

$15(64-9d^2) = 7(64-d^2)$

$960-135d^2 = 448-7d^2$

$512 = 128d^2$

$d^2 = 4$

$d = 2$

now the terms are

$8-6 = 2$

$8-2 = 6$

$8+2 = 10$

$8+6 = 14$

Terms of the arithmetic progression = 2, 6, 10, 14

111. Given

The pages read at first day is = a = 25

Common difference = d = 2

Total number of pages = 432

To find :

1. pages read at 12^{th} day

2. number of days require to complete the book

$a_n = a + (n-1)d$

$S_n = n/2\ [2a + (n-1)d]$

Number of pages read at 12^{th} day

$a_{12} = a + (12-1)d$

$= 25 + 11 \times 2$

$= 25 + 22$

$= 47$

47 pages are red at 12^{th} day

Number of days required to complete the book is

$S_n = 432$

$n/2\ [2(25) + (n-1)2] = 432$

$n/2\ [50 + 2n - 2] = 432$

$n/2\ (48 + 2n) = 432$

$n(n + 24) = 432$

$n^2 + 24n - 432 = 0$

$n^2 + 36n - 12n - 432 = 0$

$n(n + 36) - 12(n + 36) = 0$

$(n + 36)(n - 12) = 0$

$n = 12$ (we are not considering the negative numbers)

$n = 12$

Unit : 06 TRIANGLES

I. Multiple choice Questions :

1. A) Any two equiangular triangle
2. A) Two isosceles triangles
3. C) 4.5 cm
4. C) 5 cm
5. C) $\angle B = \angle D$
6. B) 5cm
7. B) 4
8. C) 16
9. C) 1.5
10. C) x = $\frac{ay}{a+b}$
11. C) 30cm
12. C) 3 cm
13. C) 8 cm
14. B) 70°
15. B) 3 cm
16. C) 60cm
17. B) DP/PL = DC/BL
18. A) 64 cm
19. A) 25m
20. B) similar but not congruent
21. B) $\frac{AD}{DE} = \frac{AE}{BC}$
22. C) 8cm
23. C) $\frac{AY}{AC}$
24. A) $\frac{DG}{GB}$
25. B) 7.5cm
26. D) $\frac{x}{x+y} = \frac{m}{m+n}$
27. A) PQ & AB
28. B) 3 cm

II. <u>One mark answering questions:</u>

29) If any two polygons have same corresponding angles and same ratio of corresponding sides then the two polygons are called similar polygons.

30) 1. Corresponding angles should be same

2. The ratio of Corresponding sides should be same.

31) Thales Theorem : "If a line is drawn parallel to one side of a triangle to intersectthe other two sides in distinct points , the other two sides are divided in the same ratio"

32) Angle-Angle-Angle(A-A-A) Criterion of similarity of two triangles :

"If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio(or proportion) and hence the two triangles are similar"

33) Angle-Angle-Angle(A-A-A) Criterion of similarity of two triangles

34) PR

35) 10cm

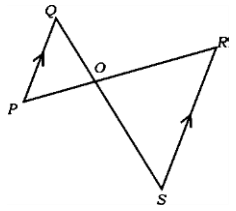
36) 2 cm

37) OS:OQ = 2 : 1

Δ POQ ~ ΔROS

$\therefore \frac{PQ}{SR} = \frac{OQ}{OS} = \frac{1}{2}$

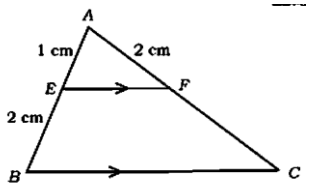
∴ OS : OQ = 2: 1



38) $\frac{AE}{EB} = \frac{AF}{FC}$

$\frac{1}{2} = \frac{2}{FC}$

$FC = 2 \times 2 = 4$



39) 42m

III. Two marks questions

40)

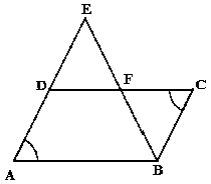
In ΔABC and ΔCFB

∠A = ∠C) (opposite angles of parallelogram))

∠AEB = ∠CBF (AF||BC, alternate angles)

So , by AA similarity criteria

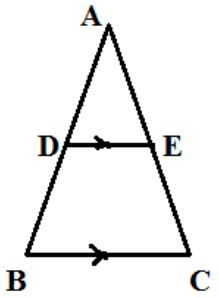
ΔABC ~ΔCFB



41) According Thales theorem

$$\frac{AD}{AB} = \frac{AE}{AC}$$

$$\frac{2.4}{3} = \frac{AE}{5}$$



$AE = \frac{2.4 \times 5}{3}$

AE = 0.8 X 5

AE = 4 cm

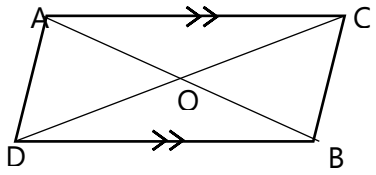
42)

In ΔACO and ΔBDO

$\angle CAO = \angle DBO$ (alternate angles AC || BD)

$\angle ACO = \angle BDO$

$\angle AOC = \angle BOD$ (verticle angles)



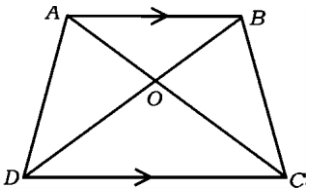
By A A A Similarity criteria

$\therefore \Delta AOC \sim \Delta BOD$

43) In Δ AOB and Δ DOC $\angle AOB = \angle DOC$ AND $\angle ABO = \angle ODC$

$\angle BAO = \angle OCD$

$\therefore \Delta AOB \sim \Delta DOC$



$$\therefore \frac{AO}{BO} = \frac{CO}{DO}$$

44) In ΔABC , DE || BC

$\therefore \frac{AD}{DB} = \frac{AE}{EC}$ [$\because$ Thales Theorem]

$\frac{x}{x-2} = \frac{x+2}{x-1}$

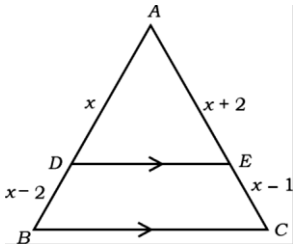
Cross multiplication

$x(x - 1) = (x - 2)(x + 2)$

$x^2 - x = x^2 - 4$

$-x = -4$

$x = 4$



$\therefore \frac{AD}{DB} = \frac{X}{X-2} = \frac{4}{4-2} = \frac{4}{2} = = \frac{2}{1}$

$\therefore$ AD:DB = 2:1

45. ABC is an isosceles triangle

AB = AC

$\angle B = \angle C$ (opposite sides of equal angles)

$\angle ABD = \angle ECF$

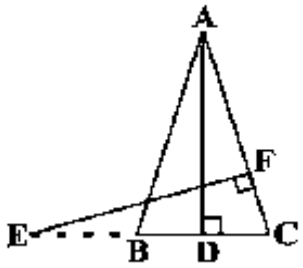
In ΔABD and ΔECF

$\angle ADB = \angle EFC = 90^O$

$\therefore \angle ABD = \angle ECF$

By AA similarity criteria

$\Delta ABD \sim \Delta ECF$



46. In ΔPQR

$\angle PQR = \angle PRQ$ (data)

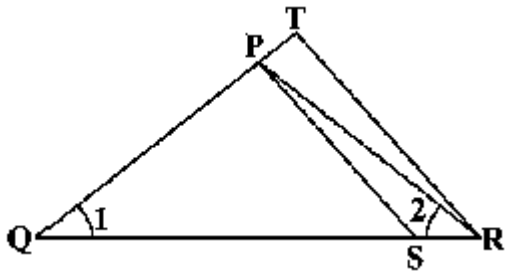
PQ = PR

but

$\frac{QR}{QS} = \frac{QT}{PR}$

from (1)

$\frac{QR}{QS} = \frac{QT}{PQ} \quad ------2$



In Δ PQS and ΔTQR

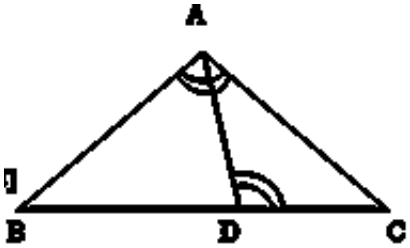
$$\frac{QR}{QS} = \frac{QT}{PQ} \quad \text{(from equation 2)}$$

$\angle Q = \angle Q$ (common angle)

$\therefore \Delta$ PQS $\sim \Delta$TQR

IV.Three marks questions

47. In ΔABC and ΔADC



∠BAC = ∠ADC [data]

∠ACB = ∠ACD (common angle)

∴∠ABC = ∠DAC

∴ΔABC ~ ΔDAC [A A similarity criteria]

$$\frac{\mathrm{AC}}{\mathrm{CD}} = \frac{\mathrm{BC}}{\mathrm{AC}}$$

$\therefore AC^2 = BC \cdot CD$

48.

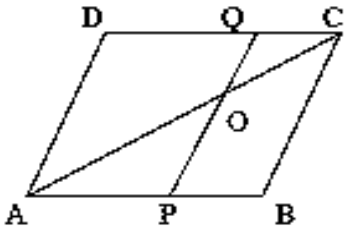
In ΔOAP and ΔOQC

∠OAP = ∠QCO (∵AB ‖ CD alternate angles)

∠AOP = ∠QOC (∵verticle angle)

∠APO = ∠OQC (∵third angle)

∴ΔOAP ~ ΔOQC (∵A A criteria)

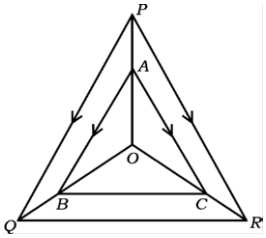


$$\frac{OA}{OC} = \frac{AP}{CQ}$$

so $\mathrm{CQ} = \frac{1}{5}\,\mathrm{CD}$ and $\mathrm{AP} = \frac{2}{5}\mathrm{AB}$

$$\frac{OA}{OC} = \frac{\frac{2}{5}\mathrm{AB}}{\frac{1}{5}\mathrm{CD}}$$

But AB = CD (opposite angles of the parallelogram)



$$\frac{OA}{OC} = \frac{\frac{2}{5}\mathrm{AB}}{\frac{1}{5}\mathrm{CD}}$$

$$\frac{OA}{OC} = \frac{2}{5} \times \frac{5}{1}$$

$$\frac{OA}{OC} = 2$$

$\therefore \mathrm{OA} = 2\mathrm{OC}$

49. In △ OPQ , AB || PQ

$\therefore \frac{\mathrm{OA}}{\mathrm{AP}} = \frac{\mathrm{OB}}{\mathrm{BQ}}$ … … … … (1) (∵Thales theorem)

In △ OPR , AC || PR

$\therefore \frac{\mathrm{OC}}{\mathrm{CR}} = \frac{\mathrm{OA}}{\mathrm{AP}}$ … … … … (2) (Thales theorem)

From (1) and (2) , we get

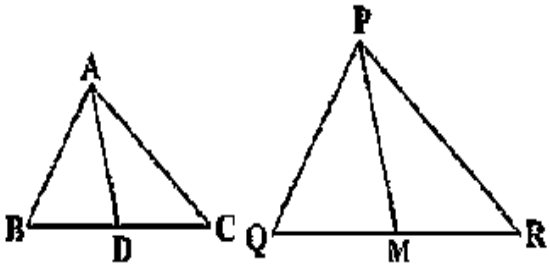
$\frac{OB}{BQ} = \frac{OC}{CR}$

$\therefore$ BC || QR ($\because$Converse of Thales theorem)

50.

In ΔABC and ΔPQR

$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$



To prove : $\Delta ABC \sim \Delta PQR$

Proof :

$\frac{AB}{PQ} = \frac{\frac{1}{2}BC}{\frac{1}{2}QR} = \frac{AD}{PM}$ ----------(1)

$\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ (D is midpoint of BC & M is midpoint of QR)

$\Rightarrow \Delta ABD \sim \Delta PQM$ (S S S similarity criteria)

$\therefore \angle ABD = \angle PQM$ (Corresponding angles of similar triangles)

$\therefore \angle ABC = \angle PQR$

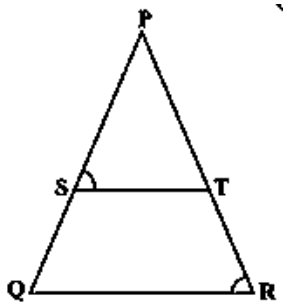
Now In ΔABC and ΔPQR

$\frac{AB}{PQ} = \frac{BC}{QR}$

$ABC = \angle PQR$

$\therefore \Delta ABC \sim \Delta PQR$

51.



ST || QR ($\therefore$ Converse of Thales theorem)

$\angle PST = \angle PQR$ ($\therefore$Corresponding angles) -----(1)

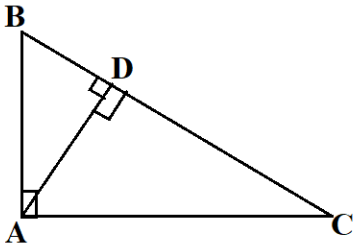
$\angle PST = \angle PRQ$ ($\therefore$data) ----- (2)

$\Rightarrow \angle PRQ = \angle PQ R$

$\therefore PQ = PR$

Δ PQR is an isosceles triangle

52. To prove: $AB^2 = BC \times$ BD



Proof: In ΔBDA and ΔBAC

$\angle B$ is common

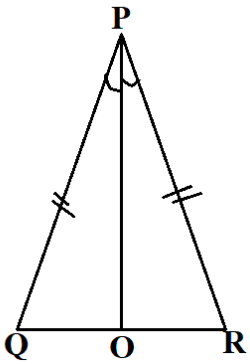
$\angle D = \angle A = 90°$ (Data)

∴ ΔBDA ~ΔBAC (AA criteria)

$\frac{BD}{AB} = \frac{BA}{BC}$ (CSST)

$\therefore AB^2 = BC \times$ BD

53. To prove: $\frac{OQ}{OR} = 1$



Proof: In ΔPOQ and ΔPOR

$\angle OPQ = \angle OPR$ ($\because PO$ $bisects$ $\angle P$)

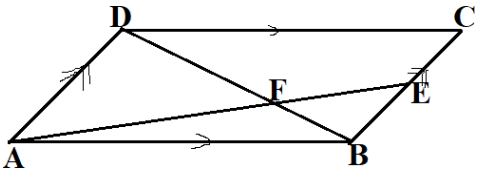
$\angle Q = \angle R$ (Base angles of an isosceles triangle are equal)

∴ ΔPOQ~ΔPOR (AA criteria)

$\frac{OQ}{OP} = \frac{PQ}{PR}$ (CSST)

$$\therefore \frac{OQ}{OP} = 1 \ (\because PQ = PR)$$

54. To Prove: DF x EF = FB x FA



Proof: In ΔDFAand ΔBFE

$\angle ADF = \angle EBF$ ($\because$ $Alternate$ $angles$)

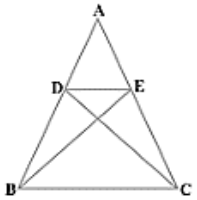
$\angle AFD = \angle EFB$ (Vertically opposite angles)

∴ ΔDFA~ΔBFE (AA criteria)

$\frac{DF}{BF} = \frac{FA}{FE}$ (CSST)

∴DF x EF = FB x FA

55. If ΔABE ≅ ΔACD, show that.ΔADE ~ΔABC



Solution :

ΔABE ≅ΔACD (Gven)

∴ AB = AC----------(1)

and AD = AE----------(2)

[By CPCT]

In ΔADE and ΔABC ,

Divide (2)by (1)

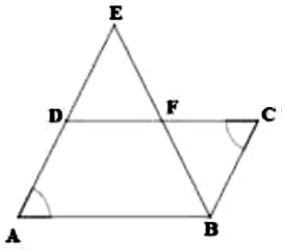
$\frac{AD}{AB} = \frac{AE}{AC}$

$\angle A = \angle A$

$\Delta ABE \sim \Delta CFB$ $\Delta ADE \sim \Delta ABC$ [SAS similarity criteria]

56. E is a point on the side AD Produced of a parallelogram ABCD and BE intersects CD at F.

Show that $\Delta ABE \sim \Delta CFB$



Solution **:** In ΔABE and ΔCFB

A = C (opposite angles of parallelogram)

AEB = CBF (AE || BC alternate angles)

∴ AA similarity criteria

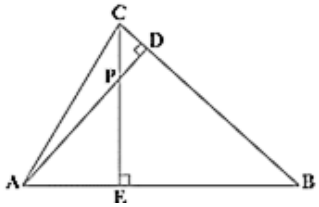
ΔABE~ΔCFB

57. Altitude AD and CE of ΔABC intersect each other at point p.

Show that i) $\Delta AEP \sim \Delta CDP$ ii) $\Delta ABD \sim \Delta CBE$ iii) $\Delta AEP \sim \Delta ADB$ iv) $\Delta PDC \sim \Delta BEC$

Solution :

(i) In ΔAEP and ΔCDp



AEP = CDP = 90°

$\angle APE = \angle CPD$ (vertically opposite angles)

∴AA similarity criteria

$\Delta AEP \sim \Delta CDP$

(ii) In ΔABD and ΔCBE

ADB = CEB = 90°

ABD = CBE (common angle)

∴ AA similarity criteria

ΔABD ~ ΔCBE

(iii) In ΔAEP and ΔADB

AEP = ADB = 90_0

PAE = DAB (common angle)

∴AA similarity criteria

ΔAEP ~ ΔADB

(iv) In ΔPDC and ΔBEC

PDC = BEC = 90°

PCD = BCE (common angle)

∴AA similarity criteria

ΔPDC ~ ΔBEC

58. CD and GH respectively bisectors of∠ACB ಮತ್ತು∠EGF, such that D and H lie on sides AB and FE of ΔABC and ΔEFG respectively. If ΔABC ~ ΔEFG

Show that .

i) ΔDCB ~ ΔHGE

ii) ΔDCA ~ ΔHGF

Solution :

(i) In ΔABC ~ ΔFEG(Given)

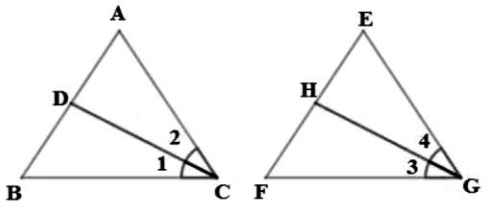
∴ A = F, ACB = FGE

[corresponding angles of similar triangles]

CD is the bisector of ∠ACB , GH is the bisector of ∠FGE

∴ ACD = FGH

In ΔACD and ΔFGH .



A = F

∠ACD = ∠FGH

∴AA similarity criteria

ΔACD ~ ΔFGH

$$\Rightarrow \frac{CD}{GH} = \frac{AC}{PG}$$

(ii) ΔABC ~ ΔFEG [Given**]**

∴ B = E, and ACB = FGE [corresponding angles of similar triangles]

CD is the bisector of ∠ACB , GH is the bisector of ∠FGE

∴ DCB = HGE

Now in ΔDCB and ΔHGE ,

∠DCB = ∠HGE ; ∠B = ∠E

∴AA similarity criteria

∴ΔDCB ~ ΔHGE

59. ΔPQR is a bilateral triangle and here PQ = PR bisector of ∠P touches QR at 'O' then S.T $\frac{OQ}{OR} = 1$ (model paper 3/20256-26)



Given : △ PQR is a bilateral triangle . Here
PQ = QR . Bisector of ∠P touches QR
at 'O'

Toprove : $\frac{OQ}{OR} = 1$

Proof : In △POQ and △ POR

PQ = QR (bilateral triangle)

∠QPO =∠RPO (PO divides ∠P into two equal parts.)

PO = PO (common side for both triangles)

△POQ ≅POR (S.A.S)

Lengths of sides of △POQ and △POR are be equqal

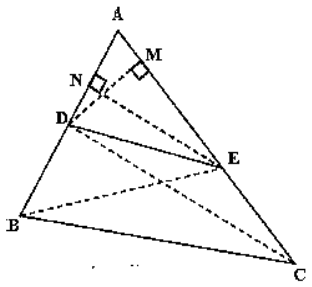
V. Four/ Five marks questions

60. State and prove Thales theorem.

Statement : "If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points , the other two sides are divided in the same ratio" (Thales theorem)

Data : InABC , the line DE drawn parallel to intersects AB and AC at D and E

To prove : $\frac{AD}{DB} = \frac{AE}{EC}$



Construction : join BE and DC , draw $\mathbf{DM \perp AC}$, and $\mathbf{EN \perp AB}$

Proof : InΔADE & ΔBDE

$\frac{Area\ of \Delta ADE}{Area\ of\ \Delta DBE} = \frac{\frac{1}{2}AD \times EN}{\frac{1}{2}BD \times EN}$

$\frac{Area\ of \Delta ADE}{Area\ of\ \Delta DBE} = \frac{AD}{BD}$ ----------1

In ΔADE & ΔECD

$\frac{Area\ of \Delta ADE}{Area\ of\ \Delta ECD} = \frac{\frac{1}{2}AE \times DM}{\frac{1}{2}EC \times DM}$

$\frac{Area\ of \Delta ADE}{Area\ of\ \Delta ECD} = \frac{AE}{EC}$ ----------2

ΔBDE and Δ DEC stand on same base DE and in between BC $\parallel$ DE

$\therefore$ Area of Δ BDE = Area of Δ ECD

From (1) and (2)

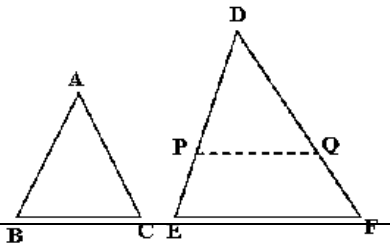
$$\frac{AD}{DB} = \frac{AE}{EC}$$

61. Prove that " If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (or proportion) and hence the two triangles are similar

Data : In triangles $\mathbf{ABC}$ and $\angle \mathbf{A} = \angle \mathbf{D}, \angle \mathbf{B} = \angle \mathbf{E}, \angle \mathbf{C} = \angle \mathbf{F}$

To prove : $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

Construction : Cut AB=DP, and AC = DQ on DE & DF at P & Q, join PQ



Proof : In ΔABC and ΔD ,

AB = DP , AC = DQ (construction)

ΔBAC = ΔPDQ (data)

ΔABC ≅ΔDPQ (SAS congruency rule .)

ΔABC =ΔDPQ

But ΔABC =ΔDEF

∴ΔDPQ = ΔDEF

PQ ||EF (Since corresponding angles equal.)

$\frac{DP}{DE}=\frac{PQ}{EF}=\frac{DQ}{DF}$------1

But AB = DP , BC = DQ

$\frac{AB}{DE}=\frac{BC}{EF}=\frac{AC}{DF}$

62. Data : In ΔABC and ΔDEF $\frac{AB}{DE}=\frac{AC}{DF}=\frac{BC}{EF}$ ----- (1)

To prove : ∠A = ∠D, ∠B = ∠E and ∠C= ∠F and ΔABC ≅ΔDEF

Construction : take P and Q points on DE and DF so that AB = DP and AC = DQ then join PQ

Proof : $\frac{AB}{DE}=\frac{AC}{DF}\Longrightarrow\frac{DP}{DE}=\frac{DQ}{DF}$ (□ DP = AB, DQ = AC)

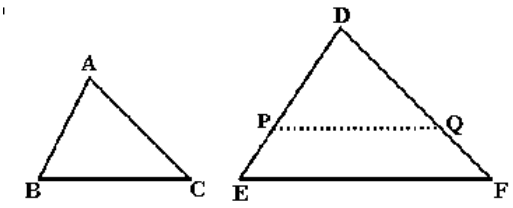
$\Longrightarrow\frac{DE}{DP}=\frac{DF}{DQ}$ (Inverse)

$\Longrightarrow\frac{DE}{DP}-1,\frac{DF}{DQ}-1,$

$\Longrightarrow\frac{DE-DP}{DP}=\frac{DF-DQ}{DQ}$

$\Longrightarrow\frac{PE}{DP}=\frac{QE}{DQ}$

$\Longrightarrow\frac{DP}{PE}=\frac{DQ}{QF}$ (inverse)



∴ PQ ||EF (□ Thales theorem)

∴∠P = ∠E and ∠Q =∠F

∴Δ DPQ = Δ DEF (AA similarity criteria)

There fore $\frac{DP}{DE}=\frac{DQ}{DF}=\frac{PQ}{EF}$ ------ (2)

If AB = DP, AC = DQ

$\frac{DP}{DE}=\frac{DQ}{DF}=\frac{BC}{EF}$ ------- (3)

From (2)and (3)

BC = PQ

In Δ ABC and Δ DPQ

BC = PQ

AB = DP

AC = DQ

Δ ABC $\cong \Delta$ DPQ

$\therefore \angle A = \angle D$, $\angle B = \angle P$, & $\angle C = \angle Q$,

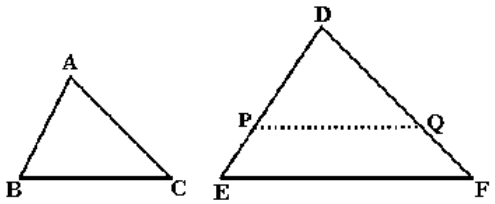
$\Rightarrow \angle A = \angle D$, $\angle B = \angle E$, & $\angle C = \angle F$

& Δ ABC $\sim \Delta$ DE F

63.

Data :In Δ ABC and Δ DEF

$\angle A = \angle D$, and $\frac{AB}{DE} = \frac{AC}{DF}$



To prove : Δ ABC $\sim \Delta$ DEF

Construction: take P and Q points on DE and DF so that AB = DP and AC = DQ then join PQ

Proof :

In Δ ABC and Δ DPQ
AB = DP (construction)
AC = DQ (construction)
$\angle A = \angle D$, (data)

Δ ABC $\cong \Delta$ DPQ (SAS)
$\therefore \angle B = \angle P$,
$\angle C = \angle Q$, (corresponding sides of similar triangles) ------ (1)
$\frac{AB}{DE} = \frac{AC}{DF}$ (data)

$\frac{DP}{DE} = \frac{DQ}{DF}$ (AB = DP & AC = DQ)
$\therefore$ PQ || EF (converse of Thales)
$\therefore \angle E = \angle P$,
$\angle F = \angle Q$, --------(2)

From (1)and (2)
$\angle B = \angle E$, $\angle C = \angle F$, and $\angle A = \angle D$,

$\therefore \Delta$ ABC $\sim \Delta$ DEF

Unit : 07 COORDINATE GEOMETRY

I. Multiple Choice questions

1) A) (x , 0)
2) D) (0 , y)
3) A) 2 Units
4) D) -4 Units
5) C) (0, 0)
6) D) $\sqrt{a^2 + b^2}$
7) C) $\sqrt{x^2 + y^2}$
8) A) ± 3
9) C) (3, 5)
10) B) (-3, 4)
11) B) 3
12) A) $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
13) D) -5
14) D) (-2, 0)

II. One Mark Questions :

15) P (-3, 5) = (x, y) OP = $\sqrt{x^2 + y^2}$

OP = $\sqrt{(-3)^2 + 5^2}$

OP = $\sqrt{9 + 25}$ = $\sqrt{34}$Units

16) P (6, 8) = (x, y) OP = $\sqrt{x^2 + y^2}$

OP = $\sqrt{6^2 + 8^2}$ =$\sqrt{36 + 64}$ = $\sqrt{100}$ = 10 Units

17) P(x, y) = $\left[\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right]$

18) (5, 4) = (x_1, y_1), (1, 4) = (x_2, y_2)

P(x, y) = $\left[\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right]$

$$P(x,\ y) = \left[\frac{5\ +\ 1}{2},\ \ \frac{4\ +\ 4}{2}\right]$$

P(x, y) = $\left[\frac{6}{2},\ \ \frac{8}{2}\right]$= (3, 4)

19) (2, 3) = $(x_1,\ y_1)$, (4, 3) = $(x_2,\ y_2)$

$$P(x,\ y) = \left[\frac{x_1+x_2}{2},\ \ \frac{y_1+y_2}{2}\right]$$

$$P(x,\ y) = \left[\frac{2\ +4}{2},\ \ \frac{3+3}{2}\right]$$

P(x, y) = $\left[\frac{6}{2},\ \ \frac{6}{2}\right]$= (3, 3)

20) (3, 4) = $(x_1,\ y_1)$, (5, 6) = $(x_2,\ y_2)$

$$P(x,\ y) = \left[\frac{x_1+x_2}{2},\ \ \frac{y_1+y_2}{2}\right]$$

$$P(x,\ y) = \left[\frac{3+5}{2},\ \ \frac{4+6}{2}\right]$$

P(x, y) = $\left[\frac{8}{2},\ \ \frac{10}{2}\right]$= (4, 5)

21) (6, 3) = $(x_1,\ y_1)$, (4, y) = $(x_2,\ y_2)$ P(x, y) = (5, 5)

$$P\ (x,\ y) = \left[\frac{x_1+x_2}{2},\ \ \frac{y_1+y_2}{2}\right]$$

$$(\ 5,\ \ 5\ ) = \left[\frac{6+\ 4}{2},\ \ \frac{3\ +\ y}{2}\right]$$

$$(\ 5,\ \ \mathbf{5}\ ) = \left[\frac{10}{2},\ \ \frac{\mathbf{3\ +\ y}}{\mathbf{2}}\right]$$

$5 = \frac{3\ +\ y}{2}$

$\Rightarrow$ 10 = 3 + y

$$10 - 3 = y \ \Rightarrow\ y = 7$$

$\therefore$ **y = 7**

22)$P(x,\ y) = \left[\frac{m_1x_2+m_2x_1}{m_1+m_2},\ \ \frac{m_1y_2+m_2y_1}{m_1+m_2}\right]$

23)$P\ (x,\ y) = \left[\frac{x_1+x_2}{2},\ \ \frac{y_1+y_2}{2}\right]$

Two Marks Questions : -

24) P(2, 3) = (x_1, y_1), Q(4, 1) = (x_2, y_2)

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(4-2)^2 + (1-3)^2}$$

$$= \sqrt{2^2 + (-2)^2}$$

$$= \sqrt{4 + 4} = \sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$$

∴ **PQ = $2\sqrt{2}$** Units

25) P(2, 4) = (x_1, y_1), Q(8, 12) = (x_2, y_2)

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(8-2)^2 + (12-4)^2}$$

$$= \sqrt{6^2 + 8^2}$$

$$= \sqrt{36 + 64} = \sqrt{100} = 10$$

∴ **PQ = 10** Units

26) P(5, 6) = (x_1, y_1), Q(1, 3) = (x_2, y_2)

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(1-5)^2 + (3-6)^2}$$

$$= \sqrt{(-4)^2 + (-3)^2}$$

$$= \sqrt{16 + 9} = \sqrt{25} = 5$$

∴ **PQ = 5** Units

27) P(-5, 7) = (x_1, y_1), Q(-1, 3) = (x_2, y_2)

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{[-1-(-5)]^2 + (3-7)^2}$$

$$= \sqrt{(-1+5)^2 + (-4)^2}$$

$$= \sqrt{4^2 + 16} = \sqrt{16 + 16} = \sqrt{16 \times 2} = 4\sqrt{2}$$

∴ **PQ =** $4\sqrt{2}$ Units

28) A(2, 6) = (x_1, y_1), B(5, 10) = (x_2, y_2)

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(5-2)^2 + (10-6)^2}$$

$$= \sqrt{3^2 + 4^2}$$

$$= \sqrt{9 + 16} = \sqrt{25} = 5$$

∴ **AB = 5** Units

29) A(5, -7) = (x_1, y_1), B (1, -3) = (x_2, y_2)

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(1-5)^2 + [-3-(-7)]^2}$$

$$= \sqrt{(-4)^2 + (-3+7)^2}$$

$$= \sqrt{16 + (4)^2} = \sqrt{16+16} = \sqrt{32}\sqrt{16 \times 2} = 4\sqrt{2}$$

∴ **PQ = $4\sqrt{2}$** Units

30) P(2, -3) = (x_1, y_1) Q (10, y) = (x_2, y_2), Distance between PQ = 10 Units y = ?

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$10 = \sqrt{(10-2)^2 + [(y-(-3)]^2}$$

$$10 = \sqrt{(8)^2 + (y+3)^2}$$

$10 = \sqrt{64 + (y+3)^2}$ **[** Squaring on both sides **]**

$$10^2 = [\sqrt{64 + (y+3)^2}]^2$$

$$100 = 64 + (y+3)^2$$

$$100 - 64 = (y+3)^2$$

$$36 = (y+3)^2$$

$$\sqrt{36} = (y+3)$$

$$(y+3) = \sqrt{36} = \mp 6$$

$$(y+3) = \mp 6$$

y + 3 = + 6 **OR** y + 3 = - 6

y = 6 - 3 y = -6 – 3

y = 3 y = - 9

∴ **y = 3 OR y = - 9**

31) P(3, 1) = (x_1, y_1) Q (0, x) = (x_2, y_2), Distance between PQ = 5 Units x = ?

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$5 = \sqrt{(0-3)^2 + (x-1)]^2}$

$5 = \sqrt{(-3)^2 + (x-1)^2}$

$5 = \sqrt{9 + (x-1)^2}$ **[** Squaring on both sides **]**

$5^2 = [\sqrt{9 + (x-1)^2}]^2$

$25 = 9 + (x-1)^2$

$25 - 9 = (x-1)^2$

$16 = (x-1)^2$

$\sqrt{16} = (x - 1)$

$4 = x - 1 \Rightarrow 4 + 1 = x$

⇒x = 5

32) Coordinates of the point P = P (1, 1) = (x_1, y_1),

Coordinates of the point Q = Q (5, 4) = (x_2, y_2),

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(5-1)^2 + (4-1)^2}$$

$$= \sqrt{(4)^2 + (3)^2}$$

$$= \sqrt{16+9} = \sqrt{25} = 5$$

∴ **PQ = 5Units**

33) A (-6, 10) = (x_1, y_1), B(3, -8) = (x_2, y_2), P(-4, 6) = (x, y), $m_1 : m_2$ = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1+m_2}, \frac{m_1y_2 + m_2y_1}{m_1+m_2}\right]$$

$$(-4, 6) = \left[\frac{m_1(3) + m_2(-6)}{m_1+m_2}, \frac{m_1(-8) + m_2(10)}{m_1+m_2}\right]$$

$$(-4, 6) = \left[\frac{3m_1 - 6m_2}{m_1+m_2}, \frac{-8m_1 + 10m_2}{m_1+m_2}\right]$$

$-4 = \frac{3m_1 - 6m_2}{m_1+m_2}$ **OR** $6 = \frac{-8m_1 + 10m_2}{m_1+m_2}$

$-4(m_1 + m_2) = 3m_1 - 6m_2$

$-4m_1 - 4m_2 = 3m_1 - 6m_2$

$-4m_1 - 3m_1 = -6m_2 + 4m_2$

$-7m_1 = -2m_2$

$\frac{m_1}{m_2} = \frac{-2}{-7} = \frac{2}{7}$

$\therefore m_1 : m_2 = 2 : 7$

34) A (4, -3) = (x_1, y_1), B(8, 5) = (x_2, y_2), $m_1 : m_2 = 3 : 1$, P (x, y) = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{3(8) + 1(4)}{3 + 1}, \frac{3(5) + 1(-3)}{3 + 1}\right]$$

$$= \left[\frac{24 + 4}{4}, \frac{15 - 3}{5}\right]$$

$$= \left[\frac{28}{4}, \frac{12}{4}\right] = [7, 3]$$

$\therefore P(x, y) = [7, 3]$

35) A (-1, 7) = (x_1, y_1), B (4, -3) = (x_2, y_2), $m_1 : m_2 = 2 : 3$, P(x, y) = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{2(4) + 3(-1)}{2 + 3}, \frac{2(-3) + 3(7)}{2 + 3}\right]$$

$$= \left[\frac{8 - 3}{5}, \frac{-6 + 21}{5}\right]$$

$$= \left[\frac{5}{5}, \frac{15}{5}\right] = [1, 3]$$

$\therefore P(x, y) = [1, 3]$

36) (1, 6) = (x_1, y_1), (4, 3) = (x_2, y_2), $m_1 : m_2 = 1 : 2$, P(x, y) = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{1(4) + 2(1)}{1 + 2}, \frac{1(3) + 2(6)}{1 + 2}\right]$$

$$= \left[\frac{4 + 2}{3}, \frac{3 + 12}{3}\right]$$

$$= \left[\frac{6}{3}, \frac{15}{3}\right] = [2, 5]$$

$\therefore P(x, y) = [2, 5]$

37) A(1, -3) = (x_1, y_1), B(8, 5) = (x_2, y_2), $m_1 : m_2 = 3 : 1$ P(x, y) = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{3(8) + 1(1)}{3 + 1}, \frac{3(5) + 1(-3)}{3 + 1}\right]$$

$$= \left[\frac{24 + 1}{4}, \frac{15 - 3}{4}\right]$$

$$= \left[\frac{25}{4}, \frac{12}{4}\right] = \left[\frac{25}{4}, 3\right]$$

$\therefore P(x, y) = \left[\frac{25}{4}, 3\right]$

38) Centre of the circle is the mid point of the diameter

B (x_2, y_2) = (1, 4), P(x, y) = (2, -3), A(x_1, y_1) = ?,

$$P(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

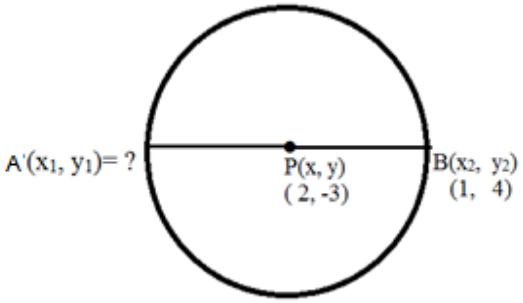
$$P(2, -3) = \left(\frac{x_1 + 1}{2}, \frac{y_1 + 4}{2}\right)$$

$$2 = \frac{x_1 + 1}{2}, \qquad -3 = \frac{y_1 + 4}{2}$$

$$2 \times 2 = x_1 + 1 \qquad -3 \times 2 = y_1 + 4$$

$$4 = x_1 + 1, \qquad -6 = y_1 + 4$$

$$x_1 = 4 - 1 = 3, \qquad y_1 = -6 - 4 = -10$$



$x_1 = 3$, $y_1 = -10$

$\therefore$ Coordinates of the point A = A (3, -10)

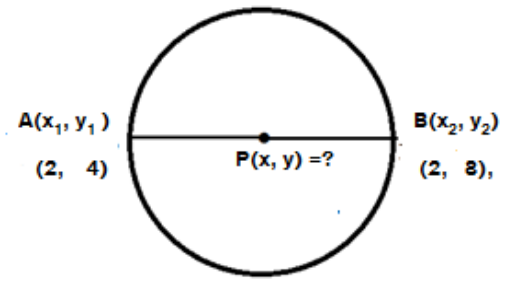
39) Centre of the circle is the mid point of the diameter

.A(x_1, y_1) = (2, 4) B(x_2, y_2) = (2, 8), P(x, y) = ?

$$P(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$P(x, y) = \left(\frac{2 + 2}{2}, \frac{4 + 8}{2}\right)$$

$$= \left(\frac{4}{2}, \frac{12}{2}\right) = (2, 6)$$



∴Coordinates of the mid pointP(x, y) = (2, 6)

40) O (x_1, y_1) = (-5, 4) A(x_2, y_2) = (-7, 1),

$$OA = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{[-7 - (-5)]^2 + (1 - 4)^2}$$

$$= \sqrt{(-7 + 5)^2 + (-3)^2}$$

$$= \sqrt{(-2)^2 + 9}$$

$OA = \sqrt{4 + 9} = \sqrt{13}$

∴OA = $\sqrt{13}$ Units

41.

$$(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$(6, 5) = \left(\frac{4 + x}{2}, \frac{6 + y}{2}\right)$$

$$\frac{4 + x}{2} = 6 \quad \frac{6 + y}{2} = 5$$

$4 + x = 12$ $\quad$ $6 + y = 10$

$x = 12 - 4$ $\quad$ $y = 10 - 6$

$x = 8$ $\quad$ $y = 4$

∴ The co ordinates of point B are $(8, 4)$

42. A(1 , 6) = (x_1, y_1), B(4 , 3) = (x_2, y_2) $m_1 : m_2 \Rightarrow 3 : 1$ P(x, y) = ?

$$P(x, y) = \left[\frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{3(4) + 1(1)}{3 + 1}, \frac{3(3) + 1(6)}{3 + 1}\right]$$

$$P(x,\ y) = \left[\frac{12+1}{4},\ \frac{9+6}{4}\right]$$

$$P(x,\ y) = \left[\frac{13}{4},\ \frac{15}{4}\right]$$

43.

$$(x\ ,y) = \left(\frac{x_1+x_2}{2}\ ,\frac{y_1+y_2}{2}\right)$$

$$(4\ ,3) = \left(\frac{x+2}{2}\ ,\frac{5+y}{2}\right)$$

$$\frac{x+2}{2} = 4 \quad \frac{5+y}{2} = 3$$

$$x + 2 = 8 \qquad 5 + y = 6$$

$$x = 8 - 2 \qquad y = 6 - 5$$

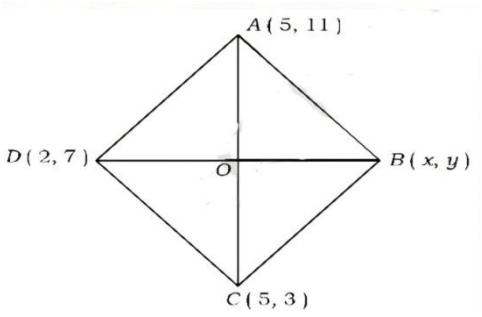
$$x = 6 \qquad y = 1$$

AB $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(6-2)^2 + (5-1)^2}$

AB $= \sqrt{(4)^2 + (4)^2} = \sqrt{16+16} = \sqrt{32} = \sqrt{16\ x\ 2} = 4\sqrt{2}$ Units

44.



Soln: Mid point of AC = Mid point of BD

$(x , y) = \left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2}\right)$

$(x , y) = \left(\frac{5+5}{2} , \frac{11+3}{2}\right)$

$(x , y) = \left(\frac{10}{2} , \frac{14}{2}\right)$

$(x , y) = (5 , 7)$

$(x , y) = \left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2}\right)$

$(5 , 7) = \left(\frac{2+x}{2} , \frac{7+y}{2}\right)$

$$\frac{2 + x}{2} = 5 \quad \frac{7 + y}{2} = 7$$

$2 + x = 10$ $\qquad$ $7 + y = 14$

$x = 10 - 2$ $\qquad$ $y = 14 - 7$

$x = 8$ $\qquad$ $y = 7$

BD = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

= $\sqrt{(8 - 2)^2 + (7 - 7)^2}$

= $\sqrt{(6)^2 + (0)^2}$

= $\sqrt{(6)^2}$

= 6 Units

IV. Three Marks Questions : -

45) Coordinates of the point A = (0, 6) = (x_1, y_1),

Coordinates of the point B = (3, 0) = (x_2, y_2),

Coordinates of the point P = (2, 2) = (x, y), $m_1 : m_2$ = ?

P(x, y) = $\left[\frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}\right]$

$(2,\ 2) = \left[\frac{m_1(3)+m_2(0)}{m_1+m_2},\ \frac{m_1(0)+m_2(6)}{m_1+m_2}\right]$

$(2,\ 2) = \left[\frac{3m_1+0}{m_1+m_2},\ \frac{0+6m_2}{m_1+m_2}\right]$

$(2,\ 2) = \left[\frac{3m_1}{m_1+m_2},\ \frac{6m_2}{m_1+m_2}\right]$

$2 = \frac{3m_1}{m_1+m_2}$ **OR** $2 = \frac{6m_2}{m_1+m_2}$

$2(m_1 + m_2) = 3m_1$ $\quad$ $2(m_1 + m_2) = 6m_2$

$2m_1 + 2m_2 = 3m_1$ $\quad$ $2m_1 + 2m_2 = 6m_2$

$2m_2 = 3m_1 - 2m_1$ $\quad$ $2m_1 = 6m_2 - 2m_2$

$2m_2 = m_1$ $\quad$ $2m_1 = 4m_2$

$\frac{2}{1} = \frac{m_1}{m_2}\frac{m_1}{m_2} = \frac{4}{2}$

$\therefore m_1 : m_2 = 2 : 1$

46) Coordinates of the point A : A (2, 5) = (x_1, y_1), $m_1 : m_2 = 1 : 2$, P (x, y) = ?

Coordinates of the point B : B (5, 2) = (x_2, y_2),

$P(x,\ y) = \left[\frac{m_1x_2+m_2x_1}{m_1+m_2},\ \frac{m_1y_2+m_2y_1}{m_1+m_2}\right]$

$= \left[\frac{1(5)+2(2)}{1+2},\ \frac{1(2)+2(5)}{1+2}\right]$

$= \left[\frac{5+4}{3},\ \frac{2+10}{3}\right]$

$= \left[\frac{9}{3},\ \frac{12}{3}\right] = (3,\ 4)$

$P(x,\ y) = (3,\ 4)$

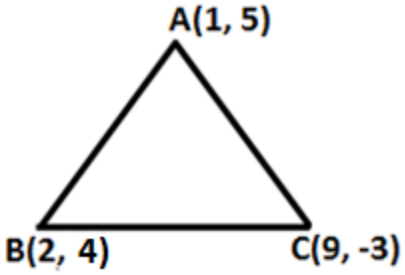
47) Distance between the points **AB** = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

A(1, 5) = (x_1, y_1), B (2, 4) = (x_2, y_2)

$= \sqrt{(2-1)^2+(3-4)^2}$

$= \sqrt{(1)^2+(-1)^2}$

$\Rightarrow$**AB** $= \sqrt{1+1} = \sqrt{2} = 1.414$



Distance between the points **BC** = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

B (2, 4) = (x_1, y_1), C (9, -3) = (x_2, y_2)

$= \sqrt{(9-2)^2 + (-3-4)^2}$

$= \sqrt{(7)^2 + (-7)^2}$

⇒**BC**= $\sqrt{49+49}$ =$\sqrt{\mathbf{98}}$ = 9.899

Distance between the points **AC** = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

A (1, 5) = (x_1, y_1) , C (9, -3)= (x_2, y_2)

$= \sqrt{[9-1]^2 + (-3-5)^2}$

$= \sqrt{(8)^2 + (-8)^2}$

⇒**AC** = $\sqrt{64+64}$ =$\sqrt{128}$ = 11.313

1.414 + 9.899 = 11.313

11.313 = 11.313

AB + BC = AC∴ **The given points are collinear**

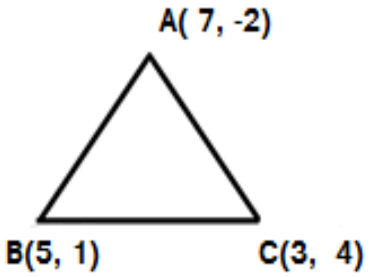
48) Distance between the points **AB** = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

A(7, -2) = (x_1, y_1), B (5, 1) = (x_2, y_2)

$= \sqrt{(5-7)^2 + [1-(-2)]^2}$

$= \sqrt{(-2)^2 + (1+2)^2}$

⇒**AB**= $\sqrt{4+9}$ =$\sqrt{\mathbf{13}}$ = **3.605**



Distance between the points **BC** = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

B (5, 1) = (x_1, y_1), C (3, 4) = (x_2, y_2)

$= \sqrt{(3-5)^2 + (4-1)^2}$

$= \sqrt{(-2)^2 + (-3)^2}$

⇒**BC**= $\sqrt{4+9}$ =$\sqrt{\mathbf{13}}$ = **3.605**

Distance between the points **AC** = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

A (7, -2) = (x_1, y_1) , C (3, 4)= (x_2, y_2)

$= \sqrt{[3-7]^2 + [4-(-2)]^2}$

$= \sqrt{(-4)^2 + (4+2)^2}$

⇒**AC** = $\sqrt{16+36}$ =$\sqrt{52}$= **7.211**

$3.605 + 3.605 \neq 7.21$

7.21 = 7.21

AB + BC = AC∴ The given points are collinear

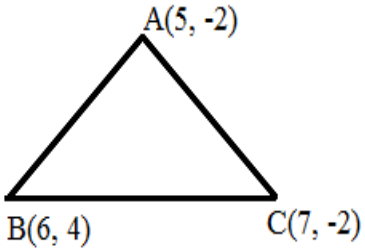
49) Distance between the points **AB =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

A(5, -2) = (x_1, y_1) , B (6, 4) =(x_2, y_2)

$= \sqrt{(6-5)^2+[4-(-2)]^2}$

$= \sqrt{(1)^2+(4+2)^2}$

⇒**AB**= $\sqrt{1+(6)^2}$ = $\sqrt{1+36}$ =$\sqrt{\mathbf{37}}$



Distance between the points **BC =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

B (6, 4) = (x_1, y_1) C (7, -2) = (x_2, y_2)

$= \sqrt{(7-6)^2+(-2-4)^2}$

$= \sqrt{(1)^2+(-6)^2}$

⇒**BC**= $\sqrt{1+36}$ =$\sqrt{\mathbf{37}}$

Distance between the points **CA =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

C(7, -2) = (x_1, y_1), A(5, -2) = (x_2, y_2)

$= \sqrt{(7-5)^2+[-2-(-2)]^2}$

$= \sqrt{(2)^2+(-2+4)^2}$

⇒**AC** = $\sqrt{4+(2)^2}$ =$\sqrt{4+4}$ = $\sqrt{\mathbf{8}}$

AB = BC =$\sqrt{\mathbf{37}}$

∴The given points are vertices of an isosceles triangle

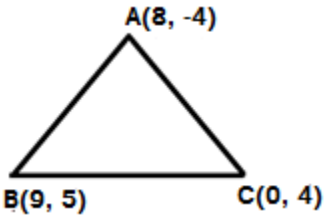
50)Distance between the points **AB =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

A(8, -4) = (x_1, y_1) , B (9, 5) =(x_2, y_2)

$= \sqrt{(9-8)^2+[5-(-4)]^2}$

$= \sqrt{(1)^2+(5+4)^2}$

⇒**AB**= $\sqrt{1+(9)^2}$ = $\sqrt{1+81}$ =$\sqrt{\mathbf{82}}$



Distance between the points **BC =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

B (9, 5) = (x_1, y_1) , C (0, 4) = (x_2, y_2)

$= \sqrt{(0-9)^2+(4-5)^2}$

$= \sqrt{(-9)^2+(-1)^2}$

⇒**BC**= $\sqrt{81+1}$ =$\sqrt{\mathbf{82}}$

Distance between the points **AC =** $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

C(0, 4) = (x_1, y_1), A(8, -4) = (x_2, y_2)

$= \sqrt{(8-0)^2+[-4-(-4)]^2}$

$= \sqrt{(8)^2+(0)^2}$

⇒**AC** = $\sqrt{64}$

AB = **BC** = $\sqrt{82}$

∴The given points are vertices of an isosceles triangle

51) A (x, 0) = (x_1, y_1) , B (0, y) = (x_2, y_2), (4, 3) = (x, y)

x = $\frac{x_1+x_2}{2}$ y = $\frac{y_1+y_2}{2}$

4 = $\frac{x+0}{2}$ 3 = $\frac{0+y}{2}$

8 = x 6 = y

A (8, 0) = (x_1, y_1) , B (0, 6) = (x_2, y_2),

AB = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

= $\sqrt{(0-8)^2+(6-0)^2}$

AB = $\sqrt{(8)^2+(6)^2}$ = $\sqrt{64+36}$ = $\sqrt{100}$ = 10 Units

52)



Let P and Q are the trisection points of AB ∴ AP = PQ = QB

The point P divides AB internally in the ratio 1 : 2

A(4 , -1) = (x_1, y_1), B(-2, -3) = (x_2, y_2) $m_1 : m_2$ ⇒1 : 2P(x, y) = ?

P(x, y) = $\left[\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right]$

P(x, y) = $\left[\frac{1(-2)+2(4)}{1+2}, \frac{1(-3)+2(-1)}{1+2}\right]$

= $\left[\frac{-2+8}{3}, \frac{-3-2}{3}\right]$

= $\left[\frac{6}{3}, \frac{-5}{3}\right]$ = [2, $\frac{-5}{3}$]

P(x, y) = [2, $\frac{-5}{3}$]

The point Q divides AB internally in the ratio 2 : 1 : $m_1 : m_2$ ⇒ 2 : 1P(x, y) = ?

P(x, y) = $\left[\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right]$

P(x, y) = $\left[\frac{2(-2)+1(4)}{2+1}, \frac{2(-3)+1(-1)}{2+1}\right]$

= $\left[\frac{-4+4}{3}, \frac{-6-1}{3}\right]$

$= \left[\frac{0}{3}, \frac{-7}{3}\right] = [\,0, \frac{-7}{3}]$

P(x, y) = [0, $\frac{-7}{3}$]

∴Trisection points of A and B are **: [2, $\frac{-5}{3}$] and [0, $\frac{-7}{3}$]**

53)



Let P and Q are the trisection points of AB ∴ AP = PQ = QB

The point P divides AB internally in the ratio 1 : 2

A(2 , -2) = (x_1, y_1), B(-7, 4) = (x_2, y_2) $m_1 : m_2 \Rightarrow 1 : 2$ P(x, y) = ?

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{1(-7) + 2(2)}{1 + 2}, \frac{1(4) + 2(-2)}{1 + 2}\right]$$

$$= \left[\frac{-7 + 4}{3}, \frac{4 - 4}{3}\right]$$

P(x, y) = $\left[\frac{-3}{3}, \frac{0}{3}\right]$= [-1, 0]

The point Q divides AB internally in the ratio 2 : 1

$$P(x, y) = \left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

$$P(x, y) = \left[\frac{2(-7) + 1(2)}{2 + 1}, \frac{2(4) + 1(-2)}{2 + 1}\right]$$

$$= \left[\frac{-14 + 2}{3}, \frac{8 - 2}{3}\right]$$

P(x, y) =$\left[\frac{-12}{3}, \frac{6}{3}\right]$= (- 4, 2)

∴Trisection points of A and B are **: (-1, 0) & (- 4, 2)**

54) The point on the x-axis is of the form (X, 0) ∴ P (x, y) = (x , 0)

Let ratio be k : 1 ∴ $m_1 : m_2$ = k : 1

A**(1, -5) =** (x_1, y_1)B**(-4, 5) =** (x_2, y_2)

P(x, y) = $\left[\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right]$

P(x, 0) = $\left[\frac{k(-4)+1(1)}{k+1}, \frac{k(5)+1(-5)}{k+1}\right]$

(x, 0) = $\left[\frac{-4k+1}{k+1}, \frac{5k-5}{k+1}\right]$

x = $\frac{-4k+1}{k+1}$ ---(1) 0 = $\frac{5k-5}{k+1}$

0(k + 1) = 5k -5

0 = 5k - 5

5k = 5 k = $\frac{5}{5}$ = 1∴ **k = 1**

Put k = 1 in eqn. (1)

x = $\frac{-4(1)+1}{1+1}$

x = $\frac{-4+1}{1+1}$ = $\frac{-3}{2}$

x = $\frac{-3}{2}$

The coordinates of the point of division = (x , 0) = ($\frac{-3}{2}$, 0)

55). The point P(x,y) is equidistant from (3, 6) and (-3, 4), PA = PB

PA = PB

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\sqrt{(x-3)^2+(y-6)^2}$ = $\sqrt{(x-(-3))^2+(y-4)^2}$

$\sqrt{(x-3)^2+(y-6)^2}$ = $\sqrt{(x+3))^2+(y-4)^2}$

By squaring on both sides

$(x-3)^2+(y-6)^2$= $(x+3)^2+(y-4)^2$

x^2 + 9 - 6x + y^2 + 36 -12y = x^2 + 9 + 6x + y^2 + 16 -8y

-6x - 6x + 8y – 12y + 36 -16 = 0

-12x -4y + 20 = 0 (÷4)

-3x – y + 5 = 0

5 = 3x + y OR**3x + y = 5**

56) The point P(x,y) is equidistant from (7, 1) and (3, 5), PA = PB

AP = BP

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\sqrt{(x-7)^2+(y-1)^2}$ = $\sqrt{(x-3))^2+(y-5)^2}$

By squaring on both sides

$(x-7)^2+(y-1)^2$= $(x-3)^2+(y-5)^2$

x^2 + 49 - 14x + y^2 + 1 - 2y = x^2 + 9 - 6x + y^2 + 25 -10y

-14x + 6x - 2y + 10y = -50 + 34

-8x + 8y = - 16

8(y – x) = -16

y – x = $\frac{-16}{8}$ = - 2 ⇒y – x = -2

⇒**x – y = 2**

P(x, y) = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

= $\left(\frac{7+3}{2}, \frac{1+5}{2}\right) = \left(\frac{10}{2}, \frac{6}{2}\right)$ = (5, ∴ **P(x, y) = (5, 3)**

57) Let the coordinates of D are D(x, y)

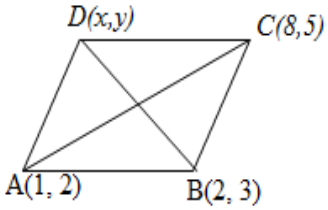
In the parallelogram ABCD diagonals AC and BD bisects each other.

Mid point of AC = Mid point of BD

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

A(1, 2) = (x_1, y_1) B(2, 3) = (x_1, y_1)

C(8, 5) = (x_2, y_2) D(x, y) = (x_2, y_2)



$\left(\frac{1+8}{2}, \frac{2+5}{2}\right) = \left(\frac{2+x}{2}, \frac{3+y}{2}\right)$

$\left(\frac{9}{2}, \frac{7}{2}\right) = \left(\frac{2+x}{2}, \frac{3+y}{2}\right)$

$\frac{9}{2} = \frac{2+x}{2}$, $\frac{7}{2} = \frac{3+y}{2}$

$\cancel{2} \times \frac{9}{\cancel{2}} = 2 + x$, $\cancel{2} \times \frac{7}{\cancel{2}} = 3 + y$

9 = 2 + x , 7 = 3 + y

x = 9 - 2 = 7, y = 7- 3 = 4

∴ **x =7** ∴ **y =4**

∴the coordinates of D are **D(x, y) =D(7,4)**

58)

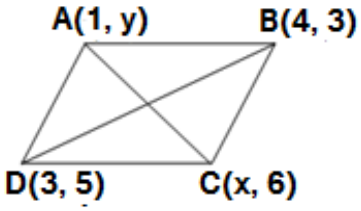
In the parallelogram ABCD diagonals AC and BD bisects each other.

Mid point of AC = Mid point of BD

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

A(1, y) = (x_1, y_1) B(4, 3) = (x_1, y_1)

C(x, 6) = (x_2, y_2) D(3, 5) = (x_2, y_2)



$\left(\frac{1+x}{2}, \frac{y+6}{2}\right) = \left(\frac{4+3}{2}, \frac{3+5}{2}\right)$

$\left(\frac{1+x}{2}, \frac{y+6}{2}\right) = \left(\frac{7}{2}, \frac{8}{2}\right)$

$\frac{1+x}{2} = \frac{7}{2}$ $\frac{y+6}{2} = \frac{8}{2}$

1 + x = 7 y + 6 = 8

x = 7 – 1 y = 8 – 6

∴**x = 6 and y = 2**

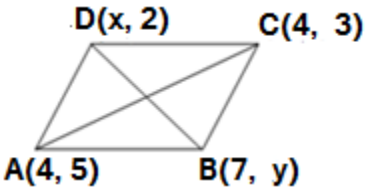
59) In the parallelogram ABCD diagonals AC and BD bisects each other.

Mid point of AC = Mid point of BD

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

A(4, 5) = (x_1, y_1) B(7, y) = (x_1, y_1)

C(4, 3) = (x_2, y_2) D(x, 2) = (x_2, y_2)



$\left(\frac{4+4}{2}, \frac{5+3}{2}\right) = \left(\frac{7+x}{2}, \frac{y+2}{2}\right)$

$\left(\frac{8}{2}, \frac{8}{2}\right) = \left(\frac{7+x}{2}, \frac{y+2}{2}\right)$

$(4, 4) = \left(\frac{7+x}{2}, \frac{y+2}{2}\right)$

$4 = \frac{7+x}{2}$ $\quad 4 = \frac{y+2}{2} =$

$8 = 7 + x$ $\quad y + 2 = 8$

$x = 8 - 7 = 1$ $\quad y = 8 - 2 = 6$ $\quad \therefore \mathbf{x = 6}$ **&** $\mathbf{y = 6}$

60) coordinates of the point M

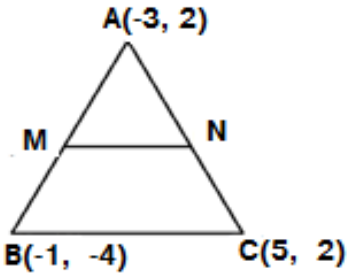
By using mid point formula P(x, y) = $\left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right]$

$M(x_1, y_1) = \left[\frac{-3+(-1)}{2}, \frac{2+(-4)}{2}\right]$

$= \left[\frac{-3-1}{2}, \frac{2-4}{2}\right]$

$= \left[\frac{-4}{2}, \frac{-2}{2}\right]$

$M(x_1, y_1) = (-2, -1)$



coordinates of the point N

$N(x_2, y_2) = \left[\frac{-3+5}{2}, \frac{2+2}{2}\right]$

$= \left[\frac{2}{2}, \frac{4}{2}\right]$

$N(x_2, y_2) = (1, 2)$

$MN = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$M(x_1, y_1) = (-2, -1)$ $\quad N(x_2, y_2) = (1, 2)$

$= \sqrt{[1-(-2)]^2 + [2-(-1)]^2}$

$= \sqrt{(1+2)^2 + (2+1)^2} = = \sqrt{3^2 + 3^2}$

$= \sqrt{9+9} = \sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}$

MN = $3\sqrt{2}$Units ---------- (1)

$BC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$B(x_1, y_1) = (-1, -4)$, $C(x_2, y_2) = (5, 2)$

$BC = \sqrt{[5-(-1)]^2 + [2-(-4)]^2}$

$= \sqrt{(5+1)^2 + (2+4)^2} = = \sqrt{6^2 + 6^2}$

$= \sqrt{36+36} = \sqrt{72} = \sqrt{36 \times 2} = 6\sqrt{2}$

BC = $6\sqrt{2}$Units ---------- (2)

From eqn (1) and (2)⇒ **BC = 2MN**

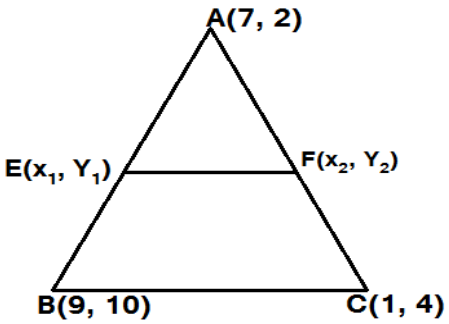
61) coordinates of the point E :

By using mid point formula P(x, y) = $\left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right]$

$E(x_1, y_1) = \left[\frac{7+9}{2}, \frac{2+10}{2}\right]$

$= \left[\frac{16}{2}, \frac{12}{2}\right] = (8, 6)$

$E(x_1, y_1) = (8, 6)$



coordinates of the point F :

$F(x_2, y_2) = \left[\frac{7+1}{2}, \frac{4+2}{2}\right]$

$= \left[\frac{8}{2}, \frac{6}{2}\right] = (4, 3)$

$F(x_2, y_2) = (4, 3)$

EF = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$E(x_1, y_1) = (8, 6)$, $F(x_2, y_2) = (4, 3)$

$= \sqrt{(4-8)^2 + (3-6)^2}$

$= \sqrt{(-4)^2 + (-3)^2} =$

$= \sqrt{16+9} = \sqrt{25}$

EF = 5 Units ---------- (1)

BC = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$B(x_1, y_1) = (9, 10)$, $C(x_2, y_2) = (1, 4)$

BC = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(1-9)^2 + (4-10)^2}$

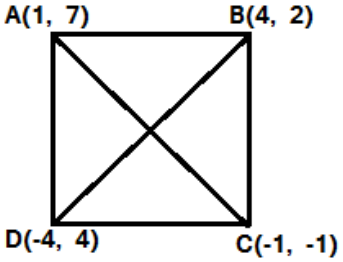
$= \sqrt{(-8)^2 + (-6)^2}$

$= \sqrt{64+36} = \sqrt{100} = 10$

BC = 10 Units ---------- (1)

From Eqn (1) and (2)⇒ **EF = $\frac{1}{2}$BC**

62) A(1, 7), B(4, 2), C(-1, -1), D(-4, 4),



Distance between AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

A(1, 7)= (x_1, y_1) B(4, 2)= (x_2, y_2)

$= \sqrt{(4-1)^2 + (2-7)^2}$

$= \sqrt{(3)^2 + (-5)^2}$

$= \sqrt{9+25}$

Distance between AB =$\sqrt{34}$ ---------- (1)

Distance between BC = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

B(4, 2)= (x_1, y_1) C(-1, -1)= (x_2, y_2)

$= \sqrt{(-1-4)^2 + (-1-2)^2}$

$= \sqrt{(-5)^2 + (-3)^2} = \sqrt{25+9}$

BC =$\sqrt{34}$ ---------- (2)

Distance between CD = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

C(-1, -1)= (x_1, y_1) D(-4, 4) = (x_2, y_2)

$= \sqrt{[(-4-(-1)]^2 + [(4-(-1)]^2}$

$= \sqrt{(-4+1)^2 + (4+1)^2} =$

$= \sqrt{(-3)^2 + (5)^2} = \sqrt{9+25}$

CD $=\sqrt{34}$ ---------- (3)

Distance between DA $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

D(-4, 4)= (x_1, y_1) A(1, 7) = (x_2, y_2)

$= \sqrt{[(1 - (-4)]^2 + (7 - 4)^2}$

$= \sqrt{(1 + 4)^2 + (3)^2}$ =

$= \sqrt{(5)^2 + (3)^2} = \sqrt{25 + 9}$

DA $=\sqrt{34}$ ---------- (4)

Distance between the Diagonal AC $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

A(1, 7) = (x_1, y_1) C(-1, -1)= (x_2, y_2)

$= \sqrt{(-1 - 1)^2 + (-1 - 7)^2}$

$= \sqrt{(-2)^2 + (-8)^2} = \sqrt{4 + 64}$

AC $=\sqrt{68}$ ---------- (5)

Distance between the Diagonal BD= $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

B(4, 2)= (x_1, y_1) D(-4, 4)= (x_2, y_2)

$= \sqrt{(-4 - 4)^2 + (4 - 2)^2}$

$= \sqrt{(-8)^2 + (-2)^2}$

$= \sqrt{64 + 4}$

BD $=\sqrt{68}$ ---------- (6)

AB = BC = CD = DA and Diagonals AC = BD

∴ ABCD is a square

Unit : 08 Introduction to Trigonometry

I. Multiple choice Questions :

1. B) $\frac{PR}{QR}$
2. B) cot L
3. C) $\frac{1}{2}$
4. A) $\frac{13}{5}$
5. B) $\frac{1}{4}$
6. D) 1
7. D) 45^0
8. B) $\frac{3}{5}$
9. D) $\frac{13}{12}$
10. D) 1
11. D) $\frac{1}{2}$
12. C) 1
13. C) 30^0
14. D) $\frac{\sqrt{y^2-x^2}}{y}$
15. D) 1
16. A)) $\frac{9}{25}$
17. D) $sin^2\theta + cos^2\theta = 1$
18. A) 0
19. A) 4 + $\tan^2$A
20. B) 1
21. C) $\sec^2\theta$
22. A) – 1
23. B) 1
24. D) $\frac{1}{k}$
25. D) $\frac{7}{17}$
26. B) $\frac{7}{8}$

II. One Mark Questions :

27. AB:AC = $sin\theta = 30^0 = \frac{1}{2}$ AB:AC = 1 : 2
28. $sin^2\theta + cos^2\theta = \frac{3^2}{5^2} + \frac{4^2}{5^2} = \frac{9}{25} + \frac{16}{25} = \frac{9+16}{25} = \frac{25}{25} = 1$

$sin^2\theta + cos^2\theta = 1$

29. $\text{cosec}60^0 + \sec 30^0 = \frac{2}{\sqrt{3}} + \frac{2}{\sqrt{3}} = \frac{4}{\sqrt{3}}$
30. $\sin 90^0 + \tan 45^0 = 1 + 1 = 2$
31. $\frac{AB}{BC} = tan30^0 = \frac{1}{\sqrt{3}}$

$\frac{AB}{BC} = \frac{15}{BC} = \frac{1}{\sqrt{3}}$

$\therefore$ BC = $15\sqrt{3} mts$

32. $\tan 45^0 + \cot 45^0 = 1 + 1 = 2$

$\therefore \tan 45^0 + \cot 45^0 = 2$

33. $sec\theta = \frac{1}{Cos\theta} = \frac{1}{24/25} = \frac{25}{24}$

$\therefore Sec\theta = \frac{25}{24}$

34. $\sin^2 A + \cos^2 A = 1$

$0 + \cos^2 A = 1$

$\therefore \cos^2 A = 1$

35. $15 \cot A = 8$

$$\therefore \cot A = \frac{8}{15} = \frac{1}{tanA}$$

$$\therefore \tan A = \frac{15}{8}$$

36. $\frac{AC}{AB} = cosec\theta = 30^0$

$\frac{AC}{12} = 2$

$\therefore$ AC = 24 cm

37. $x.\tan 45°. \sin 30° = \cos 30° \tan 30°$

$x(1)\left(\frac{1}{2}\right) = \frac{\sqrt{3}}{2} . \sqrt{3}$

$\therefore x = 3$

38. $5 \tan^2 A - 5 \sec^2 A + 1 = 5 \tan^2 A - 5 (1 + \tan^2 A) + 1$

$= 5 \tan^2 A - 5 - 5\tan^2 A + 1 = 1 - 5 = 4$

$\therefore 5 \tan^2 A - 5 \sec^2 A + 1 = 4$

39. $sinA \, . \, cosecA = 1$

40. $tanA . cotA - cosA . secA = 0$

41. $tan^2 45^0 - sin^2 45^0 = (1)^2 - \left(\frac{1}{\sqrt{2}}\right)^2 = 1 - \frac{1}{2} = \frac{1}{2}$

$\therefore tan^2 45^0 - sin^2 45^0 = \frac{1}{2}$

42. $\sin A = \cos A$

$\frac{sinA}{cosA} = 1$

$tanA = 1$

$tanA = 45^0$

$\therefore A = 45^0$

III. **Two Marks Questions :**

43. $sec\theta = \frac{1}{Cos\theta} = {}^{1}\Big/_{\frac{5}{13}} = \frac{13}{5}$

$\therefore sec\theta = \frac{13}{5}$

$tan\theta = \frac{sin\theta}{cos\theta} = {}^{\frac{12}{13}}\Big/_{\frac{5}{13}} = \frac{12}{5}$

$\therefore tan\theta = \frac{12}{5}$

44. $cosec\theta = \frac{13}{12} = \frac{1}{Sin\theta}$ $\quad \therefore sin\theta = \frac{12}{13}$

$\tan\theta = \frac{5}{12} = \frac{Cos\theta}{Sin\theta}$

$\therefore \frac{cos\theta}{{}^{12}\Big/_{13}} = \frac{5}{12}$

$\therefore cos\theta = \frac{5}{12}\ X\ \frac{12}{13}$

$\therefore cos\theta = \frac{5}{13}$

45. $sin\alpha = \frac{24}{25} cos\alpha = \frac{7}{25}$

46. $sinP = \frac{1}{2}$ ಮತ್ತು $tanR = \frac{\sqrt{3}}{1} = \sqrt{3}$

47. $\tan P - \cot R = \frac{5}{12} - \frac{5}{12} = 0$

48. $sin\alpha = \frac{3}{5}$ and $tan\theta = \frac{4}{3}$

49. $sin\alpha = \frac{4}{5}$ and $cos\theta = \frac{3}{5}$

50. $\sin A = \frac{3}{5} = \frac{opp}{hyp}$

Let opp = 3k and hyp = 5k

In a right angled triangle,

$(hyp)^2 = (opp)^2 + (adj)^2$

$(5k)^2 = (3k)^2 + (adj)^2$

$25k^2 - 9k^2 = (adj)^2$

$(adj)^2 = 16k^2$

$\therefore adj = 4k$

$\tan A = \frac{opp}{adj} = \frac{3k}{4k} = \frac{3}{4}$

51. $2\tan^2 45^0 + \cos^2 30^0 - \sin^2 60^0$

$= 2(1)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2$

$= 2$

52. $\sqrt{3}\ tan\theta = 1 \quad \therefore tan\theta = \frac{1}{\sqrt{3}}$

$$\therefore tan\theta = tan30^0$$
$$\therefore \theta = 30^0$$
$$sin3\theta + cos3\theta = sin(3X30^0) + cos(2X30^0) = sin90^0 + cos60^0$$
$$sin3\theta + cos3\theta = 1 + \frac{1}{2}$$
$$\therefore sin3\theta + cos3\theta = \frac{3}{2}$$

53. LHS $= (tanAXSinA) + cosA$

$$= \frac{SinA}{CosA} XsinA + cosA$$
$$= \frac{Sin^2A}{CosA} + cosA$$
$$= \frac{Sin^2A + Cos^2A}{CosA}$$
$$= \frac{1}{CosA}$$

$= secA$ = RHS

54. LHS = 5 sinθ – 3 tanθ

$$= 5sin\theta - 3\frac{SinA}{CosA}$$
$$= \frac{5Sin\theta XCos\theta - 3SinA}{CosA}$$
$$= \frac{5Sin\theta X0.6 - 3SinA}{0.6}$$
$$= \frac{5Sin\theta - 5Sin\theta}{0.6}$$

$= 0$ = RHS

55. LHS = sec$^4\theta$ - sec$^2\theta$

= sec$^2\theta$(sec$^2\theta$ – 1)
= (1+tan$^2\theta$) X tan$^2\theta$
= tan$^4\theta$ + tan$^4\theta$ = RHS

56. LHS = cosecA (1- cosA) (cosecA + cotA)

$$= \frac{1}{SinA}(1 - cosA)\left(\frac{1}{SinA} + \frac{CosA}{SinA}\right)$$
$$= \frac{1}{SinA}(1 - cosA)\left(\frac{1 + CosA}{SinA}\right)$$
$$= \frac{1 - Cos^2A}{Sin^2A}$$
$$= \frac{Sin^2A}{Sin^2A}$$

$= 1$ = RHS

57. LHS $= tan^2\theta - sin^2\theta$

$= \frac{Sin^2\theta}{Cos^2\theta} - sin^2\theta$

$$= \frac{Sin^2\theta - Sin^2\theta X Cos^2\theta}{Cos^2\theta}$$

$$= sin^2\theta\left(\frac{1 - Cos^2\theta}{Cos^2\theta}\right)$$

$$= sin^2\theta\left(\frac{Sin^2\theta}{Cos^2\theta}\right)$$

$= sin^2\theta.tan^2\theta$ = RHS

58. LHS $= \cot^2\theta - \cos^2\theta$

$$= \frac{cos^2\theta}{sin^2\theta} - cos^2\theta$$

$$= \frac{cos^2\theta - Sin^2\theta X Cos^2\theta}{sin^2\theta}$$

$$= cos^2\theta\left(\frac{1 - sin^2\theta}{sin^2\theta}\right)$$

$$= cos^2\theta\left(\frac{cos^2\theta}{sin^2\theta}\right)$$

$= cos^2\theta.cot^2\theta$ = RHS

59. LHS $= \sin30^0 + \cos60^0 + \tan45^0$

$= \frac{1}{2} + \frac{1}{2} + 1$

$= 1 + 1$

$= 2$

$= \sec60^0$ = RHS

60. LHS $= \frac{Sin30^0 + Cos60^0}{Cosec30^0 - Cos45^0}$

$$= \frac{\frac{1}{2} + \frac{1}{2}}{2 - 1}$$

$$= \frac{1}{1}$$

$$= 1$$

$= sin90^0$ = RHS

61. $\frac{Cos45^0.\ Sin45^0}{Sec30^0 - Cot60^0} = \frac{\frac{1}{\sqrt{2}}.\frac{1}{\sqrt{2}}}{\frac{2}{\sqrt{3}} - \frac{1}{\sqrt{3}}}$

$$= \frac{\frac{1}{2}}{\frac{2-1}{\sqrt{3}}}$$

$$= \frac{\frac{1}{2}}{\frac{1}{\sqrt{3}}}$$

$$= \frac{1}{2} X \frac{\sqrt{3}}{1}$$

$$= \frac{\sqrt{3}}{2}.$$

62. LHS $= \frac{1+CosA}{1-CosA} X \frac{1+CosA}{1+CosA}$

$$= \frac{(1+CosA)^2}{1-Cos^2A}$$

$$= \frac{(1+CosA)^2}{Sin^2A}$$

$$= \left(\frac{1+CosA}{SinA}\right)^2$$

$$= \left(\frac{1}{SinA} + \frac{CosA}{SinA}\right)^2$$

$= (cosecA + cotA)^2$ = RHS

63. LHS $= \frac{1+SinA}{1-SinA} X \frac{1+SinA}{1+SinA}$

$$= \frac{(1+SinA)^2}{1-Sin^2A}$$

$$= \frac{(1+SinA)^2}{Cos^2A}$$

$$= \left(\frac{1+SinA}{CosA}\right)^2$$

$$= \left(\frac{1}{CosA} + \frac{SinA}{CosA}\right)^2$$

$= (secA + tanA)^2$ = RHS

64. LHS $= \frac{CosA}{1+SinA} + \frac{1+SinA}{CosA}$

$$= \frac{Cos^2A + (1+SinA)^2}{(1+SinA)CosA}$$

$$= \frac{Cos^2A + 1 + Sin^2A + 2SinA}{(1+SinA)CosA}$$

$$= \frac{1+1+2SinA}{(1+SinA)CosA}$$

$$= \frac{2+2SinA}{(1+SinA)CosA}$$

$$= \frac{2(1+SinA)}{(1+SinA)CosA}$$

$$= \frac{2}{CosA}$$

$= 2secA$ = RHS

65. LHS $= \frac{sinA}{1+cosA} + \frac{1+cosA}{sinA}$

$$= \frac{sin^2A + (1+cosA)^2}{(1+cosA)sinA}$$

$$= \frac{sin^2A + 1 + cos^2A + 2cosA}{(1+cosA)sinA}$$

$$= \frac{1+1+2sinA}{(1+cosA)sinA}$$

$$= \frac{2+2CosA}{(1+cosA)sinA}$$

$$= \frac{2(1+cosA)}{(1+cosA)sinA}$$

$$= \frac{2}{sinA}$$

$$= 2cosecA$$

= RHS

66. LHS $= \frac{CosA - SinA.CosA}{CosA + SinA.CosA}$

$$= \frac{CosA(1-SinA)}{CosA\,(1+SinA)}$$

$$= \frac{(1-SinA)}{(1+SinA)}$$

$$= \frac{\left(1 - \frac{1}{CosecA}\right)}{\left(1 + \frac{1}{CosecA}\right)}$$

$$= \frac{\left(\frac{1-CosecA}{CosecA}\right)}{\left(\frac{1+CosecA}{CosecA}\right)}$$

$$= \frac{1-CosecA}{1+CosecA}$$

= RHS

67. $\sin30^0.\cos60^0 + \cos30^0.\sin60^0$

$= \frac{1}{2}.\frac{1}{2} + \frac{\sqrt{3}}{2}.\frac{\sqrt{3}}{2}$

$$= \frac{1}{4} + \frac{3}{4}$$

$$= \frac{1+3}{4}$$

$$= \frac{4}{4}$$

$$= 1$$

$$= sin90^0$$

68. $\frac{\sqrt{3}\frac{1}{CosA}}{\frac{1}{SinA}} = 1$

$$\sqrt{3}X\frac{1}{cosA}X\frac{sinA}{1} = 1$$

$$\sqrt{3}tanA = 1$$

$$tanA = \frac{1}{\sqrt{3}}$$

$$tanA = tan30^0$$

$$\therefore A = 30^0$$

69. LHS = secA (1- sinA) (secA + tanA)

$$= \frac{1}{CosA}(1 - tinA)\left(\frac{1}{CosA} + \frac{SinA}{CosA}\right)$$

$$= \frac{1}{CosA}(1 - sinA)\left(\frac{1 + SinA}{CosA}\right)$$

$$= \frac{(1 - SinA)(1 + SinA)}{Cos^2A}$$

$$= \frac{1 - Sin^2A}{Cos^2A}$$

$$= \frac{Cos^2A}{Cos^2A}$$

$= 1$ = RHS

70. $2\sin\theta = 1 \qquad \therefore sin\theta = \frac{1}{2}$

Now $\cos^2 60^0 + S\sec^2 30^0$

$$= \left(\frac{1}{2}\right)^2 + \left(\frac{2}{\sqrt{3}}\right)^2$$

$$= \frac{1}{4} + \frac{4}{3}$$

$$= \frac{3 + 16}{12}$$

$$= \frac{19}{12}$$

71. LHS = $\tan^2\theta + \cot^2\theta$

= $\sec^2\theta - 1 + \text{cosec}^2\theta - 1$

= $\sec^2\theta + \text{cosec}^2\theta - 2$ = RHS

72. $4\sin30^0 + \cos60^0.\sec60^0 - 3\tan45^0$ $= 4\left(\frac{1}{2}\right) + \frac{1}{2}(2) - 3(1)$

$$= 2 + 1 - 3$$

$$= 3 - 3$$

$$= 0$$

73. $6\cos60^0 - \sin30^0 + \sin^245^0 + \cos^245^0$

$= 6\left(\frac{1}{2}\right) - \left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2$

$$= 3$$

74. $\frac{5cos^260 + 4sec^230 - tan^245}{sin30^0 + sin90^0}$

$$= \frac{5\left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - 1}{1}$$

$$= \frac{5}{4} + \frac{16}{3} - 1$$

$$= \frac{15 + 64 - 12}{12}$$

$= \frac{67}{12}$

75. $\frac{sec60^0}{cot45^0} - \frac{2sin90^0}{cos\ 0^0} + \frac{tan45^0}{cosec30^0}$

$= \frac{2}{1} - \frac{2\ X\ 1}{1} + \frac{1}{2}$

$= 2 - 2 + \frac{1}{2}$

$= 2$

76. $2\cot^2\theta + 2 = 2(\cot^2\theta + 1)$

$= 2(\text{cosec}^2\theta)$

$= 2\left(\frac{1}{Sin^2\theta}\right)$

$$= 2\left(\frac{1}{(1/3)^2}\right)$$

$= \frac{2}{1/9}$

$= \frac{2\ X\ 9}{1}$

$= 18$

77. $2cos^2\theta + \frac{2}{1+cot^2\theta} = 2cos^2\theta + \frac{2}{cosec^2\theta}$

$= 2cos^2\theta + 2sin^2\theta$

$= 2(cos^2\theta + sin^2\theta)$

$= 2(1)$

$= 2$

78. $\frac{5}{Cot^2\theta} - \frac{5}{Cos^2\theta} = 5\left(\frac{1}{Cot^2\theta} - \frac{1}{Cos^2\theta}\right)$

$= 5(tan^2\theta - sec^2\theta)$

$= 5[tan^2\theta - (1 + tan^2\theta)]$

$= 5[tan^2\theta - 1 - tan^2\theta]$

$= 5(-1)$

$= -5$

79. $sec^2A(1+sinA)(1-sinA) = k$

$sec^2A(1 - sin^2A) = k$

$\frac{1}{cos^2A}(cos^2A) = k$

$\square$ k = 1

IV. Three Marks Questions : -

80. LHS $= \frac{sinA}{1-cotA} + \frac{cosA}{1-tanA}$

$$= \frac{sinA}{1 - \frac{cosA}{sinA}} + \frac{cosA}{1 - \frac{sinA}{cosA}}$$

$$= \frac{sinA}{\frac{sinA-CosA}{sinA}} + \frac{cosA}{\frac{cosA-sinA}{cosA}}$$

$$= \frac{sin^2A}{sinA-cosA} + \frac{cos^2A}{cosA-sinA}$$

$$= \frac{sin^2A}{sinA-cosA} - \frac{cos^2A}{sinA-cosA}$$

$$= \frac{sin^2A - cos^2A}{sinA-cosA}$$

$$= \frac{(SinA+CosA)(SinA-CosA)}{SinA-CosA}$$

$$= sinA + cosA = \text{RHS}$$

81. LHS $= \frac{1+CosA}{SinA} - \frac{SinA}{1+CosA}$

$$= \frac{(1+CosA)^2 - Sin^2A}{SinA(1+CosA)}$$

$$= \frac{1+Cos^2A+2CosA-Sin^2A}{SinA(1+CosA)}$$

$$= \frac{1+Cos^2A+2CosA-(1-Cos^2A)}{SinA(1+CosA)}$$

$$= \frac{1+Cos^2A+2CosA-1+Cos^2A}{SinA(1+CosA)}$$

$$= \frac{2Cos^2A+2CosA}{SinA(1+CosA)}$$

$$= \frac{2CosA(CosA+1)}{SinA(1+CosA)}$$

$$= \frac{2CosA}{SinA}$$

$$= 2cotA = \text{RHS}$$

82. LHS $= \frac{1+SinA}{CosA} - \frac{CosA}{1+SinA}$

$$= \frac{(1+SinA)^2 - Cos^2A}{CosA(1+SinA)}$$

$$= \frac{1+Sin^2A+2SinA-Cos^2A}{CosA(1+SinA)}$$

$$= \frac{1+Sin^2A+2SinA-(1-Sin^2A)}{CosA(1+SinA)}$$

$$= \frac{1+Sin^2A+2SinA-1+Sin^2A}{CosA(1+SinA)}$$

$$= \frac{2Sin^2A + 2sinA}{CosA(1 + SinA)}$$

$$= \frac{2SinA(SinA + 1)}{CosA(1 + SinA)}$$

$$= \frac{2SinA}{CosA}$$

$= 2tanA$ = RHS

83. LHS $= \frac{cos\theta - 2cos^3\theta}{2sin^3\theta - sin\theta}$

$$= \frac{cos\theta(1 - 2cos^2\theta)}{sin\theta(2sin^2\theta - 1)}$$

$$= \frac{Cos\theta(Sin^2\theta + Cos^2\theta - 2Cos^2\theta)}{Sin\theta(2Sin^2\theta - Sin^2\theta - Cos^2\theta)}$$

$$= \frac{Cos\theta(Sin^2\theta - Cos^2\theta)}{Sin\theta(Sin^2\theta - Cos^2\theta)}$$

$$= \frac{cos\theta}{sin\theta}$$

$= cot\theta$ = RHS

84. LHS $= \frac{Sin\theta - 2Sin^3\theta}{2Cos^3\theta - Cos\theta}$

$$= \frac{Sin\theta(1 - 2Sin^2\theta)}{Cos\theta(2Cos^2\theta - 1)}$$

$$= \frac{Sin\theta(Cos^2\theta + Sin^2\theta - 2Sin^2\theta)}{Cos\theta(2Cos^2\theta - Cos^2\theta - Sin^2\theta)}$$

$$= \frac{Sin\theta(Cos^2\theta - Sin^2\theta)}{Cos\theta(Cos^2\theta - Sin^2\theta)}$$

$$= \frac{Sin\theta}{Cos\theta}$$

$= tan\theta$ = RHS

85. LHS $= \frac{SinA - CosA}{SinA + CosA} + \frac{SinA + CosA}{SinA - CosA}$

$$= \frac{(SinA - CosA)^2 + (SinA + CosA)^2}{(SinA + CosA)(SinA - CosA)}$$

$$= \frac{Sin^2A + Cos^2A - 2SinACosA + Sin^2A + Cos^2A + 2SinACosA}{Sin^2A - Cos^2A}$$

$$= \frac{1 + 1}{Sin^2A - (1 - Sin^2A)}$$

$$= \frac{2}{Sin^2A - 1 + Sin^2A}$$

$= \frac{2}{2Sin^2A - 1}$ = RHS

86. x = p tanθ + q secθ

y = p secθ + q tanθ

$x^2 = (\text{p}\tan\theta + \text{q}\sec\theta)^2 = p^2tan^2\theta + q^2sec^2\theta + 2pq.tan\theta.sec\theta \ldots\ldots (1)$

$y^2 = (\text{p}\sec\theta + \text{q}\tan\theta)^2 = p^2sec^2\theta + q^2tan^2\theta + 2pq\ tan\theta.Sec\theta \ldots\ldots (2)$

Equation (1) – (2) gives

$x^2 - y^2 = p^2tan^2\theta + q^2sec^2\theta + 2pqtan\theta sec\theta - p^2sec^2\theta - q^2tan^2\theta - 2pqtan\theta sec\theta$

$= p^2(tan^2\theta - sec^2\theta) + q^2(sec^2\theta - tan^2\theta)$

$= p^2(tan^2\theta - sec^2\theta) - q^2(tan^2\theta - sec^2\theta)$

$= p^2(-1) - q^2(-1)$

$= -p^2 + q^2$

$= q^2 - p^2$ = RHS

87. LHS = (secθ – cosθ){(cosecθ – sinθ)(tanθ + cotθ)}

$= \left\{\frac{1}{\text{Cos}\theta} - \text{Cos}\theta\right\}\left\{\frac{1}{\text{Sin}\theta} - \text{Sin}\theta\right\}\left\{\frac{\text{Sin}\theta}{\text{Cos}\theta} + \frac{\text{Cos}\theta}{\text{Sin}\theta}\right\}$

$= \left\{\frac{1 - Cos^2\theta}{Cos\theta}\right\}\left\{\frac{1 - Sin^2\theta}{\text{Sin}\theta}\right\}\left\{\frac{Sin^2\theta + Cos^2\theta}{\text{Sin}\theta.Cos\theta}\right\}$

$= \left\{\frac{Sin^2\theta}{Cos\theta}\right\}\left\{\frac{Cos^2\theta}{Sin\theta}\right\}\left\{\frac{1}{\text{Sin}\theta.Cos\theta}\right\}$

$= 1$ = RHS

88. LHS $= \frac{SecA+TanA-1}{TanA-SecA+1}$

$= \frac{SecA + TanA - (Sec^2A - Tan^2A)}{TanA - SecA + 1}$

$= \frac{(SecA + TanA) - (SecA + TanA)(SecA - TanA)}{TanA - SecA + 1}$

$= \frac{(SecA + TanA)[1 - (SecA - TanA)]}{TanA - SecA + 1}$

$= \frac{(SecA + TanA)[1 - SecA + TanA]}{TanA - SecA + 1}$

$= secA + tanA$

$= \frac{1}{CosA} + \frac{SinA}{CosA}$

$= \frac{1+SinA}{CosA}$ = RHS

89. LHS $= \frac{Sin\theta}{1-Cos\theta} + \frac{Tan\theta}{1+Cos\theta}$

$$= \frac{Sin\theta(1+Cos\theta) + Tan\theta(1-Cos\theta)}{(1-Cos\theta)(1+Cos\theta)}$$

$$= \frac{Sin\theta + Sin\theta Cos\theta + Tan\theta - Tan\theta Cos\theta}{1-Cos^2\theta}$$

$$= \frac{Sin\theta + Sin\theta Cos\theta + Tan\theta - Sin\theta}{Sin^2\theta}$$

$$= \frac{Sin\theta Cos\theta + Tan\theta}{Sin^2\theta}$$

$$= \frac{Sin\theta Cos\theta}{Sin^2\theta} + \frac{Tan\theta}{Sin^2\theta}$$

$$= \frac{Cos\theta}{Sin\theta} + \frac{1}{Cos\theta}\frac{1}{Sin\theta}$$

$= cot\theta + sec\theta.cosec\theta$ = RHS

90. LHS $= \frac{tanA-sinA}{tanA+sinA}$

$$= \frac{\frac{SinA}{CosA} - SinA}{\frac{SinA}{CosA} + SinA}$$

$$= \frac{sinA\left(\frac{1}{CosA} - 1\right)}{sinA\left(\frac{1}{CosA} + 1\right)}$$

$= \frac{secA-1}{secA+1}$ = RHS

91. LHS = (sina + coseca)^2 + (cosa + seca)^2

= sin^{2}a+cosec^{2}a+2sinacoseca + cos^{2}a+sec^{2}a+2cosaseca

= 1 + 1+cot^{2}a+2sina$\frac{1}{SinA}$ + 1+tan^{2}a+2cosa$\frac{1}{CosA}$

= 2+ cot^{2}a+2+1+ tan^{2}a+2

= 7 + tan^{2}a+ cot^{2}a = RHS

92. LHS = secθ(1 – sinθ)(secθ +tanθ)

= $(sec\theta - sec\theta.sin\theta)$(secθ +tanθ)

= $\left(sec\theta - \frac{1}{cos\theta}.sin\theta\right)$(secθ +tanθ)

= (secθ – tanθ) (secθ +tanθ)

= sec^{2}θ – tan^{2}θ

$= 1 + \tan^2\theta - \tan^2\theta$

$= 1 = RHS$

93. LHS $= \text{coseca}\,(1 - \text{cosa})(\text{coseca} + \text{cota})$

$= (cosecA - cosecA.cosA)(\text{coseca} + \text{cota})$

$= \left(cosecA - \frac{1}{sinA}.cosA\right)(\text{coseca} + \text{cota})$

$= (\text{coseca} - \text{cota})(\text{coseca} + \text{cota})$

$= \text{cosec}^2\text{a} - \text{cot}^2\text{a}$

$= 1 + \text{cot}^2\text{a} - \text{cot}^2\text{a}$

$= 1 = RHS$

94. $(\text{coseca} - \text{sina})(\text{seca} - \text{cosa})$ $\qquad \frac{1}{tanA+CotA} = \frac{1}{\frac{SinA}{CosA}+\frac{CosA}{SinA}}$

$= \left(\frac{1}{SinA} - sinA\right)\left(\frac{1}{cosA} - cosA\right)$ $\qquad = \frac{1}{\frac{Sin^2A+Cos^2A}{SinA.CosA}} = \left(\frac{Cos^2A}{SinA}\right)\left(\frac{Sin^2A}{CosA}\right)$

$= \left(\frac{1-sin^2A}{sinA}\right)\left(\frac{1-cos^2A}{cosA}\right)$ $\qquad = \frac{SinA.CosA}{1}$

$= sinA.cosA \ldots\ldots (1)$ $\qquad = sinA.cosA \ldots\ldots\ldots (2)$

From (1) & (2)

$(\text{coseca} - \text{sina})(\text{seca} - \text{cosa}) = \frac{1}{tanA+cotA}$

95. LHS $= \sqrt{\frac{1+cosA}{1-cosA}} = \sqrt{\frac{1+cosA}{1-cosA} X \frac{1+cosA}{1+cosA}}$

$$= \sqrt{\frac{(1+cosA)^2}{1-cosA}} = \sqrt{\frac{(1+cosA)^2}{sin^2A}}$$

$$= \sqrt{\left(\frac{1+cosA}{sinA}\right)^2} = \frac{1+cosA}{sinA}$$

$= \frac{1}{sinA} + \frac{cosA}{sinA} = cosecA + cotA$ = RHS

96. LHS $= \sqrt{\frac{1+sinA}{1-sinA}} = \sqrt{\frac{1+sinA}{1-sinA} X \frac{1+sinA}{1+sinA}}$

$$= \sqrt{\frac{(1+sinA)^2}{1-sinA}} = \sqrt{\frac{(1+sinA)^2}{cos^2A}}$$

$$= \sqrt{\left(\frac{1+sinA}{cosA}\right)^2} = \frac{1+sinA}{cosA}$$

$= \frac{1}{cosA} + \frac{sinA}{cosA} = secA + tanA$ = RHS

97. LHS = (seca – cosa)(cota + tana)

$= \left(\frac{1}{CosA} - cosA\right)\left(\frac{CosA}{SinA} + \frac{SinA}{CosA}\right)$

$$= \left(\frac{1 - Cos^2A}{CosA}\right)\left(\frac{Sin^2A + Cos^2A}{SinA.CosA}\right)$$

$$= \left(\frac{Sin^2A}{CosA}\right)\left(\frac{1}{SinA.CosA}\right)$$

$$= \left(\frac{SinA}{CosA}\right)\left(\frac{1}{CosA}\right)$$

$$= tanA.secA$$

= RHS

98. LHS = (coseca – sina)(tana + cota)

$= \left(\frac{1}{SinA} - SinA\right)\left(\frac{SinA}{CosA} + \frac{CosA}{SinA}\right)$

$$= \left(\frac{1 - Sin^2A}{SinA}\right)\left(\frac{Sin^2A + Cos^2A}{SinA.CosA}\right)$$

$$= \left(\frac{Cos^2A}{SinA}\right)\left(\frac{1}{SinA.CosA}\right)$$

$$= \left(\frac{CosA}{SinA}\right)\left(\frac{1}{SinA}\right)$$

$= cotA.cosecA$ = RHS

99. $\tan\theta = \sqrt{3}$, $\therefore \theta = 60^0$

$\frac{4Sin\theta - Cos\theta - 1}{4Sin\theta + Cos\theta + 1} = \frac{4Sin60^0 - Cos60^0 - 1}{4Sin60^0 + Cos60^0 + 1} = \frac{4X\frac{\sqrt{3}}{2} - \frac{1}{2} - 1}{4X\frac{\sqrt{3}}{2} + \frac{1}{2} + 1}$

$$= \frac{2\sqrt{3} - \frac{3}{2}}{2\sqrt{3} + \frac{3}{2}}$$

$$= \frac{\frac{4\sqrt{3}-3}{2}}{\frac{4\sqrt{3}+3}{2}} = \frac{4\sqrt{3} - 3}{4\sqrt{3} + 3}$$

100. $\frac{2Cos(90^0-30^0)+Tan45^0-\sqrt{3}Cosec60^0}{\sqrt{3}Sec30^0+2Cos60^0+Cot45^0}$

$$= \frac{2Cos(60^0)+Tan45^0-\sqrt{3}Cosec60^0}{\sqrt{3}Sec30^0+2Cos60^0+Cot45^0}$$

$$= \frac{2\left(\frac{1}{2}\right)+1-\sqrt{3}\left(\frac{2}{\sqrt{3}}\right)}{\sqrt{3}\left(\frac{2}{\sqrt{3}}\right)+2\left(\frac{1}{2}\right)+1}$$

$$= \frac{1+1-2}{2+1+1}$$

$$= \frac{2-2}{4}$$

$= 0$

101. LHS = $\frac{Cos^3\theta+Sin^3\theta}{Cos\theta+Sin\theta} + \frac{Cos^3\theta-Sin^3\theta}{Cos\theta-Sin\theta}$

$$= \left[\frac{cos^3\theta+sin^3\theta}{cos\theta+sin\theta}\right] + \left[\frac{cos^3\theta-sin^3\theta}{cos\theta-sin\theta}\right]$$

$$= \left[\frac{(cos\theta+sin\theta)(cos^2\theta+sin^2\theta-cos\theta sin\theta)}{cos\theta+sin\theta}\right] + \left[\frac{(cos\theta-sin\theta)(cos^2\theta+sin^2\theta+cos\theta sin\theta)}{cos\theta-sin\theta}\right]$$

$$= \left[\frac{(cos\theta+sin\theta)(1-cos\theta sin\theta)}{cos\theta+sin\theta}\right] + \left[\frac{(cos\theta-sin\theta)(1+cos\theta sin\theta)}{cos\theta-sin\theta}\right]$$

$$= (1-cos\theta sin\theta)+(1+cos\theta sin\theta)$$

$= 1 - cos\theta sin\theta + 1 + cos\theta sin\theta$

$= 2$ = RHS

102. LHS = secA (1-sinA)(secA +tanA)

= (secA – secA.sinA) (secA + tanA)

= (secA – tanA) (secA + tanA)

=$sec^2A - tan^2A = 1$.....(i)

RHS = $\sqrt{(1+cosA)(1-cosA)}\, cosecA$

=$\sqrt{1^2-cos^2A}\, cosecA$

=$\sqrt{sin^2A}\, cosecA$

= sinA cosecA = 1.....(ii)

From (i) and (ii)

LHS = RHS

103. LHS = $\frac{sin\theta}{1-cos\theta} + \frac{tan\theta}{1+cos\theta} = cot\theta + sec\theta.cosec\theta$

=$\frac{sin\theta(1+cos\theta)+tan\theta(1-cos\theta)}{1^2-cos^2\theta}$

$= \frac{sin\theta + sin\theta cos\theta + tan\theta - tan\theta cos\theta}{sin^2\theta}$

$$= \frac{sin\theta + sin\theta cos\theta + tan\theta - sin\theta}{sin^2\theta}$$

$$= \frac{sin\theta cos\theta + tan\theta}{sin^2\theta}$$

$= \frac{sin\theta cos\theta}{sin^2\theta} + \frac{tan\theta}{sin^2\theta} = cot\theta + sec\theta . cosec\theta$ = RHS

Unit : 09 SOME APPLICATIONS OF TRIGNOMETRY

I. Multiple choice questions

1. B) 30^0

2. A) 60^0

3. C) 60^0

4. D) 45^0

5. C) 2cm

II. ONE MARK QUESTIONS

6. 10m

7.Angle of elevation

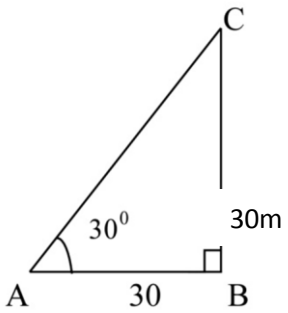
8. Angle of depression

9. 12m

10. 45^0

TWO MARK QUESTIONS

11 Angle of elevation = 30^0
The distance of the tower from the point= AB = 30m
Height of the tower = BC = ?



$\tan\theta = \frac{\text{Opposite side}}{\text{Adjacent side}} = \frac{BC}{AB}$

$\tan 30^0 = \frac{BC}{30}$

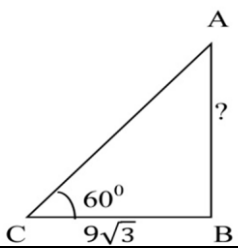
$\frac{1}{\sqrt{3}} = \frac{BC}{30}$

$BC = \frac{30}{\sqrt{3}} = \frac{10x3}{\sqrt{3}} = 10\sqrt{3}$ m

BC = $10\sqrt{3}$ m

12.. Let the height of the tower = AB

Distance from the foot of the tower to the point = $9\sqrt{3}$ m



Angle of elevation = 60^0

In Δ ABC $\tan\theta = \frac{AB}{BC}$

$\tan 60^0 = \frac{AB}{9\sqrt{3}}$

$\sqrt{3} = \frac{AB}{9\sqrt{3}}$

$AB = 9\sqrt{3} \times \sqrt{3}$

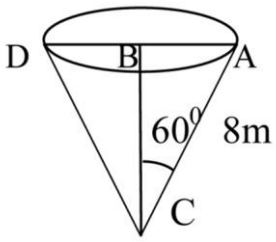
$AB = 9 \times 3 = 27m$

∴ **Height of the tower = AB = 27m**

13. $\sin\theta = \frac{\text{Opposite side}}{\text{Hypotenuse}} = \frac{AB}{AC}$

$\sin 60^0 = \frac{AB}{8}$

$\frac{\sqrt{3}}{2} = \frac{AB}{8}$



$AB = 4\sqrt{3}$ m

∴ **Diameter = AD = $2 \times 4\sqrt{3}$ m = $8\sqrt{3}$ m**

14. In Δ BCE

$\tan\theta = \frac{CE}{BC}$

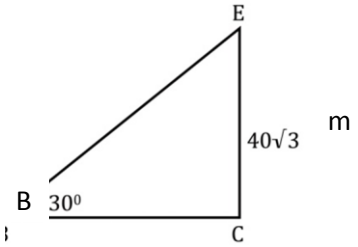
$\tan 30^0 = \frac{40\sqrt{3}}{BC}$

$\frac{1}{\sqrt{3}} = \frac{40\sqrt{3}}{BC}$

$BC = 40 \times \sqrt{3} \times \sqrt{3}$

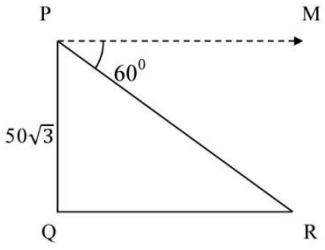
$BC = 40 \times 3$

BC = 120m



∴The distance between the person and the foot of wind[illegible] = **120m**

15. Height of the building = $50\sqrt{3}$ m
Angle of depression = 60^0



The distance of the object from the Foot of a building= QR = ?

$\angle MPR = \theta = 60^0$

$\therefore \angle PRQ = \theta = 60^0$ [$\because$ PM ‖ QR, Alternate angles]

$\tan 60^0 = \frac{PQ}{QR}$

$\sqrt{3} = \frac{50\sqrt{3}}{QR}$

$QR = \frac{50\sqrt{3}}{\sqrt{3}}$

$QR = \frac{50\sqrt{3}}{\sqrt{3}}$

∴The distance of the object from the Foot of a building = QR = 50m

IV. THREE MARK QUESTIONS

16. Distance between wind mills = AB + BC = ?

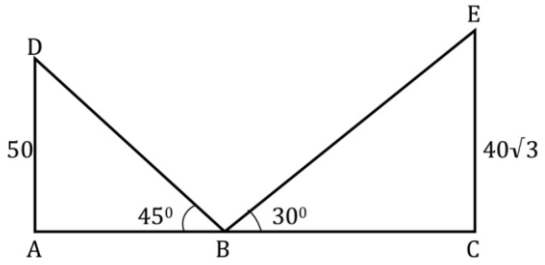
In Δ ABD

$\tan\theta = \frac{AD}{AB}$

$\tan 45^0 = \frac{50}{AB}$

$1 = \frac{50}{AB}$

AB = 50m



In Δ BCE

$\tan\theta = \frac{CE}{BC}$

$\tan 30^0 = \frac{40\sqrt{3}}{BC}$

$\frac{1}{\sqrt{3}} = \frac{40\sqrt{3}}{BC}$

$BC = 40x\sqrt{3}x\sqrt{3}$

BC = 40x3

BC = 120m

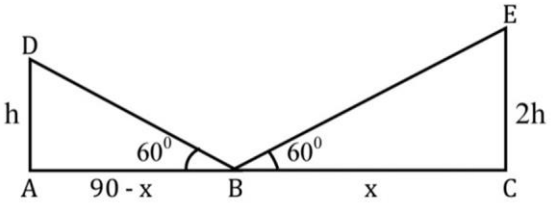
∴ Distance between wind mills = AB + BC = 50 + 120 = 170 m.

17. Width of the road = AC = 90 feet

Height of the short pole = AD = h = ?

Height of the long pole = CE = 2h = ?

Angle of elevation = 60^0



Let BC = x, then AB = 90 - x

In Δ ABD

$\tan 60^0 = \frac{AD}{AB}$

$\sqrt{3} = \frac{h}{90-x}$

$h = (90- x)\sqrt{3}$ ---------- (1)

In Δ BCE

$\tan 60^0 = \frac{CE}{BC}$

$\sqrt{3} = \frac{2h}{x}$

$2h = x\sqrt{3}$

$h = x.\frac{\sqrt{3}}{2}$ ---------- (2)

From Eqn(1) and Eqn(2),

$(90- x)\sqrt{3} = x.\frac{\sqrt{3}}{2}$

$2(90- x)\sqrt{3} = x.\sqrt{3}$

$180 – 2x = x$

$3x = 180$

$x = 60$

Substitute x = 60 in Eqn (1) then

$h = (90- x)\sqrt{3} = (90 – 60)\sqrt{3} = 30\sqrt{3}$ m

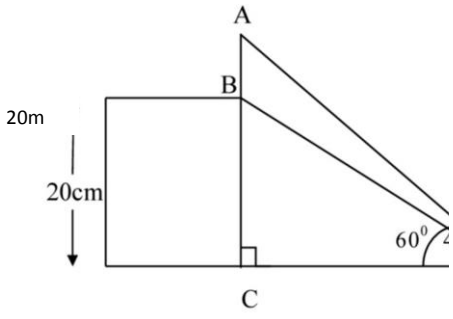
Height of the short pole = AD = $h = 30\sqrt{3}$ feet

Height of the long pole = CE = $2h = 60\sqrt{3}$ feet

18. Height of the building = BC = 20m

Angle of Elevation = $\theta = 60^0$ and 45^0

Height of the transmission tower = AB = ?



In Δ BCD $\tan\theta = \frac{BC}{CD}$

$\tan 45^0 = \frac{20}{CD}$

$1 = \frac{20}{CD}$

$\therefore$ CD = 20m

In Δ ACD $\tan\theta = \frac{AC}{CD}$

$\tan 60^0 = \frac{AB+BC}{20}$

$\sqrt{3} = \frac{AB+20}{20}$

$\sqrt{3}$ x 20 = AB + 20

AB = 20($\sqrt{3}$ -1) m

∴ Height of the transmission tower = AB = 20($\sqrt{3}$ -1) m

19. In ΔABD $\tan 60^0 = \frac{AB}{BD}$

$\sqrt{3} = \frac{50}{BD}$

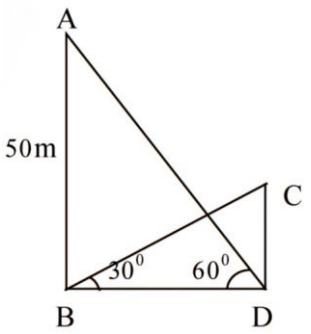
$BD = \frac{50}{\sqrt{3}}$ --------(1)

In ΔBDC $\tan 30^0 = \frac{DC}{BD}$

$\frac{1}{\sqrt{3}} = \frac{DC}{BD}$

$BD = \sqrt{3}.\ DC$ ---------- (2)

From equation (1) and (2)



$\sqrt{3}.\ DC = \frac{50}{\sqrt{3}}$

$DC = \frac{50}{\sqrt{3}X\sqrt{3}}$

∴ Height of the building= DC = $\frac{50}{3}$ m = 16.67m

20. Height of the building is 7 m.

Height of the tower = CD = CE + DE = ?

∴ AB || CD , AB = DE = 7 m and AE = BD.

AE || BD ∴∠ BDA = 45°

In ΔABD $\tan 45^0 = \frac{AB}{BD}$

$1 = \frac{AB}{BD}$

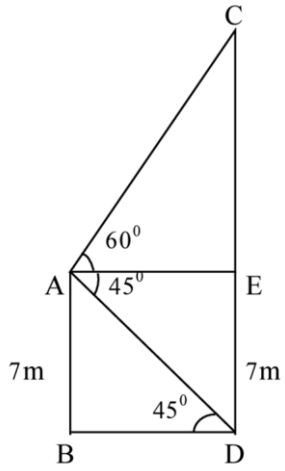
BD = AB

BD = 7m

In ΔACE $\tan 60^0 = \frac{CE}{AE}$

$\sqrt{3} = \frac{CE}{7}$

$CE = 7\sqrt{3}$



∴ Height of the tower = CE + DE = $7\sqrt{3}$ + 7 = 7($\sqrt{3}$ + 1) m

V. FOUR MARK QUESTIONS

21 Height of the tower = 60m.

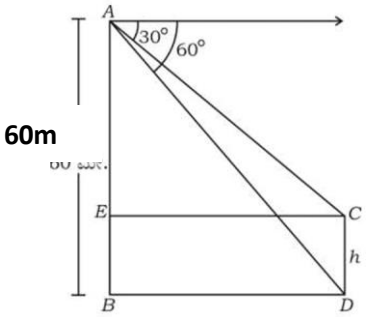
Height of the pole = CD = h m. and BE = CD = h m.

Let BD = EC = x

∴ AE = (60 – h) m.

$\angle ACE = 30^0$

$\angle ADB = 60^0$



In Δ AEC

$\tan 30^0 = \frac{AE}{EC}$

$\frac{1}{\sqrt{3}} = \frac{60-h}{x}$

$x = \sqrt{3}\,(60 - h)$ ----------(1)

In Δ ABD $\tan 60^0 = \frac{AB}{BD}$

$\sqrt{3} = \frac{60}{x}$

$x = \frac{60}{\sqrt{3}}$ ----------(2)

From Eqn(1) and Eqn(2)

$\sqrt{3}\,(60 - h) = \frac{60}{\sqrt{3}}$

$(60 - h) = \frac{60}{\sqrt{3}x\sqrt{3}}$

$(60 - h) = \frac{60}{3}$

$(60 - h) = 20$

$h = 60 - 20$

$h = 40$ m

Height of the pole = CD = h = 40m

22. Velocity = 648 km/h = $\frac{648x1000}{3600}$

= 180 m/sec.

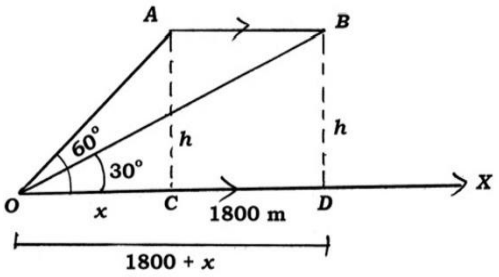
After10 seconds distance travelled by aircraft = 180x10 = 1800 m

In the diagram OC = x CD = 1800 m OD = 1800 + x

In Δ OAC $\angle C = 90^0$ $\tan\theta = \frac{AC}{OC}$

$\tan 60^0 = \frac{h}{x}$

$\sqrt{3} = \frac{h}{x}$



$h = \sqrt{3}\, x$ ---------- (i)

In Δ ODB $\angle D = 90^0$, $\tan\theta = \frac{BD}{OD}$

$\tan 30^0 = \frac{h}{1800+x}$

$\frac{1}{\sqrt{3}} = \frac{h}{1800+x}$

$\sqrt{3}\, h = 1800 + x$ ---------- (

Substitute Eqn (i) in Eqn (ii)

$x\sqrt{3}.\sqrt{3} = 1800 + x$

$3x = 1800 + x$

$3x - x = 1800$

$2x = 1800$

$x = \frac{1800}{2} = 900$

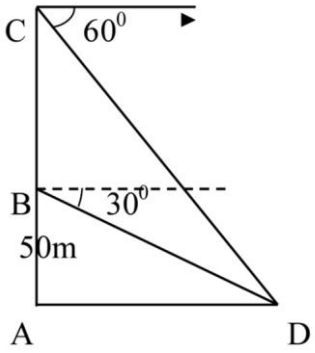
$\therefore h = \sqrt{3}x = 900.\sqrt{3} = 900 \times 1.73$

$\therefore h = 1557$ m

23 . Height of the tower = AC = ?

Height of the tower from the foot to point B = AB = 50m.

Angle of depression = 60^0 and 30^0



$\therefore$ $\angle ADB = 30^0$

$\angle ADC = 60^0$

In Δ ABD , $\tan\theta = \frac{AB}{AD}$

$\tan 30^0 = \frac{50}{AD}$

$\frac{1}{\sqrt{3}} = \frac{50}{AD}$

$AD = 50\sqrt{3}$ m ----------(1)

In Δ ADC , $\tan 60^0 = \frac{AC}{AD}$

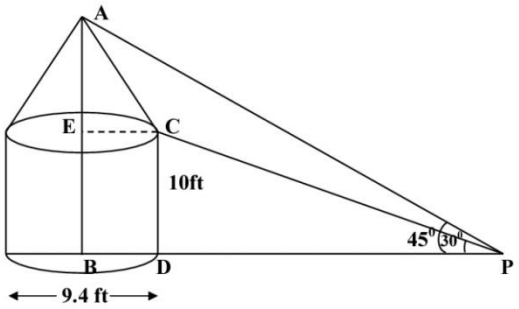
$\sqrt{3} = \frac{AC}{50\sqrt{3}}$

$AC = 50\sqrt{3}x\sqrt{3}$

$AC = 50x3 = 150$m

$\therefore$ Height of the tower = AC = 150m

24. Height of the cylinder = CD = 10 ft
Height of the conical shaped tomb = AE = ?
Angle of Elevations $\theta = 30^0$ and 45^0



In Δ PCD , $\tan\theta = \frac{CD}{PD}$

$\tan 30^0 = \frac{10}{PD}$

$\frac{1}{\sqrt{3}} = \frac{10}{PD}$

$PD = 10\sqrt{3} = 10x\ 1.73 = 17.3$ ft

Diameter of the cylinder = 9.4 ft

Radius = BD = 4.7 ft

So, BP = BD + PD = 4.7 + 17.3 = 22 ft

In Δ ABP $\tan 45^0 = \frac{AB}{BP}$

$1 = \frac{AB}{22}$

AB = 22 ft

Height of the conical shaped tomb = AE = AB – EB = 22-10 = 12 ft

25. In ΔABC , $\tan 60^0 = \frac{CD}{BD}$

$\sqrt{3} = \frac{50}{BD}$

$BD = \frac{50}{\sqrt{3}}$ --------(1)

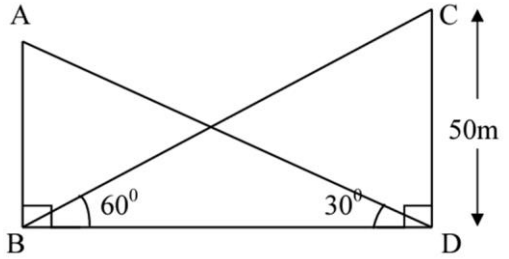
In ΔABD , $\tan 30^0 = \frac{AB}{BD}$

$\frac{1}{\sqrt{3}} = \frac{AB}{BD}$

$BD = \sqrt{3}.\ AB$ ---------- (2)

From (1) and **(2)**

$\sqrt{3}.\ AB = \frac{50}{\sqrt{3}}$



∴ Height of the building = AB = $\frac{50}{3}$ m

26. Distance between two ships is PQ

In ΔABP , $\tan 45^0 = \frac{AB}{BP}$

$1 = \frac{75}{BP}$

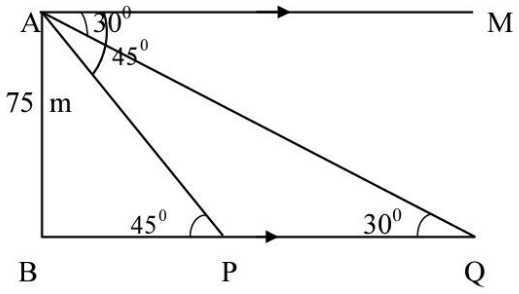
BP = 75

In ΔABQ , $\tan 30^0 = \frac{AB}{BQ}$

$\frac{1}{\sqrt{3}} = \frac{75}{BP+PQ}$

$\frac{1}{\sqrt{3}} = \frac{75}{75+PQ}$

$75 + PQ = 75\sqrt{3}$



$PQ = 75\sqrt{3} - 75$

$PQ = 75(\sqrt{3} - 1)$ m

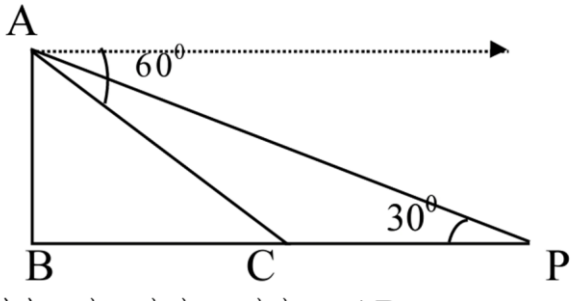
$\therefore$ Distance between two ships = $PQ = 75(\sqrt{3} - 1)$ m

27. Height of the building = AB

Angle of depression = 60^0 and angle of elevation = 30^0 ,

We have to prove that CP = 2 BC.

$\therefore \angle ACB = 60^0$



In ΔABC , $\tan\theta = \frac{AB}{BC}$

$\tan 60^0 = \frac{AB}{BC}$

$\sqrt{3} = \frac{AB}{BC}$

$AB = \sqrt{3}\ BC$ ----------(1)

In ΔABP, $\tan 30^0 = \frac{AB}{BP}$

$\frac{1}{\sqrt{3}} = \frac{AB}{BP}$

$AB = \frac{BP}{\sqrt{3}}$ ----------(2)

From equation (1) and (2)

$\sqrt{3}\ BC = \frac{BP}{\sqrt{3}}$

$3BC = BP$

$3BC = BC + CP$

$3BC - BC = CP$

$2BC = CP$

$\therefore$ **CP = 2BC**

28. The distance of the point from the foot of the tower = BC = $30\sqrt{3}$ m

Height of the building = DE = 10 m

The distance between the foot of the tower and building = BE = ?

The distance between their tops = AD = ?

In Δ ABC, $\tan\theta = \frac{AB}{BC}$

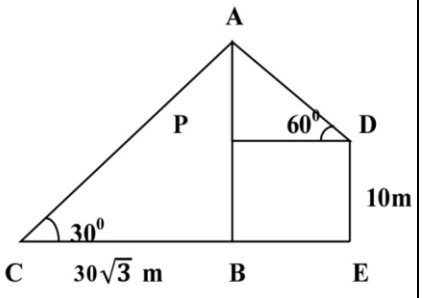
$\tan 30^0 = \frac{AB}{30\sqrt{3}}$

$\frac{1}{\sqrt{3}} = \frac{AB}{30\sqrt{3}}$

AB = 30 m

AP = AB – PB = 30 – 10 = 20 m

In Δ APD , $\tan\theta = \frac{AP}{PD}$



$$\tan 60^0 = \frac{20}{PD}$$

$$\sqrt{3} = \frac{20}{PD}$$

$$PD = \frac{20}{\sqrt{3}}$$

∴ The distance between the foot of the tower and building = BE = PD = $\frac{20}{\sqrt{3}}$ m

Δ APD ಯಲ್ಲಿ , $\sin\theta = \frac{AP}{AD}$

$$\sin 60^0 = \frac{20}{AD}$$

$$\frac{\sqrt{3}}{2} = \frac{20}{AD}$$

$$AD = \frac{40}{\sqrt{3}} \text{ m}$$

∴ The distance between their tops = AD = $\frac{40}{\sqrt{3}}$ m

29 . In ΔABO , $\sin\theta = \frac{AB}{AO}$

$$\sin 30^0 = \frac{AB}{20}$$

$$\frac{1}{2} = \frac{AB}{20}$$

$$AB = 10 \text{ cm}$$

$$DE = AB = 10\text{cm}$$

$$\cos\theta = \frac{OB}{AO}$$

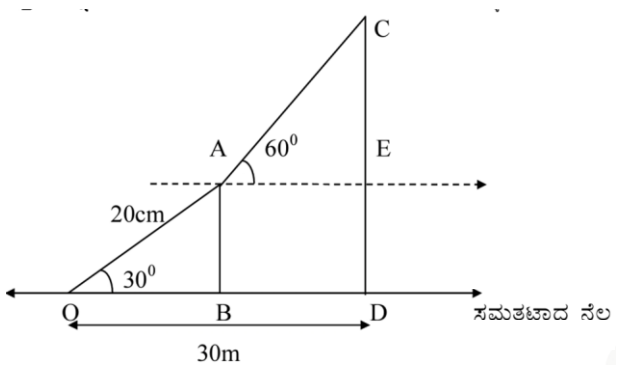
$$\cos 30^0 = \frac{OB}{20}$$

$$\frac{\sqrt{3}}{2} = \frac{OB}{20}$$

$$OB = 10\sqrt{3} = 10 \times 1.73 = 17.3 \text{ cm}$$

$$BD = OD - OB = 30 - 17.3 = 12.7 \text{ cm}$$

$$AE = BD = 12.7 \text{ cm}$$



In ΔACE , $\tan 60^0 = \frac{CE}{AE}$

$$\sqrt{3} = \frac{CE}{12.7}$$

$$CE = 1.73 \times 12.7 = 21.97 \text{ cm}$$

Height of the pole = CD = CE + DE

$$= 21.97 + 10$$

Height of the pole = 31.97 cm

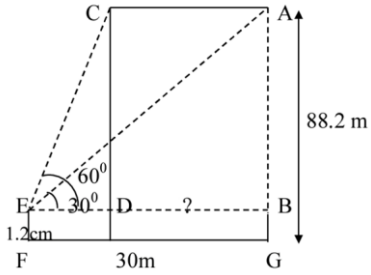
30. Height of the balloon from ground = AB = CD = 88.2 – 1.2 = 87 m

In ΔAEB , $\tan\theta = \frac{AB}{BE}$

$\tan 30^0 = \frac{87}{BE}$

$\frac{1}{\sqrt{3}} = \frac{87}{BE}$

$BE = 87\sqrt{3}$ m



In ΔCED , $\tan\theta = \frac{CD}{DE}$

$\tan 60^0 = \frac{87}{DE}$

$\sqrt{3} = \frac{87}{DE}$

$DE = \frac{87}{\sqrt{3}}$

$DE = \frac{29 \times 3}{\sqrt{3}}$

$DE = 29x\sqrt{3}$ m

Distance travelled by the balloon = AC = DB

= BE – DE

$= 87\sqrt{3} - 29\sqrt{3}$

$= 58\sqrt{3}$ m

31. $\angle ABC = 60°$, $\angle ACB = 30°$ then $\angle CAB = 90^0$

In right triangle ABC, $\angle CAB = 90^0$

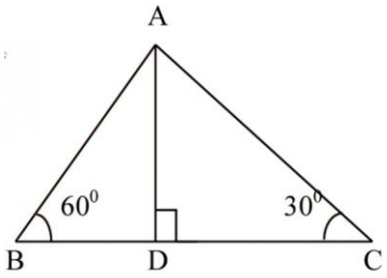
$\sin\theta = \frac{AB}{BC}$

$\sin 30^0 = \frac{AB}{36}$

$\frac{1}{2} = \frac{AB}{36}$

$AB = \frac{36}{2}$

AB = 18 cm



$\cos\theta = \frac{AC}{BC}$

$\cos 30^0 = \frac{AC}{36}$

$\frac{\sqrt{3}}{2} = \frac{AC}{36}$

$AC = 18\sqrt{3}$ cm

In right triangle ADB, $\angle ADB = 90^0$

$\sin\theta = \frac{AD}{AB}$

$\sin 60^0 = \frac{AD}{18}$

$\frac{\sqrt{3}}{2} = \frac{AD}{18}$

$AD = 9\sqrt{3}$ cm

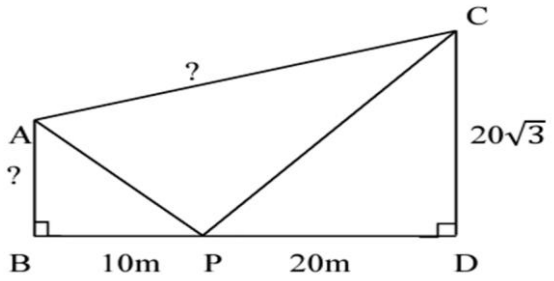
32. In Δ CPD,

Let angle CPD be θ

Then $\tan\theta = \frac{CD}{PD} = \frac{20\sqrt{3}}{20} = \sqrt{3}$

$\therefore \theta = 60^0$

$\angle APB = 90^0 - 60^0 = 30^0$



In Δ ABP ,

$\tan\theta = \frac{AB}{BP}$

$\tan 30^0 = \frac{AB}{10}$

$\frac{1}{\sqrt{3}} = \frac{AB}{10}$

$AB = \frac{10}{\sqrt{3}}$ m

$\therefore$ Length of the pole AB = $\frac{10}{\sqrt{3}}$ m

In right ΔPDC , $PC^2 = PD^2 + DC^2$

$= 20^2 + (20\sqrt{3})^2$

$= 400 + (400 \times 3)$

$= 400 + 1200$

$PC^2 = 1600$ ..... (1)

In right ΔABP , $AP^2 = AB^2 + BP^2$

$= (\frac{10}{\sqrt{3}})^2 + 10^2$

$= \frac{100}{3} + 100$

$= \frac{100+300}{3}$

$AP^2 = \frac{400}{3}$ ..... (2)

In right ΔAPC , $AC^2 = AP^2 + PC^2$

$= \frac{400}{3} + 1600$

$= \frac{400+4800}{3}$

$= \frac{5200}{3}$

$AC = \sqrt{\frac{400\ X\ 13}{3}}$

$AC = \frac{20X\sqrt{13}}{\sqrt{3}} = \frac{20}{3} \times \sqrt{39}$ m

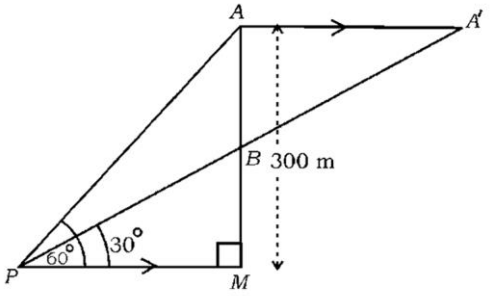
∴ Distance AC between the tops of the poles $AC = \frac{20\sqrt{39}}{3}$ m

33. Angle of elevation θ = 60° and 30°

In ΔPMA , $\tan 60^0 = \frac{AM}{PM}$

$\sqrt{3} = \frac{300}{PM}$

$PM = \frac{300}{\sqrt{3}}$



In ΔPMB , $\tan 60^0 = \frac{BM}{PM}$

$\frac{1}{\sqrt{3}} = \frac{BM}{\frac{300}{\sqrt{3}}}$

$\sqrt{3}.\sqrt{3}.BM = 300$

$3.BM = 300$

$BM = \frac{300}{3}$

$BM = 100$ m

$AB = AM - BM = 300 - 100 = 200$ m

In ΔABA^1 , ∠AA^{1}B = ∠BPM = 30° (AA^1 || PM , corresponding angles)

$\sin 30^0 = \frac{AB}{A^1B}$

$\frac{1}{2} = \frac{200}{A^1B}$

$A^1B = 200X2 = 400$ m

The distance between the kites (A^1B) = 400 m

34. Height of the taller tower = DC = 500 m,

Distance between the foot of the two towers = BD = 300 m

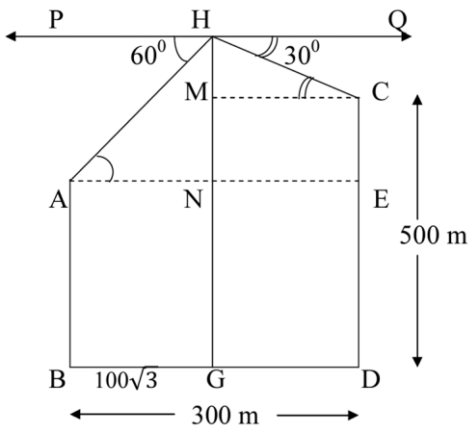
Height of the shorter tower = AB = ?

Join AN, MC and NE

Angle of depression θ = 60° and 30°

∟AHP = ∟HAN = 60^0 (alternate angles)

∟CHQ = ∟HCM = 30^0 (alternate angles)



In ΔAHN , $\tan 60 = \frac{HN}{AN}$

$\sqrt{3} = \frac{HN}{100\sqrt{3}}$ (AN = BG)

$HN = 100\sqrt{3} \times \sqrt{3}$

$= 100x\ 3$

$HN = 300$ m

But $GD = 300 - 100\sqrt{3}$

$= 100x3 - 100\sqrt{3}$

$= 100\sqrt{3}\,(\sqrt{3} - 1)$

In ΔHMC, $\tan 30^0 = \frac{HM}{MC}$

$\frac{1}{\sqrt{3}} = \frac{HM}{100\sqrt{3}(\sqrt{3}-1)}$

$HM = 100(\sqrt{3} - 1)$

$= 100(1.73 - 1)$

$= 100 \times 0.73$

$HM = 73$ m

$MN = HN - HM = 300 - 73$

$MN = 227$ m

∴ Height of the short tower = $AB = DE = DC - CE = 500 - 227 = 273$ m

VI. FIVE MARKS QUESTIONS

35. In ΔABD, $\tan 30^0 = \frac{AB}{BD}$

$\frac{1}{\sqrt{3}} = \frac{6}{BD}$

$BD = 6\sqrt{3}$ m

$BD = AE = 6\sqrt{3}$ m

In ΔAEC, $\tan 60^0 = \frac{CE}{AE}$

$\sqrt{3} = \frac{CE}{6\sqrt{3}}$

$CE = 6\sqrt{3} \times \sqrt{3}$ m

$CE = 18$ m

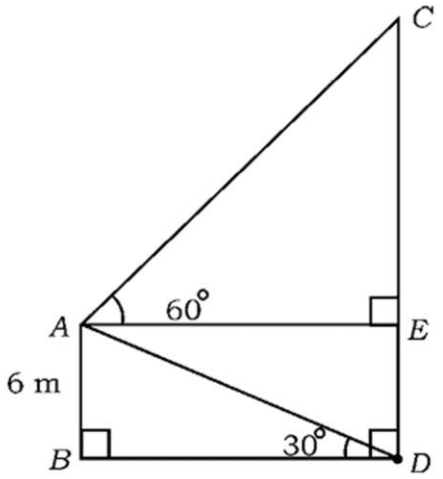
In ΔAEC, $\sin 60^0 = \frac{CE}{AC}$

$\frac{\sqrt{3}}{2} = \frac{18}{AC}$

$AC = \frac{18 \times 2}{\sqrt{3}}$

$AC = \frac{36\sqrt{3}}{3}$

$AC = 12\sqrt{3}$ m



CD=CE+DE

CD=18+6

CD=24 m

36.

The height of light house = $10\sqrt{3}$ m

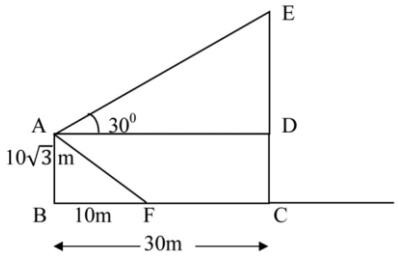
The distance between foot of the light house to foot of the tower = BC = 30 m

The distance between foot of the light house to ship = BF = 10 m

Height of the tower = CE = ?

Distance between the top of the light house to the top of the tower = AE = ?

Angle of depression = θ = ?



In Δ ADE , $\tan\theta = \frac{DE}{AD}$

$\tan 30^0 = \frac{DE}{30}$

$\frac{1}{\sqrt{3}} = \frac{DE}{30}$

$DE = \frac{30}{\sqrt{3}}$ m

∴ Height of the tower = CE = DE + CD

$= \frac{30}{\sqrt{3}} + 10\sqrt{3}$

$= (\frac{30+10X3}{\sqrt{3}})$

$= \frac{60}{\sqrt{3}}$

$= 20\sqrt{3}$ m

In Δ ADE , $\cos\theta = \frac{AD}{AE}$

$\cos 30^0 = \frac{30}{AE}$

$\frac{\sqrt{3}}{2} = \frac{30}{AE}$

$AE = \frac{60}{\sqrt{3}} = 20\sqrt{3}$ m

Distance between the top of the lighthouse to the top of the tower = AE = **$20\sqrt{3}$ m**

Angle of depression = ∟DAF = ∟AFB = θ

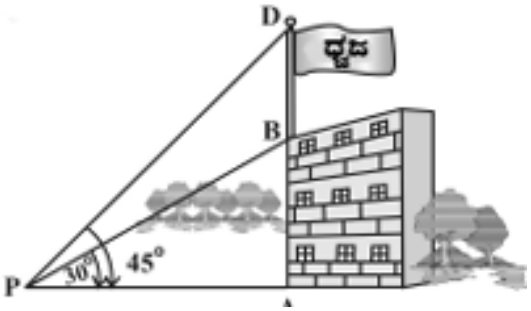
In Δ ABF , $\tan\theta = \frac{AB}{BF}$

$\tan\theta = \frac{10\sqrt{3}}{10}$

$\tan\theta = \sqrt{3}$

$\tan\theta = \tan 60^0$

$\therefore$ Angle of depression = θ = $\mathbf{60^0}$



37) In Right Angle Triangle PAB

$$\tan 30^0 = \frac{AB}{AP}$$

$$\frac{1}{\sqrt{3}} = \frac{10}{AP}$$

$$AP = 10\sqrt{3}$$

Distance of the building from P=AP=10x1.732=17.32M

In Right Angle Triangle PAD

$$\tan 45^0 = \frac{AD}{AP}$$

$$1 = \frac{AD}{17.32}$$

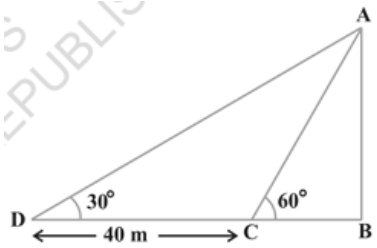
AD=17.32M

Length of the flag staff DB=AD-AB.

DB=17.32-10=7.32M

38) Let CB= xM

In Traiangle ABD



$$\tan 30^0 = \frac{AB}{DB}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{40+x}$$

$$AB = \frac{40+x}{\sqrt{3}} \text{ -------(1)}$$

In Triangle ABC

$$\tan 60^0 = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{AB}{X}$$

$$AB = \sqrt{3}x \text{ -------(2)}$$

From (1) and (2)

$$\frac{40+x}{\sqrt{3}} = \sqrt{3}x$$

40+x=3x

2x=40

x=$^{40}/_{2}$

x=20m

Height of the tower is

$AB = \sqrt{3}x$

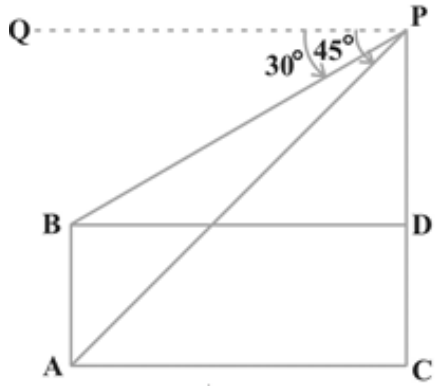
$AB = \sqrt{3}(20)$

AB = 20x1.732=34.64m

39) In figure AB=DC=8m

Let PD= x m $\quad \angle QPA = \angle PAC = 45^0$

AC = BD $\quad \angle QPB = \angle PBD = 30^0$



In Triangle ACP

$$\tan 45^0 = \frac{PC}{AC}$$

$$1 = \frac{8+x}{AC}$$

$$AC = 8 + x \text{.....(1)}$$

In Triangle PBD

$$\tan 30^0 = \frac{PD}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{x}{BD}$$

$$BD = \sqrt{3}x \text{.....(2)}$$

From (1) and (2)

$$8 + x = \sqrt{3}x$$

$$8 = (\sqrt{3}x - x)$$

$$8 = x(\sqrt{3} - 1)$$

$$8 = 0.732x$$

$$x = \frac{8}{0.732}$$

$$x = 10.93$$

Height of the multi store building is PC=8+10.93=18.93 m

Distance between the two building is 18.93 (AC=PC)

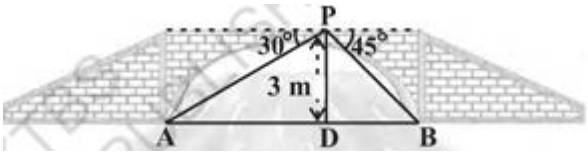
40) In triangle PDB

$\angle PBD = 45^0$

$$\tan 45^0 = \frac{PD}{DB}$$

$$1 = \frac{3}{DB}$$

$$DB = 3m.....(1)$$



In triangle PDA

$$\angle PAD = 30^0$$

$$\tan 30^0 = \frac{PD}{AD}$$

$$\frac{1}{\sqrt{3}} = \frac{3}{AD}$$

$$AD = 3\sqrt{3}m.....(2)$$

Width of the river AB = AD + DB

AB=3 $\sqrt{3}$ +3 m

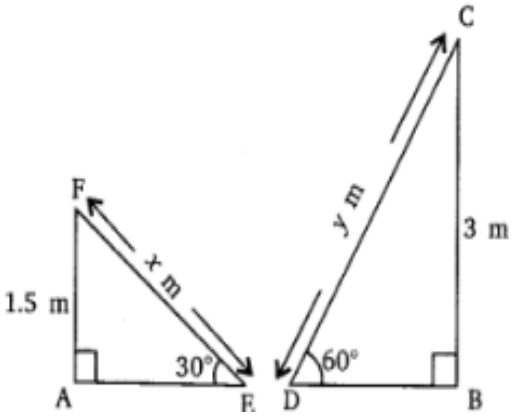
AB=3x1.732+3 = 5.196 + 3 = 8.196 m

41) In triangle AEF

$$\sin 30^0 = \frac{AF}{EF}$$

$$\frac{1}{2} = \frac{1.5}{EF}$$

$$EF = 3.0m.....(1)$$



In triangle DBC

$$\sin 60^0 = \frac{BC}{DC}$$

$$\frac{\sqrt{3}}{2} = \frac{3}{DC}$$

$$DC = \frac{6}{\sqrt{3}}$$

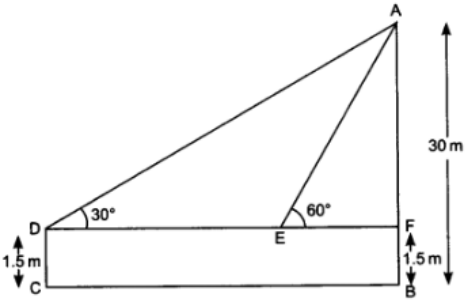
$$DC = \frac{6\sqrt{3}}{3}$$

$$DC = 2\sqrt{3} = 2.1.732 = 3.464m$$

42) AB=30m

AF=30-1.5=28.5m

In triangle AEF



$$\tan 30^0 = \frac{AF}{DF}$$

$$\frac{1}{\sqrt{3}} = \frac{28.5}{DF}$$

$$DF = 28.5\sqrt{3}m.....(1)$$

Distance worked by the boy is

$$DE = DF - EF = 28.5\sqrt{3} - \frac{28.5}{\sqrt{3}}$$

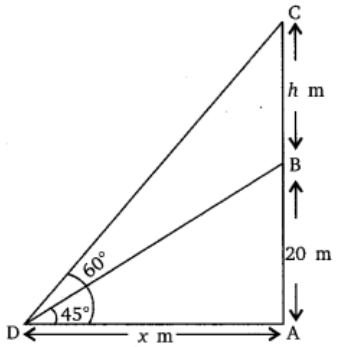
$$= 28.5\left(\sqrt{3} - \frac{1}{\sqrt{3}}\right) = 28.5\left(\frac{3-1}{\sqrt{3}}\right)$$

$$= 28.5x\frac{2}{\sqrt{3}} = \frac{57}{\sqrt{3}}m$$

$$DE = \frac{57}{1.732} = 32.9m$$

43) In Figure

In triangle DAB



$$\tan 60^0 = \frac{AB}{AD}$$

$$1 = \frac{20}{AD}$$

$$AD = 20m$$

In triangle DAC

$$\tan 60^0 = \frac{AC}{AD}$$

$$\sqrt{3} = \frac{20+h}{20}$$

$$20 + h = 20\sqrt{3}$$

$$h = 20\sqrt{3} - 20$$

$$h = 20(\sqrt{3} - 1) = 20(1.732 - 1) = 20x0.732$$

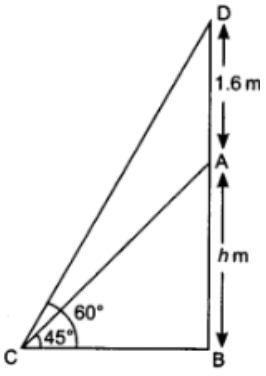
$$h = 14.64m$$

44) In triangle ABC

$$\tan 45^0 = \frac{AB}{BC}$$

$$1 = \frac{h}{BC}$$

$$BC = h.....(1)$$



In triangle DBC

$$\tan 60^0 = \frac{DB}{BC}$$

$$\sqrt{3} = \frac{h+1.6}{BC}$$

$$BC = \frac{h+1.6}{\sqrt{3}} \text{.....(2)}$$

From (1) and (2)

$$h = \frac{h+1.6}{\sqrt{3}}$$

$$\sqrt{3}h - h = 1.6$$

$$h(\sqrt{3}-1) = 1.6$$

$$h(0.732) = 1.6$$

$$h = \frac{1.6}{0.732}$$

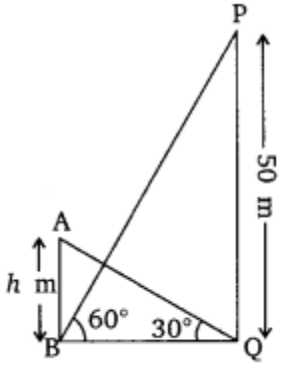
$$h = 2.19m$$

45) In triangle BPQ

$$\tan 60^0 = \frac{PQ}{BQ}$$

$$\sqrt{3} = \frac{50}{BQ}$$

$$BQ = \frac{50}{\sqrt{3}} m$$



In triangle BAQ

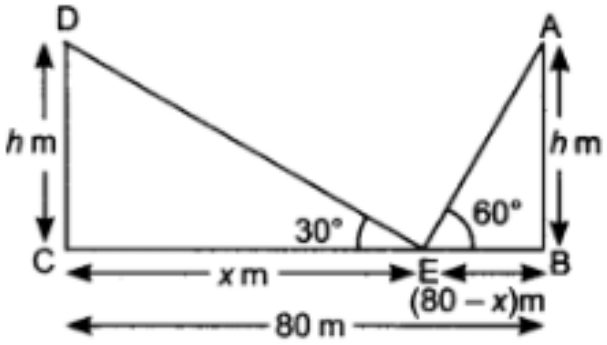
$$\tan 30^0 = \frac{AB}{BQ}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{50/\sqrt{3}}$$

$$\frac{AB\sqrt{3}}{50} = \frac{1}{\sqrt{3}}.$$

$$AB = \frac{50}{3}$$

$$AB = 16.67m.$$



46) In figure let CE= xm EB = 80-xm

In triangle DCE

$$\tan 30^0 = \frac{DC}{CE}$$

$$\frac{1}{\sqrt{3}} = \frac{DC}{x}$$

$$DC = \frac{x}{\sqrt{3}} m.....(1)$$

In triangle ABE

$$\tan 60^0 = \frac{AB}{EB}$$

$$\sqrt{3} = \frac{AB}{80 - x}$$

$$AB = \sqrt{3}(80 - x)m.....(2)$$

From (1) and (2)

AB=DC

$$\frac{x}{\sqrt{3}} = \sqrt{3}(80 - x)$$

x = 3(80-x)

x = 240-3x

4x = 240

x = $^{240}/_{4}$

x = 60m

Distance of the point from the pole with angle 30^0=60m

Distance of the pole from the pole with angle 60^0=80-60=20m

47) In figure let BC= xm

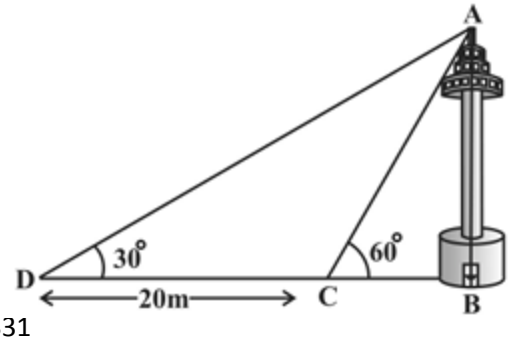
In triangle ABC

$$\tan 60^0 = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{AB}{x}$$

$$AB = \sqrt{3}xm.....(1)$$

In triangle ABD



$$\tan 30^0 = \frac{AB}{DB}$$

$$\frac{1}{\sqrt{3}} = \frac{AB}{20+x}$$

$$AB = \frac{20+x}{\sqrt{3}} \text{.....(2)}$$

From (1) & (2)

$$\sqrt{3}x = \frac{20+x}{\sqrt{3}}$$

$$3x = 20 + x$$

$$2x = 20$$

$$x = \frac{20}{2}$$

$$x = 10m$$

Width of the canal 10m

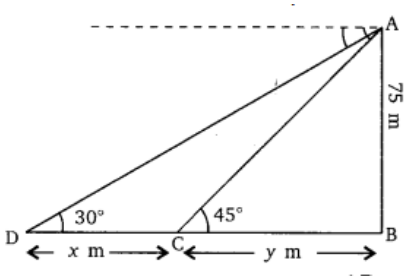
Height of the tower

$$AB = \sqrt{3}x$$

AB = 1.732 x 10

AB = 17.32m

48) In figure



$$\angle ACB = 45^0 \angle ADB = 30^0$$

In Triangle ABC

$$\tan 45^0 = \frac{AB}{BC}$$

$$1 = \frac{75}{BC}$$

$$BC = 75m$$

In Triangle ABD

$$\tan 30^0 = \frac{AB}{DB}$$

$$\frac{1}{\sqrt{3}} = \frac{75}{DB}$$

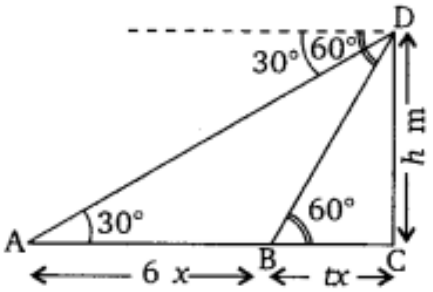
$$DB = 75\sqrt{3}m = 75x1.732$$

$$DB = 129.9m$$

Distance between two ships is

129.9-75 = 54.9m

49) In figure



$\angle DBC = 60^0 \angle DAC = 30^0$

In triangle DBC

$$\tan 60^0 = \frac{DC}{BC}$$

$$\sqrt{3} = \frac{DC}{BC}$$

$$BC = \frac{DC}{\sqrt{3}} \text{.....(1)}$$

In triangle DAC

$$\tan 60^0 = \frac{DC}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{DC}{AC}$$

$$AC = \sqrt{3}DC \text{.....(2)}$$

Distance travelled in 6 seconds

$$AC - BC = \sqrt{3}DC - \frac{DC}{\sqrt{3}}$$

$$AC - BC = \frac{3DC - DC}{\sqrt{3}} = \frac{2DC}{\sqrt{3}}$$

$$v = \frac{d}{t} = \frac{2DC}{\sqrt{3}/6} = \frac{DC}{3\sqrt{3}}$$

Time to reach the foot of the tower from the second position

$$t = \frac{DC}{\sqrt{3}} X \frac{3\sqrt{3}}{DC} = 3\text{sec}onds$$

Total time taken = 6+3= 9 seconds

CHAPTER 10: CIRCLES

I. Multiple choice Questions :

1) D) MN

2) D) AB

3) A) P

4) C) 8cm

5) C) 90^0

6) A) 7cm

7) B)) Secant

8) A) tangent

9) B)100^0

10) D) 4cm

11) B) 50^0

12) B) 3cm

13) A) 25^0

14) D) 65^0

15) D) 40^0

16) B) 5cm

17) D)$\sqrt{119}$ cm

18) A) 7cm

19) B) 70^0

II. ONE MARK QUESTIONS:

20) The line that intersects circle at only one point is a Tangent.

21) A line intersecting a circle in 2 points is a secant.

22) 90^0

23) 2

24) One

25) $\angle BOC + \angle BAC = 180^0$

$130^0 + \angle BAC = 180^0$

$\angle BAC = 180^0 - 130^0$

$\angle BAC = 50^0$

26) In Δ OAP

$\angle OPA + \angle OAP + \angle AOP = 180°$

$40^0 + 90^0 + \angle AOP = 180°$

$130^0 + \angle AOP = 180°$

$\angle AOP = 180° - 130^0$

$\angle AOP = 50°$

III. TWO MARKS QUESTIONS:

27) In Δ OAP , $\angle AOP = 90°$ [∵OA⊥AP]

$\angle AOP = 180° - (90^0 + 40)$

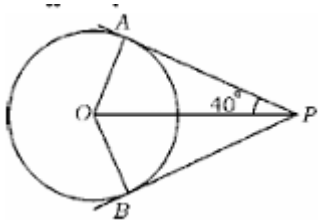
$= 180^0 - 130^0$

$\angle AOP = 50°$

$\angle AOP = \angle BOP = 50°$

$\angle AOB = 50° + 50^0 = 100^0$

AP = PB (by theorem) ∴PB =4cm



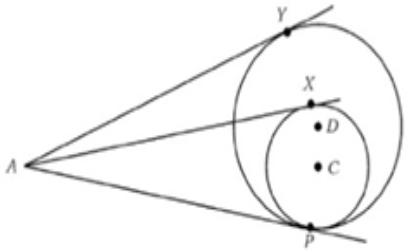
28) In a circle with center 'D' AY=AP--------(1)

(∵Tangents drawn from an external point to a circle are equal)

In a circle with center 'C' AX = AP ----------(2)

From (1) and (2)

AY = AX



29) According to Phythagorus theorem, $OA^2 = AB^2 + OB^2$

$5^2 = AB^2 + 3^2$

$OA^2 = AB^2 + 9^2$

$AB^2 = 25 - 9$

$AB^2 = 16$

AB = 4cm

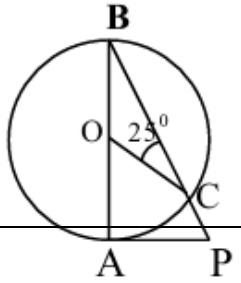
∴Length of the chord =AC =8cm



30) $\angle OCD = 25^0$

OB = 0C (∵ Radii of same circle)

$\angle OBC = \angle OCD = 25^0$ (∵Δ OBC is an Isosceles triangle)



$\angle PAB = 90^0$ (∵ Tangents at any point of a circle is perpendicular to the radius through the point of contact)

In Δ PAB, $\angle APB + \angle ABP + \angle PAB = 180^0$

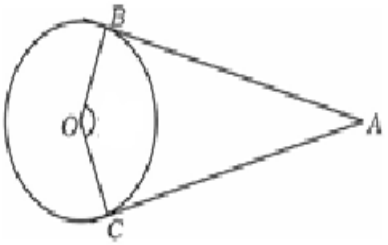
$\angle APB + 25^0 + 90^0 = 180^0$

$\angle APB = 180^0 - 115^0$

$\angle APB = 65^0$

31) To Prove: $\angle BOC + \angle BAC = 180°$

Proof: $\angle OBA = \angle OCA = 90°$ (Theorem 10.1)



In Quadrilateral OBAC,

$\angle BOC + \angle OCA + \angle BAC + \angle OBA = 360°$ (Angle sum property of quadrilateral)

$\angle BOC + 90° + \angle BAC + 90° = 360°$

$\angle BOC + \angle BAC + 180° = 360°$

$\angle BOC + \angle BAC = 360° - 180°$

$\angle BOC + \angle BAC = 180°$

32) To prove : BE = BC

Proof: Given AB = AC

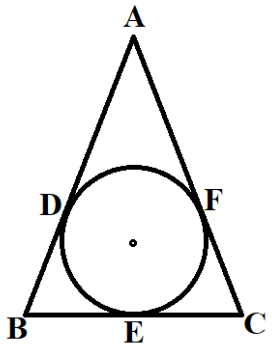
AD + BD = AF + FC

Here AD = AF (Theorem 10.2)

We get, BD = FC

Here, BD = BE and FC = CE

Hence we get, BE = CE



33) From the figure,

(i) DR = DS, (ii) BP = BQ, (iii) AP = AS, (iv) CR = CQ

(By Theorem 10.2)

Now, adding the LHS and RHS of the above equations, we get,

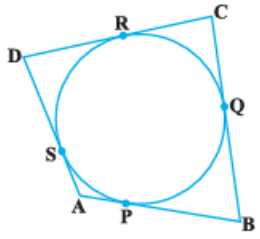
DR+BP+AP+CR = DS+BQ+AS+CQ

By rearranging them, we get,

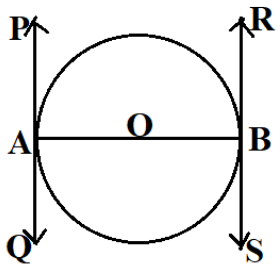
(DR+CR) + (BP+AP) = (CQ+BQ) + (DS+AS)

By simplifying,

AD+BC= CD+AB



34) In the figure, O is centre of circle, PQ and RS are tangents drawn to the circle at the ends of diameter AB.



$\angle OAP = 90°$ (Theorem 10.1)

$\angle OBS = 90°$ (Theorem 10.1)

$$Here, \angle OAP = \angle OBS = 90°$$

As alternate angles are equal PQ || RS

35) Given : A circle with center O. A tangent line AB touches the circle at the point P.

To prove: The perpendicular line drawn from point P passes through the center O.

Proof : Let us assume that perpendicular from P passes through another point O' .

Now, ∠O'PB = 90°

We know that radius drawn from center to point of contact P is always perpendicular.

Hence, ∠OPB = 90°

From the above two equations we can conclude that O' and O coincoides.

Therefore , the perpendicular line drawn from point P passes through the center O.

36) For external point, $OA^2 = OP^2 + AP^2$ where OP = r,

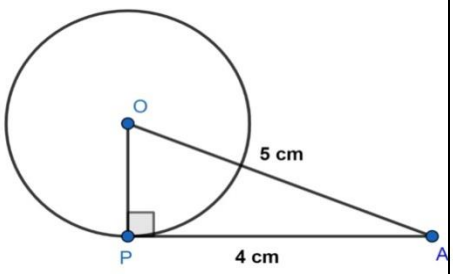
AP = 4, OA = 5

$r^2 + 4^2 = 5^2$

$r^2 + 16 = 25$

$r^2 = 9 \rightarrow r = 3$ cm

Radius = 3 cm



37) Let chord AB of bigger circle touch smaller circle at P.

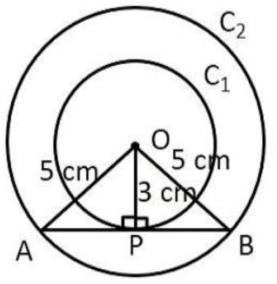
OP ⊥ AB and OP = 3 cm = radius of smaller circle.

In Δ OMA: OA = 5, OP = 3, ∠OPA = 90°

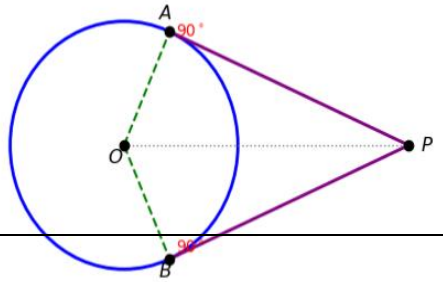
$AP^2 = OA^2 - OP^2 = 25 - 9 = 16 \rightarrow AP = 4$ cm

Since perpendicular from center bisects chord, AB = 2 × AM = 8 cm

Length AB = 8 cm



38) Given: PA, PB tangents from P. O is center.



To Prove: ∠APB + ∠AOB = 180°

Proof:

Radius is perpendicular to tangent at the point of contact.

OA ⊥ PA, OB ⊥ PB →∠OAP = ∠OBP = 90°

In quadrilateral OAPB:

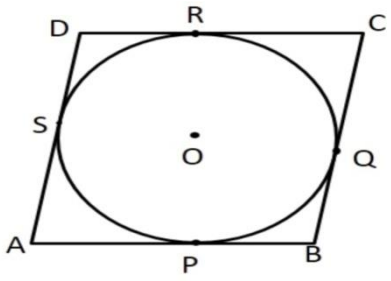
∠OAP + ∠APB + ∠PBO + ∠BOA = 360°

90° + ∠APB + 90° + ∠AOB = 360°

∠APB + ∠AOB = 180°.

Hence supplementary.

39) Proof: Let ABCD be parallelogram circumscribing circle.



Tangents from external point to circle are equal.

Let circle touch sides at P, Q, R, S.

Then AP = AS, BP = BQ, CR = CQ, DR = DS

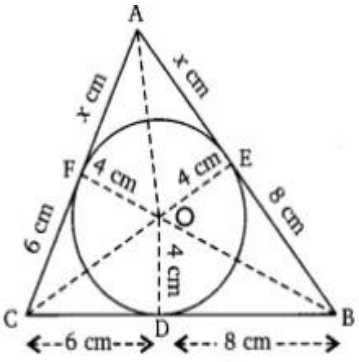
AB + CD = AP + PB + CR + RD = AS + BQ + CQ + DS = AD + BC

For parallelogram, AB = CD, BC = AD.

So, 2AB = 2BC → AB = BC

Hence all sides equal, ABCD is a rhombus.

40) Let circle touch AB at E, BC at D, AC at F.



Tangents from same point are equal:

BD = BE = 8, CD = CF = 6, AF = AE = x

So BC = BD + DC = 8 + 6 = 14 cm

AB = x + 8, AC = x + 6

By Heron, Area of Δ ABC = $\sqrt{s(s-a)(s-b)(s-c)}$

where s = $\frac{AB+BC+AC}{2}$ = $\frac{x+8+14+x+6}{2}$ = x + 14

s = x + 14, s-a = x+14-14 = x, s-b = x+14-(x+6) = 8, s-c = x+14-(x+8) = 6

Area = $\sqrt{(x+14)(x)(8)(6)}$ = $\sqrt{48x(x+14)}$

We know that , Area of Δ = $\frac{1}{2}$ × b × h

Area of ΔABC = Area of Δ AOC + Area of Δ COB + Area of Δ AOB

= $\frac{1}{2}$ × (x+6) × 4 + = $\frac{1}{2}$ × (14) × 4 + = $\frac{1}{2}$ × (x+8) × 4

= 4(x+14)

Equate: 4(x+14) = $\sqrt{48x(x+14)}$

Square: $16(x+14)^2 = 48x(x+14)$

Divide by $16(x+14)$: $x+14 = 3x \rightarrow 14 = 2x \rightarrow x = 7$

So, AB = 7 + 8 = 15 cm, AC = 7 + 6 = 13 cm

AB = 15 cm, AC = 13 cm

41) Given: Quadrilateral ABCD circumscribes circle with center O.

To Prove: $\angle AOB + \angle COD = 180°$ and $\angle BOC + \angle DOA = 180°$

Proof: Join points of contact. Tangents from vertex make equal angles with line to center.

Hence, $\angle 1 = \angle 2$, $\angle 3 = \angle 4$, $\angle 5 = \angle 6$, $\angle 7 = \angle 8$

Sum of all angles of ABCD = 360°

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$

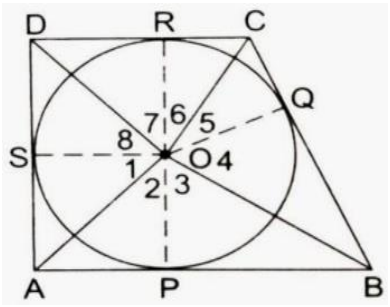
$2\angle 2 + 2\angle 3 + 2\angle 6 + 2\angle 7 = 360°$

$2(\angle 2 + \angle 3 + \angle 6 + \angle 7) = 360°$

$\angle 2 + \angle 3 + \angle 6 + \angle 7 = 180°$

$\rightarrow \angle AOB + \angle COD = 180°$.

Similarly, $\angle BOC + \angle DOA = 180°$

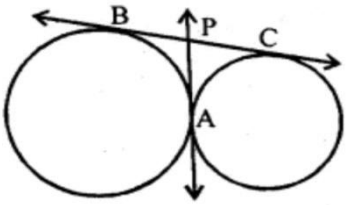


42) Two circles touch externally at A. Since lengths of the tangents drawn from an external point are equal,

BP = PA = PC = 3.8 cm

Thus, BC = BP + PC = 3.8 + 3.8 = 7.6 cm

Hence, BC = 7.6 cm



43) BD = BF = 4 cm , DC = CE = 3 cm

AF = AE = CA - CE = 8 – 3 = 5 cm

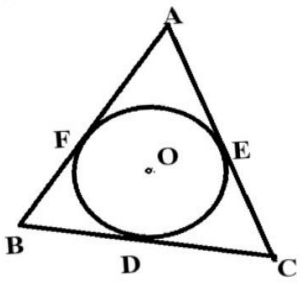
AB = AF + BF = 5 + 4 = 9 cm

BC = BD + DC = 4 + 3 = 7 cm

CA = 8 cm

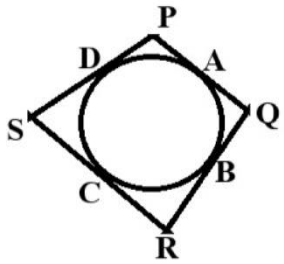
Perimeter = 9 + 7 + 8 = 24 cm

Perimeter = 24 cm



44)

Tangents from same point: PD = PA, QA = QB, RB = RC, SC = SD



PQ = PA + AQ = PD + BQ. Hence proved.

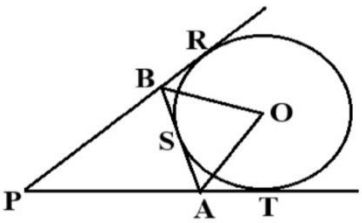
SC = DS = 2 cm → SC = 2 cm

RC = RB = 3 cm → RC = 3 cm

So, RS = RC + SC = 3 + 2 = 5 cm

RS = 5 cm

45) Given, ∠APB = 40°



In Δ ABP, ∠APB + ∠ABP + ∠BAP = 180°

40° **+** ∠ABP + ∠BAP = 180°

∠ABP + ∠BAP = 180° - 40°

∠ABP + ∠BAP = 140°

From fig, ∠SAT = 180° - ∠BAP .....(1)

∠RBS = 180° - ∠ABP .....(2)

Adding (1) and (2),

∠SAT + ∠RBS = 360° - (∠ABP + ∠BAP)

∠SAT + ∠RBS = 360° - 140°

∠SAT + ∠RBS = 220°

Since OA and OB bisect ∠SAT and ∠RBS respectively,

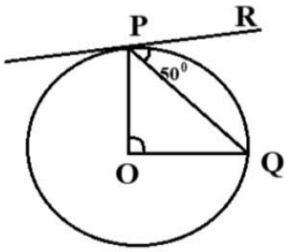
∠OAS + ∠OBS = $\frac{1}{2} \times 220°$

∠OAS + ∠OBS = 110°

Hence, ∠AOB = 180° - 110°

∠AOB = 70°

46)



Given, ∠QPR = 50°

Since tangent is perpendicular to the radius at the point of contact , ∠OPR = 90°

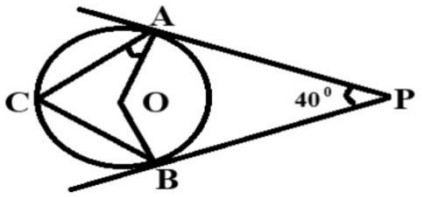
Hence, ∠OPQ = ∠OPR - ∠QPR = 90°- 50° = 40°

Since triangle OPQ is an isosceles , ∠OPQ = ∠OQP = 40°

Therefore, ∠POQ = 180° - (∠OPQ + ∠OQP) = 180° - 80° = 100°

∠POQ = 100°

47)



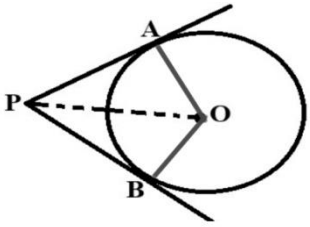
In fig, ∠AOB and ∠APB are supplementary.

Hence, ∠AOB = 180°- ∠APB = 180°- 40° = 140°

In fig, ∠ACB = $\frac{1}{2}$ ×∠AOB = = $\frac{1}{2}$ × 140^° = 70°

∠ACB = 70°

48)



Since tangent is perpendicular to radius at the point of contact,

∠OAP = ∠OBP = 90°

Given, ∠OPB = 90°

In quadrilateral OAPB three angles are 90° , the fourth angle is also 90° .

Hence all the angles are 90° and the adjacent sides OA = OB, PA = PB.

→ OAPB is square.

So. OP is diagonal of square of side 5 cm.

By Pythagoras theorem. OP = $5\sqrt{2}$ cm ≈ 7.07 cm

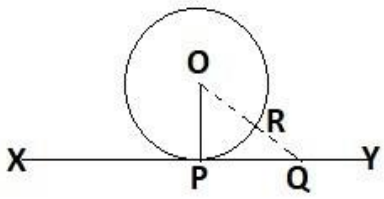
IV. THREE MARKS QUESTIONS:

49) Data : A circle with center O and tangent XY at a point P.

To Prove : OP⊥XY

Construction :Take any point Q other than P on the tangent XY, and join OQ

Proof : Hence Q is a point on the tangent XY,other than the point of contact P. So Q lies outside the circle.



Let OQ intersect the circle at R

∴ OP = OR [Radii of same circle]

Now OQ = OR + RQ

⇒OQ> OR

⇒OQ > OP [∵ $\mathrm{OP} = \mathrm{OR}$]

Therefore OP is the shortest distance to the tangent from the centre O, ∴ OP⊥XY [∵ Perpendicular distance is always the shortest distance]

50) Given : PQ and PR are the two tangents drawn from the external point P to a circle of center O.

To Prove : PQ= PR

Construction : Join OP, OQ, OR

Proof : In $\triangle OQP$ and $\triangle ORP$

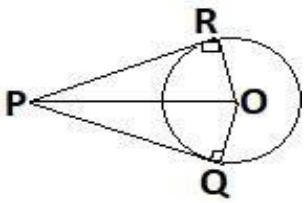
$OQ = OR$ ($\because$Radii of same circles)

$OP = OP$ ($\because$Common side)

$\angle OQP = \angle ORP = 90^0$

$\therefore \Delta OQP \cong \triangle ORP$

$\therefore PQ = PR$



51) Join OT, let it intersect PQ at the point R.

Then ΔTPQ is isosceles and TO is the angle bisector of $\angle PTQ$

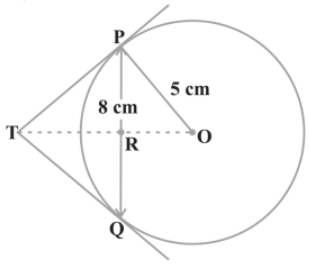
Therefore $OT \perp PQ$ and OT bisects PQ

$\Rightarrow PR = RQ = 4cm$

$RO = \sqrt{5^2 - 4^2}$

$RO = \sqrt{25 - 16}$

$RO = \sqrt{9} = RO = 3cm$



$\angle OPR + \angle TPR = 90^0$ ---------- (1)

$\angle PTR + \angle TPR = 90^0$ ---------- (2)

From (1) and (2)

$\angle OPR = \angle PTR$ ----------(3)

ΔPRO and ΔPTR right angled triangles are similar [AA similarity criteria]

$\Rightarrow \frac{PT}{OP} = \frac{PR}{OR} = \frac{PT}{5} = \frac{4}{3}$

$PT = \frac{4 \times 5}{3} = \frac{20}{3}$

52) Data : TP and TQ are two tangents drawn from an external point T to the circle with center O.

To Prove : $\angle PTQ = 2\angle OPQ$

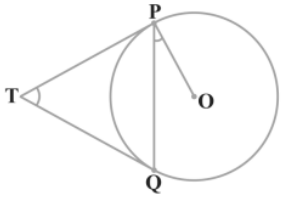
Let $\angle PTQ = \theta$ ----------(1)

TP = TQ

Therefore TPQ is an Isosceles triangle.

$\angle TPQ = \angle TQP = \frac{1}{2}[180 - \theta]$

$\Rightarrow \angle TPQ = \angle TQP = 90^0 - \frac{1}{2}\theta$ ----------(2)



$\angle OPT = 90^0$ ----------(3)

$\angle OPT = \angle OPT - \angle TPQ$

$\Longrightarrow \angle OPQ = 90^0 - (90^0 - \frac{1}{2}\theta)$

$\Longrightarrow \angle OPQ = \frac{1}{2}\theta$

$\Longrightarrow \angle PTQ = 2 \angle OPQ$ [∵ (2) and (3)]

53) Proof : Let the tangent AB touch the circle at C, join OC

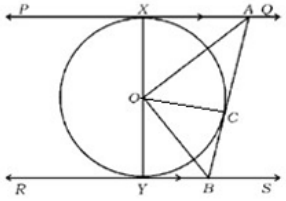
In Δ OXA and ΔOCA

AX = AC (∵ Tangents)

OX = OC (∵ Radii)

OA = OA (∵ common sides)

∴Δ OXA ≅Δ OCA (∵ SSS Postulate)



$\angle XOA = \angle COA$ ----------(1)

Similarly, Δ OCB ≅Δ OYB (∵SSS Postulate)

$\angle COB = \angle YOB$ ----------(2)

$\angle XOA + \angle COA + \angle COB + \angle YOB = 180^0$ ----------(3) (∵XY is a straight line)

From (1) and (2) ,

$2 \angle AOC + 2 \angle COB = 180^0$

$\angle AOC + \angle COB = 90^0$

$\angle AOB = 90^0$

Unit : 11 Area Related to Circles

I. Multiple Choice Questions :

1. A) 7π units
2. A) 2 πr^2
3. C) $\frac{\theta}{180} X\ \pi r$
4. C) $\frac{\pi r^2}{4}$cm
5. C) $\frac{3\pi r^2}{4}$$cm^2$
6. D) 88cm
7. B) 80^0
8. C) Area of Sector – Area of ΔAOB
9. C) 66cm
10. C) 44 cm^2
11. A) $\frac{(360-30)\pi r^2}{360}$$cm^2$
12. C) $\frac{\pi r}{2}$ cm

II. One Marks Questions : -

13. $\frac{\theta}{360} X\ \pi r^2$
14. $\frac{\theta}{360} X\ 2\pi r$
15. 45^0
16. 11cm
17. 11cm
18. 7cm
19. 3.5cm
20. Radius r =2 units

III. Two Marks Questions : -

21. Length of the Arc = $\frac{\theta}{360} X\ 2\pi r$

$= \frac{60}{360} X\ 2\ X\ \frac{22}{7} X\ 2$

$= \frac{1}{3}\ X\ \frac{22}{7} X\ 21$

Length of the Arc $= 22cm$

22. Area of Sector $= \frac{\theta}{360} X\ \pi r^2$

$$= \frac{45}{360} X \frac{22}{7} X 4^2$$
$$= \frac{1}{8} X \frac{22}{7} X 16$$

Area of Sector= 6.28 cm^2.

23. Area of big Circle = (92 + 62) Sq.cm

$$\pi r^2 = 154$$
$$r^2 = 154 X \frac{7}{22} = 49$$
$$r^2 = 49$$

Radius r = 7cm.

24. Area swept by the minute hand of the clock = Area of sector

$$= \frac{\theta}{360} X \pi r^2$$
$$= \frac{60}{360} X \frac{22}{7} X 14^2$$
$$= \frac{1}{8} X \frac{22}{7} X 16$$
$$= \frac{22 X 14}{3} = \frac{308}{3} \text{ cm}^2.$$

25. Area of Quadrant of Circle = $\frac{\pi r^2}{4} = \frac{3.14X20\ X20}{4} = 3.14\ X5X20 = 3.14X100 = 314$ cm^2.

Perimeter of Quadrant of Cirlce $= \frac{\pi r}{2} + 2r = \frac{3.14\ X\ 20}{2} + 2X20 = 31.4 + 40 = 71.4cm$

IV. Three Marks Questions : -

26. Area of Cloth required to make hand fan = Area of Sector

$$= \frac{\theta}{360} X \pi r^2$$
$$= \frac{120}{360} X \frac{22}{7} X 21\ X\ 21$$
$$= 22\ X\ 21$$

Area of Cloth required to make hand fan $= 462 cm^2$.

Total length of the wire = Length of Arc + 2 Radius

$$= \frac{\theta}{360} X\ 2\pi r + 2r$$
$$= \frac{120}{360} X\ 2X \frac{22}{7} X\ 21 + 2X21$$
$$= 44 + 42$$

Total length of the wire $= 86cm$

27. i) Length of Arc $= \frac{\theta}{360} X\ 2\pi r$

$= \frac{60}{360} X\ 2X\ \frac{22}{7} X21$

$= \frac{1}{6} X2\ X\ 22\ X\ 3$

$= 22cm$

ii) Area of Sector $= \frac{\theta}{360} X\ \pi r^2$

$= \frac{60}{360} X\ \frac{22}{7} X\ 21\ X\ 21$

$= \frac{1}{6}\ X\ 22\ X\ 3\ X\ 21$

$= 231$ cm^2.

28. Area of Segment = Area of Sector – Area of Equilateral Triangle

$= \frac{\theta}{360} X\ \pi r^2 - \frac{\sqrt{3}}{4} a^2$

$= \frac{60}{360} X\ \frac{22}{7} X\ 21\ X\ 21 - \frac{1.73}{4}\ X21\ X21$

$= \frac{1}{6}\ X\ 22\ X\ 3\ X\ 21 - \frac{762.93}{4}$

$= 231\ - 190.7325$

$= 40.2675$ cm^2.

29. Area of remaining part of Circle = Area of Semicircle – Area of Triangle

$= \frac{\pi r^2}{2} - \frac{1}{2}\ X\ base\ X\ height$ $Height = \sqrt{100 - 36} = \sqrt{64} = 8cm$

$= \frac{22\ X5\ X5}{2\ X\ 7} - \frac{1}{2}\ X\ 6\ X\ 8$

$= \frac{11\ X\ 25}{7} -\ 24$

$= 39.28 -\ 24$

Area of remaining part of Circle$= 15.28$ cm^2.

30. Area of Sector : Area of Circle = 1:5

(θ/360°) πr^2/ πr^2= ⅕

θ = 360°/ 5

θ = 72°

Length of Arc = (θ/360°) 2πr

= (72°/ 360°) × 2 × 22/7 × 7

= (1/5) × 44

= 44/5 cm

31. Area of Sector = 231

$(\theta/360°)\ \pi r^2 = 231$

$(\theta/360°) = 231/\pi r^2$.....(1)

Length of Arc = 22

$(\theta/360°)\ 2\pi r = 22$

$(\theta/360°) = 22/2\pi r$ .....(2)

From (1) & (2)

$231/\pi r^2 = 22/2\pi r$

$231/22 = \pi r^2/ 2\pi r$

$r = 21$ cm

$(\theta/360°)\ 2\pi r = 22$

$(\theta/360°) = 22/2\pi r$

$\theta = 22 \times 360°/ 2\times 22/7 \times 21$

$\theta = 60°$

32. Length of Arc = 22cm

$(\theta/360°)\ 2\pi r = 22$

$(60°/360°) \times 2\times 22/7 \times r = 22$

$(1/6) \times 2\times 22/7 \times r = 22$

$r = 22 \times 7 \times 6 / 2\times 22$

$r = 21$ cm

Area of Sector $= (\theta/360°)\ \pi r^2$

$= (60°/360°) \times 22/7 \times 21\times 21$

$= 11 \times 21$

$= 231\ cm^2$

33. Area of Sector = Length of Arc

$(\theta/360°)\ \pi r^2 = (\theta/360°)\ 2\pi r$

$\pi r^2 = 2\pi r$

$r = 2$

Length of Arc = 44/21

$(\theta/360°)\ 2\pi r = 44/21$

$(\theta/360°) \times 2 \times 22/7 \times 2 = 44/21$

θ = 44× 360× 7/ 21×22×2×2

θ = 60°

34. Area of Sector = 462 cm^2

$(\theta/360°)\ \pi r^2 = 462$

$(120°/360°)\times \pi r^2 = 462$

$(1/3) \times 22/7 \times r^2 = 462$

$r^2 = 462\times 3\times 7/ 22$

$r^2 = 21\times 21$

$r = 21$ cm

Length of Arc = $(\theta/360°)\ 2\pi r$

$= (120°/360°) \times 2 \times 22/7 \times 21$

$= 44$cm

35. Length of Arc = 11 cm

$$11 = \frac{\theta}{360} X\ 2\pi r$$

$$11 = \frac{30}{360} X\ 2X \frac{22}{7} X\ r$$

11 X 12 X 7 = 2 X 22 X r

$$r = \frac{11\ X12}{2\ X\ 22}$$

$$r = 21cm$$

Area of Sector OAXB = A1 $= \frac{\theta}{360} X\ \pi r^2$

$$= \frac{30}{360} X\ \frac{22}{7} X21\ X\ 21$$

$A1 = \frac{231}{2}$ cm^2.

Area of Sector OCYD = A2 $= \frac{\theta}{360} X\ \pi r^2$

$$= \frac{30}{360} X\ \frac{22}{7} X7\ X\ 7$$

$A2 = \frac{77}{6}$ cm^2.

Area of Shaded region = A1 – A2

$$= \frac{231}{2} - \frac{77}{6}$$

$$= \frac{693 - 7}{6}$$

$$= \frac{606}{6}$$

$$= \frac{308}{3}$$

$= 102.66$ cm^2.

36. ABC is a equilateral Triangle, therefore $\theta = 60^0$ r = 3.5cm

Length of Arc PQ $= \frac{\theta}{360} X\ 2\pi r = \frac{60}{360} X\ 2\ X \frac{22}{7} X \frac{7}{2} = \frac{11}{3}\ cm$

PQ = RS = UT

 Length of Arc RS $= \frac{11}{3}\ cm$

Area of Equilateral Triangle $= \frac{\sqrt{3}a^2}{4}$

$$= \frac{\sqrt{3}a^2}{4} = 49\sqrt{3}$$

$$a^2 = 49\ X4$$

 a = 14cm

AB = AC = BC = 14cm

Length of QR = AC – AQ – CR

= 14 – 3.5 – 3.5

= 7 cm

QR = TS = PU = 7cm

Perimeter of PQRSTUP = PQ + RS + UT + QR + TS + PU

$$= \frac{11}{3} + \frac{11}{3} + \frac{11}{3} + 7 + 7 + 7$$

$$= \frac{33}{3} + 21$$

$$= 11 + 21$$

Perimeter of PQRSTUP $= 32\ cm$

37. Length of Arc $= \frac{\theta}{360} X\ 2\pi r$

$$\frac{22}{3} = \frac{\theta}{360} X\ 2\ X \frac{22}{7} X7$$

$$\frac{1}{3} = \frac{\theta}{360} X\ 2$$

$$\theta = \frac{180}{3}$$

$$\theta = 60^0$$

Area of Circle = A1 = $\pi r^2 = \frac{22}{7}\ X\ 7\ X\ 7 = 22\ X\ 7 = 154$ cm^2.

Area of Sector = A2 $= \frac{\theta}{360} X\ \pi r^2 = \frac{60}{360} X\ \frac{22}{7}\ X\ 7\ X\ 7 = \frac{1}{6} X22\ X\ 7 = 25.66$ cm^2.

Required Area = A1 - A2

= 154 – 25.66

= 128.34 cm^2.

38. Area of semicircle πr = 44

$$r = 44\ X\ \frac{7}{22} = 14cm$$

$\angle OPQ = 180 - 90 = 90^0$

Area of Sector OPRQ $= \frac{\theta}{360} X\ \pi r^2 = \frac{90}{360} X\ \frac{22}{7}\ X\ 14\ X\ 14 = \frac{1}{4} X\ \frac{22}{7}\ X\ 196$

$= \frac{1}{4} X\ 22\ X\ 28$

$= 22\ X\ 7$

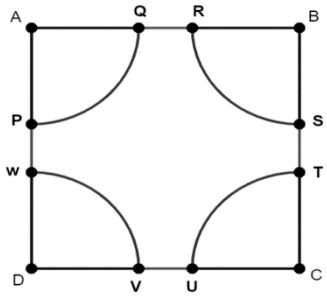
$= 154$ cm^2.

Area of $\Delta OPQ = \frac{1}{2}\ X\ baseXheight\ = \frac{1}{2}\ X\ 14\ X\ 14 = \frac{1}{2}\ X\ 196 = 98$cm^2.

Area of Sector = Area of OPRQ – Area of ΔOPQ

= 154 – 98

= 56 cm^2.



39. Area of square = 144 cm^2

Length of each side = $\sqrt{144} = 12cm$

Arc length PQ = $\frac{90}{360} 2\pi r = \frac{1}{4} \times 2 \times \frac{22}{7} \times 3.5 = 5.5$ cm

Similarly arc RS = arc UT= arc VW = 5.5 cm

QR = ST = UV = PW = 12 – 3.5 – 3.5 = 5 cm

Perimeter of PQRSTUVWP = PQ +QR+RS +ST+TU+UV+VW+WP

= 5.5+5+5.5+5+5.5+5+5.5+5= 42cm

40. Sector angle formed = 35minutes $\times \frac{360°}{60\ minutes} = 210°$

Area swept = $\frac{\theta}{360°} \times \pi r^2$

= $\frac{210}{360°} \times \frac{22}{7} \times (18)^2 = 594$cm^2

Length of the arc = $\frac{\theta}{360°} \times 2\pi r$

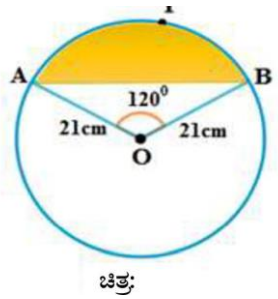
= $\frac{210}{360°} \times 2 \times \frac{22}{7} \times 18 = 66$cm

41) Area of the segment

= Area of sector OAYB –Area of ΔOAB---------- (1)

Area of the sector = $\frac{\theta}{360}\ \times \pi r^2$

=$\frac{120}{360} \times\ \frac{22}{7} \times 21 \times 21 = 462$ cm^2 ----------(2)



ಚಿತ್ರ:

To find the area of ΔOAB , draw OM ⊥ AB as shown in fig.

Note that OA=OB,

Therefore, by RHS congruence Δ AMO ≅ΔBMO

So, M is the mid-point of AB and $\angle$ AMO=$\angle$ BMO = 60^0

In Δ OAM, $\frac{OM}{OA}$ =Cos 60^0

$\Rightarrow\frac{OM}{21} = \frac{1}{2}$

$\Rightarrow$OM = $\frac{21}{2}$ cm

In Δ OAM, $\frac{AM}{OA}$ = Sin60^0

$\Rightarrow\frac{AM}{21} = \frac{\sqrt{3}}{2}$

$\Rightarrow$ AM =$\frac{21\sqrt{3}}{2}$ cm

$\Rightarrow$ AB =2AM

$\Rightarrow 21\sqrt{3}$ cm

$\therefore$ Area of ΔOAB = $\frac{1}{2} \times AB \times OM$

=$\frac{1}{2} \times 21\sqrt{3} \times \frac{21}{2}$

=$\frac{441\sqrt{3}}{4}$ cm^2

Area of the segment = 462 - $\frac{441\sqrt{3}}{4}$

=$\frac{462\times4-441\sqrt{3}}{4}$

= $\frac{21}{8}(88 - 21\sqrt{3})$ cm^2

42) Radius of the circle = 10 cm

The angle of the major sector = $360^0 - 90^0 = 270^0$

Area of the Major sector =$\frac{270}{360} \times \pi r^2\ cm^2$

= $\frac{3}{4} \times 3.14 \times 10 \times 10$

= 75$\times$ 3.14 cm^2

= 235.5 cm^2

In right angle ΔAOB , OA=10cm, OB= 10cm

Area of ΔAOB = $\frac{1}{2} \times OA \times OB$

$=\frac{1}{2} \times 10 \times 10$

= 50 cm^2 ----------(1)

The angle of the Minor sector = 90^0

Area of the minor sector = $\frac{90}{360} \times \pi r^2$ cm^2

$= \frac{1}{4} \times 3.14 \times 10 \times 10$

= 25× 3.14 cm^2

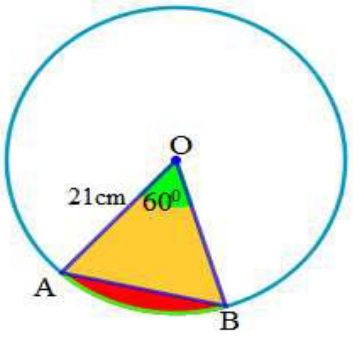
= 78.5 cm^2 -------(2)

Area of minor segment = (2) – (1)

= 78.5 cm^2 – 50 cm^2

= 28.5 cm^2

43) Radius of the circle = 21 cm



i) The length of the Arc AB = $\frac{\theta}{360} \times 2\,\pi r$

Arc AB $=\frac{60}{360} \times 2 \times \frac{22}{7} \times 21$

$= \frac{1}{6} \times 22 \times 3 \times 21$ cm^2

= 22 cm

ii) The area of the formed by arc AB $=60^0$

Area of the sector of angle 60^0 $=\frac{60}{360} \times \pi r^2$ cm^2

$= \frac{60}{360} \times \frac{22}{7} \times 21 \times 21$ cm^2

$= \frac{1}{6} \times 22 \times 3 \times 21$ cm^2

$= \frac{1}{2} \times 22 \times 21$ cm^2

= 11× 21 cm^2

= **231 cm^2**

iii) The area of the equilateral ΔAOB = $\frac{\sqrt{3}}{4} \times (OA)^2$

= $\frac{\sqrt{3}}{4} \times (21)^2$

= $\frac{441\sqrt{3}}{4}$ cm^2

Hence the required area = Area of the sector formed by the Arc - area of ΔAOB

= (231- $\frac{441\sqrt{3}}{4}$) cm^2

44) Length of the rope , r = 5m ,$\theta = 90^0$

Area of segment = ?

Area of segment = $\frac{\theta}{360} \times \pi r^2$

= $\frac{90}{360} \times 3.14 \times (5)^2$

= $\frac{1}{4} \times 3.14 \times 25$

= 3.14 × 6.25 sq.cm .....(1)

ii) Length of the rope , r=10cm , $\theta = 90^0$

Area of segment =?

Area of segment = $\frac{\theta}{360} \times \pi r^2$

= $\frac{90}{360} \times 3.14 \times (10)^2$

= $\frac{1}{4} \times 3.14 \times 100$

= 3.14 × 25

= 78.5 sq. cm.....(2)

∴ Area of the field which is increase in the grazing

= Equation (2) – equation (1)

= 78.5 – 19.63

= 58.87 sq.cm.

45) Number of diameters = 5 : Length of the diameter= 35 cm

∴ Radius (r) = 35/2 mm

(i) The total length of wire required

= Perimeter of the + length of 5 diameter

$=2\pi r$ +(5× 35) mm

$= (2\times \frac{22}{7} \times \frac{35}{2}) + 175$ mm

=110+175 =285 mm



(ii) Number of sectors = 10

Therefore area of each sector = $\frac{\pi r^2}{10} = \frac{\frac{22}{7}\times(\frac{35}{2})^2}{10}$

$= \frac{\frac{22}{7}\times\frac{35}{2}\times\frac{35}{2}}{10}$

$= \frac{\frac{3850}{4}}{10}$

$= \frac{385}{4}$ mm^2

46) Total ribs in the umbrella = 8



The radius of the umbrella

When it to be flat =45

Consecutive ribs = $\frac{Total\ Area}{number\ of\ ribs}$

$= \frac{\pi r^2}{8} = \frac{\frac{22}{7}\times 45^2}{8}$

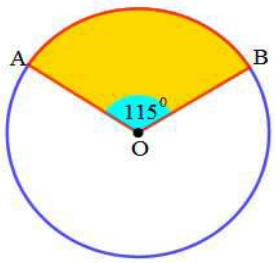
$= \frac{44550}{56}$ cm^2

$= \frac{22275}{28}$ cm^2

= 795.5 cm^2

47) Radius of the sector = length of the wiper = 25 cm

Area of the sector formed by the wiper $= \frac{115^0}{360^0} \times \pi r^2 \text{cm}^2$



$= \frac{115^0}{360^0} \times \frac{25}{7} \times 25 \times 25 \text{ cm}^2$

$= \frac{23}{72} \times \frac{22}{7} \times 625 \text{ cm}^2$

$= \frac{23}{36} \times \frac{11}{7} \times 625 \text{ cm}^2$

$= \frac{158125}{252} \text{ cm}^2$

The total area covered by blades of two wipers

$= 2 \times \frac{158125}{252} \text{ cm}^2$

$= \frac{158125}{126} = 1254.96 \text{ cm}^2$

48) Let the lighthouse be at O

Radius of the sector = length of the beam r = 16.5 km

Angle of the sector formed by the beam = 80^0

The area of the sector which light spreads

= Area of the sector = $\frac{80^0}{360^0} \times \pi r^2 \text{ km}^2$

$= \frac{2}{9} \times 3.14 \times 16.5 \times 16.5 \text{ km}^2$

$= \frac{2}{9} \times 3.14 \times 272.25 \text{ km}^2$

$= 189.97 \text{ km}^2$

49) The number of equal designs = 6

The radius of the cover = 28 cm

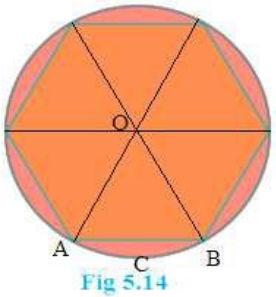


Fig 5.14

Making cost of the design = 0.35/cm^2

The angle of each sector= $\frac{360}{6}$ = 60^0

ΔAOB , $OA = OB$ (Radius of the same circle)

$\therefore \angle A = \angle B = 60^0$

$\therefore$ Area of the equilateral ΔAOB =$\frac{\sqrt{3}}{4} \times (OA)^2$

= $\frac{\sqrt{3}}{4} \times (28)^2$

=1.7× 7 ×× 28 = 333.2 cm^2

Area of the sector OACB = $\frac{60^0}{360^0} \times \pi r^2$ cm^2

= $\frac{1}{6} \times \frac{22}{7} \times 28^2$ cm^2

= $\frac{1}{3} \times 22 \times 4 \times 28$ cm^2= 410. 67 cm^2.

=Area of of the design = Area of the sector OACB – Area of the Δ AOB

= 410.67 cm^2 – 333.2 cm^2 = 77.47 cm^2

$\therefore$ The total area of 6 designs = 6× 77.47 cm^2

= 464.82 cm^2

$\therefore$ Total cost of making designs = 464.76 cm^2× 0.35 /cm^2

Unit : 12 SURFACE AREA & VOLUMES

I. Multiple choice questions

1. B) $6a^2$
2. D) $4a^2$
3. C) a^3
4. A) 2(lb+bh+hl)
5. B) 2h(l+b)
6. B) lxbxh
7. D) $2\pi rh$
8. A) $2\pi r\ (r+h)$
9. C) πr^2h
10. A) πrl
11. B) $\pi r(r+l)$
12. C) $^1/_3\ \pi r^2h$
13 D) $4\pi r^2$
14 D) $\mathbf{^4/_3\ \pi r^3}$
15. C) 3 : 1
16. D) $20cm^3$
17. B) 6cm
18. C) $216cm^3$
19. D) $30cm^3$
20. B) 10cm
21. D) 60,000 ltr
22. C) $220cm^3$
23. A) 120 cm^3
24. C) 616 cm^3
25. D) 125 cm^3

II. One-mark questions

26. $A = 3\pi r^2$

27. $A = 2\pi r^2$

28. $V = {}^{2}/_{3}\pi r^3$

29. $V = {}^{4}/_{3}\,\pi r^3$

30. 2:1

31. 4:1

32. $30cm^3 \times 3 = 90cm^3$

33. $A = 2\pi rh = 25 \times 10 = 250\ cm^2$

34. $TSA = \pi rl + 2\pi r^2$

35. $V = \pi r^2 h - {}^{4}/_{3}\,\pi r^3$

36. $V = \pi r^2 h$

$$500 = \frac{22}{7} x r^2 x 10$$
$$r^2 = \frac{500x7}{22x10}$$
$$\frac{350}{22} = r^2$$
$$r = 3.9cm$$

37.

$$\frac{v_1}{v_2} = \frac{\pi r_1^2 h_1}{\pi r_1^2 h_2}$$
$$\frac{v_1}{v_2} = \frac{9^2}{1^2} = \frac{1}{9}$$
$$\frac{v_1}{v_2} = \frac{81}{9}$$
$$\frac{v_1}{v_2} = \frac{9}{1}$$
$$v_1 : v_2 = 9:1$$

38. 616cm^2

III. Two-mark questions

39. h=20cm r=6cm

CSA of cylinder = 2πrh

$$A = 2x\frac{22}{7}x6x20$$

$$A = \frac{5280}{7}$$

$$A = 754.2857cm^2$$

40**.** length of the edge of a cube is = 3cm

Length of a cuboid = 3+3 = 6cm

l=6cm, b=3cm, h=3cm

TSA = 2[lb+bh+hl]

= 2[6x3+3x3+3x6]

= 2 x 45

TSA = 90 cm^2

41. Volume of toy = Volume of Hemisphere + Volume of cone

$$V = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$V = \frac{1}{3}x\frac{22}{7}x7x7[2x7+4]$$

$$V = \frac{2772}{3}$$

$$V = 924cm^3$$

42. TSA of a toy = CSA of cylinder + TSA of sphere

$$A = 2\pi rh + 4\pi r^2$$

$$A = 2\pi r(h+2r)$$

$$A = 2x\frac{22}{7}x7(10+2x7)$$

$$A = 44x24$$

$$A = 1056cm^2$$

43. $a^3=125$ a=5cm

CSA of the cube = 4a2

$A=4x5^2$

A=4x25

$A=100cm^2$

.**44.**

$\mathbf{V = {}^4/_3\,\pi r^3}$

$\mathbf{38808={}^4/_3\,({}^{22}/_7)\,r^3}$

$\mathbf{r^3 = {}^{814968}/_{88}}$

$\mathbf{r = 21}$

$A= 4\pi r^2$

$\mathbf{A= 4({}^{22}/_7)21^2}$

$\mathbf{A = 5544\ cm^2}$

IV. Three Marks Questions

45. Height of the cone h = 14-6 = 8cm

r = 6cm

Slope of the cone $l^2=r^2+h^2$

$l^2=6^2+8^2$

$l^2=10^2$

l=10 cm

Surface area of the toy = CSA of cone + CSA of hemisphere

$A=\pi rl+2\pi r^2$

$A=\pi r\,(l+2r)$

A=22/7(6) (10+2*6)

A=22/7 (6)(22)

A=13684 / 7

$A=1954.85\ cm^2$

46. Surface area of toy = CSA Of cylinder + CSA of hemisphere + area of circle

$A = 2\pi rh + 2\pi r^2 + \pi r^2$

$A = 2\pi r (h+2r+r)$

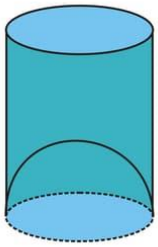
$A = 2 (^{22}/_{7}) (3.5)(10+3*3.5)$

$A = 3157 / 7$

$A = 451\ cm^2$

47. d = 6cm r=3cm h=12cm

Real capacity of the glass = volume of cylinder – volume of hemisphere



$$V = \pi r^2 h - \frac{2}{3}\pi r^3$$

$$V = \pi r^2 (h - \frac{2}{3} r)$$

$$V = \frac{22}{7} x3x3(12 - \frac{2}{3} x3)$$

$$V = \frac{1980}{7}$$

$$V = 282.857 cm^3$$

48. d=126m r=63m h=5m

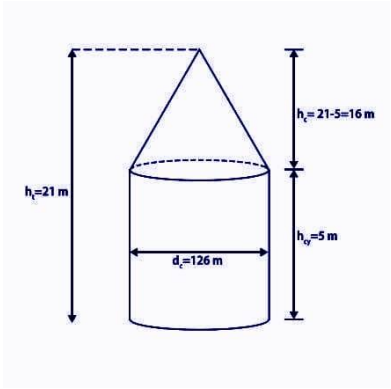
height of the cone h = 21-5 = 16 m

$l^2 = r^2 + h^2$

$l^2 = 63^2 + 16^2$

$l^2 = 65^2$

l= 65 m



Area of the canvas cloth = CSA of cylinder + CSA of cone

$$A = 2\pi rh + \pi rl$$

$$A = 2\pi r(2h + l)$$

$$A = \frac{22}{7} x63(2x5 + 65)$$

$$A = 14850 m^2$$

Area of the convas cloth = 14850 m

V. Four Marks Questions

49. Transforming the petrol per minute = 742.5 lit

In one hour = 742.5 x 60 = 44550 lit

Capacity of the tank = 44550 lit

Volume of tank = volume of cylinder + volume of 2 hemisphere

$$V = \pi r^2 h + 2x\frac{2}{3}\pi r^3$$

$$V = \pi r^2 + \left(h + \frac{4}{3}x\frac{3}{2}\right)$$

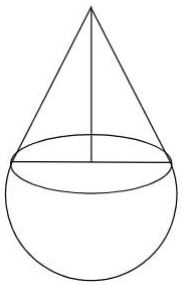
$$44550 = \frac{22}{7}x\frac{3}{2}x\frac{3}{2}\left(h + \frac{4}{3}x\frac{3}{2}\right)$$

6.3 = h+2

h = 6.3-2 = 4.3 m

Length of the tank = 4.3 m

50. **VOLUME = $^2/_3\pi\ r^3$**



$539/6 = {}^2/_3({}^{22}/_7)\ r^3$

$r^3 = 1/8$

r = ½ cm

SURFACE AREA OF THE TOY= $2\pi r^2 + \pi rl$

$= \pi r(2r + l)$

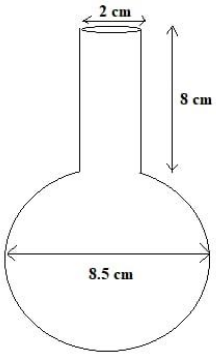
= 22/7 X 1/2 (281/2 +12.5)

A = 21.21 cm^2

51. $r_s = {}^{8.5}/_2$ = 4.25 cm

r_c=1cm

Volume of water = volume of cylinder + Volume of sphere



$$V = \pi r_c^2 h + \frac{4}{3}\pi r_s^3$$

$$V = \pi\left(r_c^2 h + \frac{4}{3} r_c^2\right)$$

$$V = 3.14\left(1^2 x8 + \frac{4}{3}(4.25)^3\right)$$

$$V = 3.14\left(\frac{24 + 307.08}{3}\right)$$

$$V = \frac{1039.59}{3}$$

$$V = 346.53cm^3$$

52. r = 7cm h_1=21 cm for cylinder

h_2 = 9cm for cone

volume of solid= volume of cylinder + volume of cone

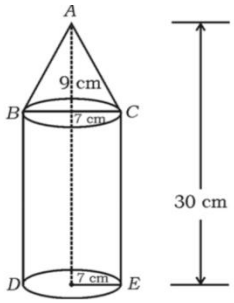
= $\pi r^2 h_1 + {}^1/_3\, r^2 h_2$

= $\pi r^2 (h_1 + {}^1/_3\, h_2$

= $^{22}/_7$ x 7 x 7 (21 + $^1/_3$ x 9)

= 22 x 7 x 24

V = 3696 c.c.



53. Height of the cone = 61 – (30+7)

= 61 – 37 = 24 cm

But 7,24,25 are Pythagorean triplets

Slant height of the cone = l = 25 cm

TSA of the solid = LSA of the cone + LSA of the cylinder + LSA of the hemisphere

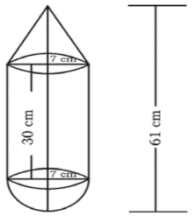
= $\pi rl + 2\pi rh + 2\pi r^2$

= $\pi r (l+2h +2r)$

= $^{22}/_7$ x 7 (25 + 2x30 + 2x7)

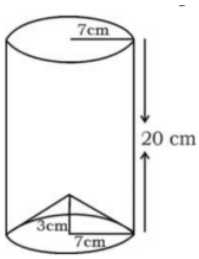
= 22 x 99

= 2178 cm^2



Cost of painting at the rate of Rs. 10 per 100 cm^2 is = $\frac{2178x10}{100} = 217.8 rupees$

54. Volume of the vessel equal to volume of the cylinder – volume of cone



OR

Volume of the cylinder = $\pi r^2 h$

= $^{22}/_{7}$ x 7 x 7 x 20

V_1 = 3080 cm^3

Volume of the cone = $^{1}/_{3}\pi r^2 h$

= $^{1}/_{3} x ^{22}/_{7}$ x 7 x 7 x 3

V_2 = 154 cm^3

Volume of vessel = $V_1 - V_2$ = 3080 – 154 = 2926 cm^2

$$\frac{2926}{1000} = 2.926 lit$$

Cost of the milk to fill this vessel at the rate of Rs. 20 per lit.

= 2.926 x 20= Rs. 58.20

55. Radius of hemisphere r = 1m

Radius of cylinder r = 1m

Height of cylinder h = 4m

Volume of solid = Volume of cylinder + 2 (volume of hemisphere)

$$= \pi r^2 h + 2\left(\frac{2}{3}\pi r^3\right)$$

$$= \pi r^2 \left(h + \frac{4}{3} r\right)$$

$$= \frac{22}{7} x1x1\left(4 + \frac{4}{3} x1\right)$$

$$= \frac{22}{7} x \frac{16}{3} m^3$$

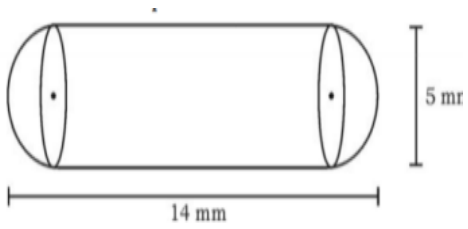
$$= \frac{352}{21} x(100)^3 cm^3$$

$$= \frac{352000}{21}$$



Capacity of milk tank = 16761.9 litres.

56. Diameter of hemisphere = 5mm



Radius = 2.5 mm
Length of entire capsule = 14 mm

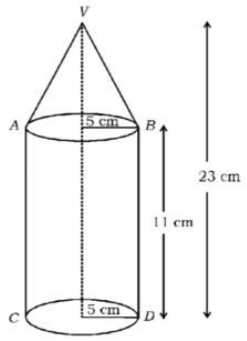
Height of cylinder h = 14-5 = 9mm

Surface area of capsule $= 2\pi rh + 4r^2$

$= 2\pi r (h + 2r)$

$= 2 \times {}^{22}/_{7} \times 2.5 (9+2\times2.5)$
$= 88 \times 2.5$
Surface area of capsule = 220 mm^2

57. Height of cone h_c = 23-11 = 12 cm
Radius of cone r = 5cm
Slant height of cone $l^2 = r^2 + h^2$
$l^2 = 5^2 + 12^2$
$l^2 = 169$
l = 13 cm



CAS of given solid = CSA of cone + CSA of cylinder
$= \pi rl + 2\pi rh$
$= \pi r (l + 2h)$
$= {}^{22}/_{7} \times 5 (13+2\times11)$
$= 550\ cm^2$

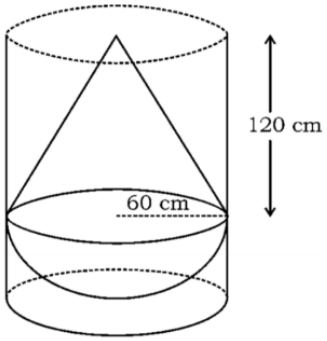
Volume of given = volume of cone + volume of cylinder

$$= \frac{1}{3}\pi r^2 h_c + \pi r^2 h_{cy}$$
$$= \pi r^2 (\left(\frac{1}{3} x h_c + h_{cy}\right)$$
$$= \frac{22}{7} x5x5\left(\frac{1}{3} x12 + 11\right)$$
$$= \frac{8250}{7}$$
$$= 1178.57 cm^3$$

58. Volume of cylinder $= \pi r^2 h$

$= (60x60)x180$

$= 648000\ \pi\ cm^3$



Volume of solid = Volume of cone + Volume of hemisphere

$$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

$$= \frac{1}{3}\pi r^2 \left(h + 2r\right)$$

$$= \frac{1}{3} x\pi + 60 + 60\left[120 + 6(60)\right]$$

$$V = 288000\pi cm^3$$

Volume of water left in the cylinder = Volume of cylinder – Volume of solid

$= 64800\ \pi\ - 28800\ \pi$

$= 360000\ \pi\ cm^3$

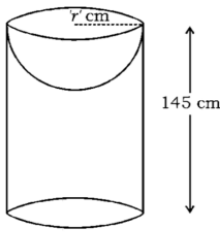
59. Volume of the hemisphere $= {}^2/_3 \pi\ r^3$

$18000\ \pi = {}^2/_3 \times \pi \times r^3$

$r^3 = {}^{18000 \times 3}/_2$

$r^3 = 27000$

$r = 30$ cm



TSA of solid = CSA of Hemisphere + CSA of cylinder + Area of circular base

$= 2\ \pi\ r^2 + 2\ \pi\ rh + \pi\ r^2$

$= \pi\ r\ (2r + 2h + r)$

$= {}^3/_2 \times 30\ (2x30 + 2x145 + 30)$

$= {}^{250800}/_7\ cm^2$

$= 35828.5 cm^2$

60. Base radius of cone = BO = ${}^1/_2 \times 4 = 2$cm

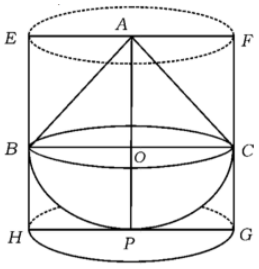
Radius of hemisphere = BO = r = 2cm

Volume of the toy = Volume of hemisphere + Volume of cone

$$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$= \frac{2}{3} x3.14x2^3 + \frac{1}{3} x3.14x2^2 x2$$

$$= 25.12cm^3$$



EFGH is right circular cylinder

Radius of EFGH = HP = BO = r = 2m

Height of EFGH = EH = h

EH = 4cm

Volume required = Volume of right circular cylinder – volume of the toy

$= \pi r^2 h - 25.12$

$= 3.14 \times 2^2 \times 4 - 25.12$

$= 25.12\ cm^3$

61. Height of cylinder = h = Height of cone = 2.4 m

Diameter of cylinder = d = 1.4 m

Radius of cylinder = $^{1.4}/_{2}$ = 0.7 m

Slant height of cone $l^2 = h^2 + r^2$

$l^2 = 2.4^2 + 0.7^2$

$l = 2.5$ m

Radius of cone = r = 0.7 m

TSA of the remaining solid = CSA of cylinder + CSA of cone + base area of cylinder

$= 2\pi rh + \pi rl + \pi r^2$

$= \pi r (2h+l+r)$

$= {}^{22}/_{7} \times 0.7\ (2x2.4+2.5+0.7)$

$= 2.2 \times 8$

$= 17.6\ m^2$

VI. **Five Marks Questions**

62. Surface area of the toy = CSA of toy + CSA of hemisphere + CSA of cone

$$A = 2\pi rh + 2\pi r^2 + \pi rl$$

$$A = \pi r(2h + 2r + l)$$

$$A = \frac{22}{7} x5(2x20 + 2x5 + 13)$$

$$A = \frac{110}{7} x63$$

$$A = 990cm^2$$

$l^2=h^2+r^2$

$13^2=h^2+5^2$

$h^2=144$

$h=12$

Volume of the toy V = Volume of cylinder + Volume of hemisphere + Volume of cone

$$A = \pi r^2 h + \frac{22}{7}\pi r^3 + \frac{1}{3}\pi r^3 h$$

$$A = \pi r^2 \left(h + \frac{2}{3} r + \frac{1}{3} h \right)$$

$$A = \frac{22}{7} x5x5\left(20 + \frac{2}{3} x5 + \frac{1}{3} x12 \right)$$

$$A = \frac{15015}{7} x27.3$$

$$A = 2145cm^3$$

63. d=4.2cm r=2.1cm

height of cylinder = height of cone = 2.8cm

slope of the cone $l^2=h^2+r^2$

$l^2=(2.8)^2+(2.1)^2$

$l^2=12.25$cm

$l^2=(3.5)^2$

l=3.5cm

1. Surface area of the rest part of the Solid.

A= CSA of cylinder + CSA of cone + Area of circle

$$A = 2\pi rh + \pi rl + \pi r^2$$

$$A = 2x\frac{22}{7} x2.1x2.8 + \frac{22}{7} x2.1x3.5 + \frac{22}{7} x2.1x2.1$$

$$A = 36.96 + 23.1 + 13.86$$

$$A = 73.92cm^2$$

64. height of cylinder = 27cm

r=6cm

height of cone = 8cm

slope of cone $l^2=h^2+r^2$

$l^2=8^2+6^2$

$l^2=10^2$

l=10cm

Surface area of Solid = CSA of the cylinder + CSA of hemisphere + CSA of cone

$$A = 2\pi rh + 2\pi r^2 + \pi rl$$
$$A = \pi r[2h + 2r + l]$$
$$A = \pi x6[2x27 + 2x6 + 10]$$
$$A = 6\pi[54 + 12 + 10]$$
$$A = 456\pi cm^2$$
$$A = 456x\frac{22}{7}$$
$$A = 1433.142cm^2$$

V = Volume of the cylinder – volume of hemisphere – volume of cone

$$V = \pi r^2 h - \frac{2}{3}\pi r^3 - \frac{1}{3}\pi r^2 h$$
$$V = \pi\left(6x6x27 - \frac{2}{3}6x6x6 - \frac{1}{3}6x6x8\right)$$
$$V = \pi(972 - 144 - 96)$$
$$V = 732\pi cm^3$$
$$V = 732x\frac{22}{7}$$
$$V = 2300.57cm^3$$

65. Height of the cone $h^2 = l^2 - r^2$

$h^2 = 25^2 - 7^2$

$h^2 = 625 - 49$

$h^2 = 576$

h= 24 cm

Volume of cone = $^1/_3\pi r^2 h$

= $^1/_3$ x $^{22}/_7$ x 7 x 7 x 24

= 1232 cc

Volume of cylinder = 5 x volume of cone

= 5 x 1232

= 6160 cc

Radius of cylinder = 14 cm

Volume of cylinder = $\pi r^2 h$

= $^{22}/_7$ x 14 x 14 x h

h = $^{6160}/_{616}$ = 10 cm

Curved surface area of a cone = 2πrh

=2 x $^{22}/_{7}$ x 14 x 10

= 880 cm^2

66. Radius of the container

CSA of a hemisphere: $2\pi r^2 = 2772$

$$2 \times \frac{22}{7} \times r^2 = 2772$$

$$r^2 = \frac{2772 \times 7}{2 \times 22}$$

$$r^2 = 441$$

$$r = \sqrt{441}$$

$$r = 21cm$$

Maximum amount of water stored:

Height of water in the cylinder= $140 - 20 = 120cm$

Volume of water=$\pi r^2 h$

$$= \frac{22}{7} \times 21^2 \times 120$$

$$= 22 \times 3 \times 21 \times 120$$

$$= 166320cm^3$$

Amount of air in the remaining portion:

Air in the top part of the cylinder=$\pi r^2 h$

$$= \frac{22}{7} \times 21^2 \times 20$$

$$= 22 \times 3 \times 21 \times 20$$

$$= 27720cm^3$$

Air in the hemisphere= $\frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \frac{22}{7} \times 21^3$$

$$= 2 \times 22 \times 21 \times 21$$

$$= 19404cm^3$$

Total air volume: $27720 + 19404 = 47124cm^3$

67. Radius of the cone:

CSA of cone: $\pi rl = 23.1$

$$\frac{22}{7} \times r \times 3.5 = 23.1$$

$$11 \times r = 23.1$$

$$r = \frac{23.1}{11}$$

$$r = 2.1cm$$

Height of the cone: $h_2 = \sqrt{l^2 - r^2}$

$$= \sqrt{3.5^2 - 2.1^2}$$

$$= \sqrt{12.25 - 4.41}$$

$$= \sqrt{7.84}$$

h_2=2.8cm

Total volume of the solid =V cylinder+V cone – V hemisphere

$$= \pi r^2 h_1 + \frac{1}{3}\pi r^2 h_2 - \frac{2}{3}\pi r^3$$

$$= \pi r^2 \left[h_1 + \frac{1}{3}h_2 - \frac{2}{3} r\right]$$

$$= \frac{22}{7} \times 2.1^2 \left[14 + \frac{1}{3} \times 2.8 - \frac{2}{3} \times 2.1\right]$$

$$= 6.6 \times 2.1[14 + 0.93 - 1.4]$$

$$= 13.86 \times 13.53$$

Total volume of the solid $= 187.52cm^2$

68. CSA of the hemisphere:$2\pi r^2=1584/7$

$$2 \times \frac{22}{7} \times r^2 = \frac{1584}{7}$$

$$r^2 = \frac{1584}{7} \times \frac{7}{44}$$

$$r^2 = 36$$

$$r = \sqrt{36}$$

$$r = 6cm$$

Radius of Sphere=Radius of Cylinder=Radius of Cone=6cm

Height of the cylinder h_1=80-8=72cm

Slant height of the cone l=10cm

Height of the cone $h_2=\sqrt{l^2 - r^2}$

$$= \sqrt{10^2 - 6^2}$$

$$= \sqrt{64}$$

h_2=8cm

Volume of the model=$V_{cylinder}+V_{cone}+V_{hemisphere}$

$=\pi r^2 h_1+\frac{1}{3}\pi r^2 h_2 - \frac{2}{3}\pi r^3$

$=\pi r^2 [h_1+\frac{1}{3}h_2 - \frac{2}{3}r]$

$$= \frac{22}{7} \times 6^2 \left[72 + \frac{8}{3} - \frac{2 \times 6}{3}\right]$$

$$= \frac{792}{7} \left[\frac{216 + 8 - 12}{3}\right]$$

$$= \frac{792 \times 212}{7 \times 3}$$

Volume of the model=7995.43cm^3

$$\frac{CSA\ of\ hemisphere}{CSA\ of\ cone} = \frac{2\pi r^2}{\pi rl}$$

$$= \frac{2r}{l}$$

$$= \frac{2 \times 6}{10}$$

$$\frac{CSA\ of\ hemisphere}{CSA\ of\ cone} = \frac{6}{5}$$

CSA of hemisphere : CSA of cone = 6:5

69. Slant height of the cone:l=25cm

height of cone: h_1=24cm

$r = \sqrt{l^2 - h^2}$

$$= \sqrt{25^2 - 24^2}$$

$$= \sqrt{625 - 576}$$

$$= \sqrt{49}$$

$$\therefore r = 7cm$$

Radius of hemisphere = Radius of cylinder = Radius of cone = 7cm

Height of the cone: h_1=24cm

Height of cylinder: h_2=24+7=31cm

Volume of remaining solid=$V_{cylinder}$ - V_{cone}- $V_{hemisphere}$

$=\pi r^2 h_2+\frac{1}{3}\pi r^2 h_1-\frac{2}{3}\pi r^3$

$=\pi r^2 [h_2-\frac{1}{3} h_1-\frac{2}{3} r]$

$= \frac{22}{7} \times 7 \times 7 \left[31 - \frac{24}{3} - \frac{2\times7}{3}\right]$

$= 22 \times 7 \left[\frac{69-24-14}{3}\right]$

$= 154 \left[\frac{69-14}{3}\right]$

$= 154 \times \frac{55}{3}$

$Volume\ of\ remaining\ solid = 2823.33cm^3$

$CSA\ of\ remaining\ solid = CSA_{cylinder} + CSA_{cone} + CSA_{\text{hemisphere}}$

$=2\pi rh_2+\pi rl+2\pi r^2$

$=\pi r[2h+l+2r]$

$$= \frac{22}{7} \times 7[2 \times 31 + 25 + 2 \times 7]$$

$$= 22[62 + 25 + 14]$$

$$= 22 \times 101$$

$CSA\ of\ remaining\ solid = 2222cm^2$

70. Number of lead shots = $\frac{\frac{1}{4}\ X\ volume\ of\ cone}{volume\ of\ each\ lead\ shot}$

$$100 = \frac{\frac{1}{4}X\frac{1}{3}X\pi {r_1}^2 h}{\frac{4}{3}\pi r^3}$$

$$100 = \frac{\frac{1}{12} \times 5^2 \times 8}{\frac{4}{3}r^3}$$

$$100 = \frac{50}{4r^3}$$

$$4r^3 = \frac{50}{100}$$

$$4r^3 = \frac{1}{2}$$

$$r^3 = \frac{1}{8}$$

$$r = \sqrt[3]{\frac{1}{8}}$$

$$r = 0.5cm$$

$\therefore Radius\ of$ each lead shot $= 0.5cm$

$\therefore Volume\ of$ each lead shot $= \frac{4}{3} \times \frac{22}{7} \times 0.5^3$

$$= \frac{2 \times 11 \times 0.5}{21}$$

$$= \frac{11}{21}$$

$\therefore Volume\ of$ each lead shot $= 0.523cm^3$

71. Solid metallic cuboid: $l = 15cm, b = 10cm,$ h= $8cm$

Diameter of Cylinder: $d = 4.2cm,\ r = 2.1cm$

$TSA\ of\ t$he $remaining\ metallic\ block =$
$TSA\ of$ the $metallic\ cuboidal\ block - 3 \times upper\ circular\ areaof$ the $cylinder + 3 \times$ $CSA\ of\ cylinder + 3 \times Base\ circular\ area\ of$ the $cylinder$

$$= 2[lb + bh + hl] - 3\pi r^2 + 3 \times 2\pi rh + 3\pi r^2$$

$$= 2[lb + bh + hl] + 3 \times 2\pi rh$$

$$= 2[15 \times 10 + 10 \times 8 + 8 \times 15] + 3 \times 2 \times \frac{22}{7} \times 2.1 \times 6$$

$$= 2[150 + 80 + 120] + 6 \times 22 \times 1.8$$

$$= 2[350] + 237.6$$

$$= 700 + 237.6$$

$$TSA\ of\ the\ remaining\ metallic\ block = 937.6cm^2$$

$$Reamaining\ volume\ of\ metallic\ block = Volume\ of\ metallic\ block - 3 \times Volume\ of\ cylinder$$

$$= lbh - 3 \times \pi r^2 h$$

$$= 15 \times 10 \times 8 - 3 \times \frac{22}{7} \times 2.1^2 \times 6$$

$$= 1200 - 3 \times 0.3 \times 2.1 \times 6$$

$$= 1200 - 249.48$$

$$= 950.52cm^2$$

$$Reamaining\ volume\ of\ metallic\ block = 950.52cm^2$$

72. Cone: $l = 10cm, CSA = 60\pi\ cm^2$

Cylinder: h=24cm, r=10cm

Height of water=14.4cm

$CSA\ of\ cone = 60\pi\ cm^2$

$\pi rl = 60\pi$

$$r \times 10 = 60$$

$$r = \frac{60}{10}$$

$$r = 6cm$$

Radius of cone = Radius of hemisphere=6cm

Height of cone= $h = \sqrt{l^2 - r^2}$

$= \sqrt{10^2 - 6^2}$

$$= \sqrt{100 - 36}$$

$$= \sqrt{64}$$

$$h = 8cm$$

Let 'h_1' be the height of water raised when solid is immersed:

Volume of solid=Volume of cylinder with height h_1

Volume of cone + Volume of hemisphere=Volume of cylinder with height h_1

$$\frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 = \pi r^2 h_1$$

$$\frac{1}{3} \times \pi \times 6^2 \times 8 + \frac{2}{3} \times \pi \times 6^3 = \pi \times 10^2 \times h_1$$

$$\frac{288\pi}{3} + \frac{432\pi}{3} = \pi \times 100 h_1$$

$$\frac{720\pi}{3} = \pi \times 100 h_1$$

$$\frac{240}{100} = h_1$$

$$h_1 = 2.4cm$$

Height of water raised when solid is immersed $= h_1 = 2.4cm$

Remaining height on cylinder = 24-14.4-2.4=7.2cm

Amount of water still to be filled=Volume of cylinder with height 7.2cm

$$= \pi r^2 h$$

$$= 3.14 \times 10^2 \times 7.2$$

$$= 314 \times 7.2$$

$$= 2260.8cm^3$$

Amount of water still to be filled in the cylinder so that the water level raises up to the brim of the cylinder= $2260.8cm^3$

73. Diameter of cylinder = 10cm, radius $r = \frac{10}{2} = 5cm$ ∴Radius of all the solids is equal.

$\therefore Height\ of\ cylinder\ h = 20cm$

$$Slant\ height\ of\ cone\ l = 13cm$$

$TSA\ of\ the\ toy = CSA\ of\ cylinder + CSAof\ hemisphere + CSA\ of\ cone$

$$A = 2\pi rh + 2\pi r^2 + \pi rl$$

$$A = \pi r[2h + 2r + l]$$

$$A = \frac{22}{7} \times 5[2 \times 20 + 2 \times 5 + 13]$$

$$A = \frac{110}{7} \times 63$$

$$A = 990cm^2$$

Height of cone: $h = \sqrt{l^2 - r^2}$

$$= \sqrt{13^2 - 5^2}$$

$$= \sqrt{169 - 25}$$

$$h = \sqrt{144}$$

$$h = 12cm$$

$Volume\ of\ the\ Toy = V_{cylinder} + V_{hemisphere} + V_{cone}$

$$V = \pi r^2 h + \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h_1$$

$$V = \pi r^2 \left[h + \frac{2}{3}r + \frac{1}{3}h_1\right]$$

$$V = \frac{22}{7} \times 5 \times 5 \left[20 + \frac{2}{3} \times 5 + \frac{1}{3} \times 12\right]$$

$$V = 78.5 \times 27.3$$

$$V = 2143.05cm^3$$

74. $Height\ of\ cylinder: h_1 = 27cm, radius\ r = 6cm$ $Height\ of\ cone: h_2 = 8cm$

$$Slant\ height\ of\ cone: l = \sqrt{{h_2}^2 + r^2}$$

$$l = \sqrt{8^2 + 6^2}$$

$$l = \sqrt{64 + 36}$$

$$l = \sqrt{100}$$

$$l = 10cm$$

$$TSA\ of\ remaining\ solid = CSA_{cylinder} + CSA_{hemisphere} + CSA_{cone}$$

$$A = 2\pi rh + 2\pi r^2 + \pi rl$$

$$A = \pi r[2h + 2r + l]$$

$$A = \frac{22}{7} \times 6[2 \times 27 + 2 \times 6 + 10]$$

$$A = \frac{22}{7} \times 6[54 + 12 + 10]$$

$$A = \frac{22}{7} \times 456$$

$$A = 1432.2cm^2$$

$$Volume\ of\ the\ remaining\ solid = V_{cylinder} - V_{hemisphere} - V_{cone}$$

$$V = \pi r^2 h - \frac{2}{3}\pi r^3 - \frac{1}{3}\pi r^2 h_1$$

$$V = \pi r^2 \left[h - \frac{2}{3}r - \frac{1}{3}h_1\right]$$

$$V = \frac{22}{7} \times 6^2 \left[27 - \frac{2}{3} \times 6 - \frac{1}{3} \times 8\right]$$

$$V = \frac{22}{7} \times 36 \left[27 - 4 - \frac{8}{3}\right]$$

$$V = \frac{22}{7} \times 36 \times \frac{61}{3}$$

$$V = 2299.4cm^3$$

$$Volume\ of\ the\ remaining\ solid = 2299.4cm^3$$

Unit : 13 STATISTICS

I. Multiple Choice Questions

1. B) Mode

2. C) $\frac{upper\ limit+lower\ Limit}{2}$

3. C) 30

4. A) 35

5. B) Median

6. A) 3 Median = 2 Mean + Mode

7. C) size of the class Interval

8 . C) 7

9. B) The height of 50% girls is more than 149.03 cm and height of n50% of the girls is less than 149.03 cm

10. A) $x = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

II. One Mark Questions :

11. 17

12. 20-30

13. 3-5

14. $\overline{X} = \frac{\sum f_i x_i}{\sum f_i}$

15. 40

16. Median = Mean + 3

Mode = 3 Median – 2 Mean

= 3 (Mean + 3) – 2 Mean

Mode = Mean + 9

more than the mean Mode is 9

17. $Median = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$

18. $Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$

19. 3 Median = Mode + 2 Mean

= 12.4 + 2 x 10.5

= 33.4

20. 3 Median = Mode + 2 Mean

3(33) = Mode + 2 (27)

Mode = 99 – 54 = 45

21. 3 Median = Mode + 2 Mean

= 7 + 2 x 8

= 7 + 16

Median =23/3

= 7.66

III. Two Mark questions

22. 3 Median = Mode + 2 Mean

3 x 45.5 = 50.5 + 2 Mean

2 Mean = 136.5−50.5.

Mean = $\frac{86}{2}$

Mean = 43

23.

I-C	f	x	$f_i x_i$
1-5	2	3	6
6-10	3	8	24
11-15	4	13	52
16-20	2	18	36
	.=10		$\Sigma f_i\, x_i$.=118

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i}$$

$$= \frac{118}{10}$$

$$= 11.8$$

IV. THREE MARKS QUESTIONS :

24.

I -C	f	x_i	$f_i x_i$
45 - 55	3	50	150
55 – 65	10	60	600
65 – 75	11	70	770
75 – 85	8	80	640
85 – 95	3	90	270
	Σ,f .=35		$\Sigma f_i\, x_i$=2430

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{2400}{35} = 69.42$$

25.

I -C	f	x_i	$f_i x_i$
1 – 3	2	2	4
3 – 5	5	4	20
5 – 7	8	6	48
7 – 9	3	8	24
9 – 11	2	10	20
	Σ,f-i .=20		$\Sigma f_i\, x_i$.=116

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{116}{20} = 5.8$$

26.

I –C	f	x_i	$f_i x_i$
10-14	2	12	24
15-19	3	17	51
20-24	5	22	110
25-29	3	27	81
30-34	2	32	64
	Σ,f_i .=15		$\Sigma f_i\, x_i$=330

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{330}{15} = 22$$

27.

I -C	f	x_i	$f_i x_i$
0 - 10	4	5	20
10 - 20	9	15	135
20 - 30	15	25	375
30 - 40	14	35	490
40 - 50	8	45	360
	Σ,f_i =50		$\Sigma f_i\, x_i = 1380$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{1380}{50} = 27.6$$

28.

I -C	f	x_i	$f_i x_i$
11 - 13	7	12	84
13 - 15	6	14	84
15 - 17	9	16	144
17 - 19	13	18	234
19 - 21	x	20	20x
21 - 23	5	22	110
23 - 25	4	24	96
	Σf_i =44+x		$\Sigma f_i x_i$ = 752+20x

.

$$\overline{X} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$18 = \frac{752+20x}{44+x}$$

$$792 + 18x = 752 + 20x$$

$$40 = 2x$$

$$x = \frac{40}{2} = 20$$

29.

I - C	f	x_i	$f_i x_i$
15-25	8	20	160
25-35	12	30	360
35-45	15	40	600
45-55	9	50	450
55-65	6	60	360
	Σf_i =50		$\Sigma f_i x_i$=1930

$$\overline{X} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{1930}{50} = 38.6$$

30.

I -C	f	x_i	$f_i x_i$
10-20	2	15	30
20-30	3	25	75
30-40	5	35	175
40-50	7	45	315
50-60	3	55	165
	.=20		$\Sigma f_i x_i$.=760

$$\overline{X} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{760}{20} = 38$$

31.

I –C	f	x_i	$f_i x_i$
10-20	2	15	30
20-30	3	25	75
30-40	6	35	210

40-50	5	45	225
50-60	4	55	220
	$\Sigma f_i = 20$		$\Sigma f_i x_i = 760$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{760}{20} = 38$$

32.

I -C	f	x_i	$f_i x_i$
10-20	2	15	30
20-30	5	25	125
30-40	6	35	210
40-50	5	45	225
50-60	2	55	110
	$\Sigma f_i = 20$		$\Sigma f_i x_i = 700$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{700}{20} = 35$$

33.

I -C	f	x_i	$f_i x_i$
10-20	4	15	60
20-30	6	25	150
30-40	5	35	175
40-50	4	45	180
50-60	1	55	55
	$\Sigma f_i = 20$		$\Sigma f_i x_i = 620$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{620}{20} = 31$$

34.

I -C	f	x_i	$f_i x_i$
5-15	1	10	10
15-25	3	20	60
25-35	5	30	150
35-45	4	40	160
45-55	2	50	100
	Σ,f-i .=15		$\Sigma f_i\, xi = 480$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{480}{15} = 32$$

35.

I -C	f	x_i	$f_i\, x_i$
5 - 15	4	10	40
15 - 25	6	20	120
25 - 35	5	30	150
35 - 45	6	40	240
45 - 55	4	50	200
	$\Sigma f_i = 25$		$\Sigma f_i\, x_i = 750$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{750}{25} = 30$$

36.

I -C	f	x_i	$f_i\, x_i$
2 - 6	4	4	16
6 – 10	8	8	64
10 – 14	2	12	24
14 – 18	1	16	16
18 - 22	5	20	100
	$\Sigma f_i = 20$		$\Sigma f_i\, x_i = 220$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{220}{20} = 11$$

37.

L=20

Cf_i =13

h =10

f=20

$\frac{N}{2} = \frac{55}{2} = 27.5$

C - I	f	Cf_i
0-10	5	5
10-20	8	13
20-30	20	33
30-40	15	48
40-50	7	55
	N=55	

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h = 20 + \left(\frac{27.5 - 13}{20}\right) \times 10$$

$= 20 + \left(\frac{145}{20}\right)$

$= 20 + 7.25$

$= 27.25$

38

C . I	f	x_i	$f_i\, x_i$
1 - 5	4	3	12
6 - 10	3	8	24
11 - 15	2	13	26
16 - 20	1	18	18
20 - 25	5	23	115
	$\Sigma f_i = 15$		$\Sigma f_i\, x_i = 195$

$$\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{195}{15} = 13$$

39.

L=250

$Cf_i = 14$

h =50

f=20

$$\frac{N}{2} = \frac{44}{2} = 22$$

C . I	f	Cf_i
100-150	6	6
150-200	3	9
200-250	5	14
250-300	20	34
300-350	10	44
	N=44	

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 250 + \left(\frac{22 - 14}{20}\right) \times 50$$

$$= 250 + \left(\frac{400}{20}\right)$$

$$= 250 + 20$$

$$= 270$$

40.

L=70

Cf_i =15

h =10

f=20

$$\frac{N}{2} = \frac{50}{2} = 25$$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 70 + \left(\frac{25 - 15}{20}\right) \times 10$$

$$= 70 + \left(\frac{100}{20}\right)$$

$$= 70 + 5 = 75$$

C.I	f	Cf_i
50-60	6	6
60-70	9	15
70-80	20	35
80-90	10	45
90-100	5	50
	N=50	

41.

L=70

Cf_i =13

h =10

f=10

$\frac{N}{2} = \frac{30}{2} = 15$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 70 + \left(\frac{15 - 13}{10}\right) \times 10$$

$$= 70 + \left(\frac{20}{20}\right) = 70 + 1 = 71$$

C.I	f	Cf_i
50-60	5	5
60-70	8	13
70-80	10	23
80-90	4	27
90-100	3	30
	N=30	

42.

L=21

Cf_i =13

h =10

f=20

$\frac{N}{2} = \frac{55}{2} = 27.5$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 21 + \left(\frac{27.5 - 13}{20}\right) \times 10$$

$$= 21 + \left(\frac{145}{20}\right) = 21 + 7.25$$

$$= 28.25$$

C.I	f	Cf_i
1-10	5	5
11-20	8	13
21-30	20	33
31-40	15	48
41-50	7	55
	N=55	

43.

L=40
Cf_i =11
h =20
f=9

$$\frac{N}{2} = \frac{26}{2} = 13$$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 40 + \left(\frac{13 - 11}{9}\right) \times 20 = 40 + \left(\frac{40}{9}\right)$$

$$= 40 + 4.4 = 44.44$$

C.I	f_i	Cf_i
0-20	6	6
20-40	5	11
40-60	9	20
60-80	4	24
80-100	2	26
	N=26	

44

L=60
Cf_i =22
h =20
f=20

$$\frac{N}{2} = \frac{48}{2} = 24$$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 60 + \left(\frac{24 - 22}{20}\right) \times 20$$

$$= 60 + \left(\frac{40}{20}\right) = 60 + 2 = 62$$

C.I	f_i	Cf_i
20-40	7	7
40-60	15	22
60-80	20	42
80-100	2	44
100-120	4	48
	N=48	

45.

L=60

Cf_i =22

h =20

f=20

$\frac{N}{2} = \frac{50}{2} = 25$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 60 + \left(\frac{25 - 22}{20}\right) \times 20$$

C.I	f_i	Cf_i
20 - 40	7	7
40 - 60	15	22
60 - 80	20	42
80 - 100	8	50
	N=50	

$$= 60 + \left(\frac{3}{20}\right) 20$$

$$= 60 + 3$$

$$= 63$$

46.

L=40

Cf_i =15

h =20

f=10

$\frac{N}{2} = \frac{40}{2} = 20$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h = 40 + \left(\frac{20 - 15}{10}\right) \times 20$$

$$= 40 + \left(\frac{5}{10}\right) \text{X } 20 = 40 + 10 = 50$$

C.I	f_i	Cf_i
0 – 20	6	6
20 – 40	9	15
40 – 60	10	25
60 – 80	8	33
80 - 100	7	40
	N=40	

47.

C.I	f	Cf_i
5-15	1	1
15-25	3	4
25-35	5	9
35-45	7	16
45-55	2	18
	N=18	

L=25

Cf_i =4

h =10

f=5

$\frac{N}{2} = \frac{18}{2} = 9$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 25 + \left(\frac{9-4}{5}\right) \times 10$$

$$= 25 + \left(\frac{50}{5}\right)$$

$$= 25 + 10$$

$$= 35$$

48.

C.I	f	Cf_i
5-15	3	3
15-25	4	7
25-35	8	15
35-45	7	22
45-55	3	25
	N=25	

L=25

Cf_i =7

h =10

f=8

$\frac{N}{2} = \frac{25}{2} = 12.5$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 25 + \left(\frac{12.5-7}{8}\right) \times 10$$

$$= 25 + \left(\frac{55}{8}\right) = 25 + 6.87$$

$$= 31.87$$

49

$$Median = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 25 + \left(\frac{15-7}{8}\right) \times 10$$

$$= 25 + \left(\frac{55}{8}\right) = 25 + 6.87 = 31.87$$

C.I	f	Cf_i
15-20	4	4
20-25	5	9
25-30	10	19
30-35	5	24
35-40	6	30
	N=30	

50.

L=55.5

Cf_i =125

h =2

f=135

$$\frac{N}{2} = \frac{400}{2} = 200$$

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF_i}{f}\right) \times h$$

$$= 55.5 + \left(\frac{200-125}{135}\right) \times 2$$

$$= 55.5 + \left(\frac{150}{135}\right) = 55.5 + 1.11 = 56.61$$

C.I	f	Cf_i
50-52	15	15
53-55	110	125
56-58	135	260
59-61	115	375
62-64	25	400
	N=400	

51.

L=7

Cf_i =36

h =3

f=40

$$\frac{N}{2} = \frac{100}{2} = 50$$

C.I	f	Cf_i
1 - 4	6	6
4 - 7	30	36
7 - 10	40	76
10 - 13	16	92
13 - 16	4	96
16 - 19	4	100
	N=100	

$$\text{Median} = \text{L} + \left(\frac{\frac{\text{N}}{2} - \text{CF}_\text{i}}{\text{f}}\right) \times \text{h} \;=\; 7 + \left(\frac{50-36}{40}\right) \times 3 \;= 7 + \left(\frac{14}{40}\right) 3 = 7 + 1.05 = 8.05$$

52.

Here class interval of the mode is 30 - 40

C.I	f
10-20	6
20-30	4
30-40	12
40-50	3
50-60	5

L =30

f_0 =4

f_1 =12

f_2 =3

$h = 10$

$$MODE = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 30 + \left[\frac{12-4}{2(12) - 4 - 3}\right] \times 10$$

$$= 30 + \left[\frac{8}{17}\right] \times 10$$

$$= 30 + 4.7$$

$$= 34.7$$

53.

Here class interval of the mode is 15 - 20

C.I	f
5-10	3
10-15	5
15-20	8
20-25	4
25-30	5

L =15

f_0 =5

f_1 =8

f_2 =4

h =5

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 15 + \left[\frac{8-5}{2(8) - 5 - 4}\right] \times 5 = 15 + \left[\frac{3}{7}\right] \times 10 = 15 + 4.28 = 19.28$$

54.

Here class interval of the mode is 3 - 5

C.I	f
1-3	7
3-5	8
5-7	2
7-9	2
9-11	1

L =3

f_0 =7

f_1 =8

f_2 =2

h =2

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 3 + \left[\frac{8 - 7}{2(8) - 7 - 2}\right] \times 2$$

$$= 3 + \left[\frac{1}{7}\right] \times 10 = 3 + 1.42 = 4.42$$

55.

Here class interval of the mode is 60 – 80

C.I	f
0-20	10
20-40	35
40-60	52
60-80	61
80-100	38

L =60

f_0 =52

f_1 =61

f_2 =38

h =20

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 60 + \left[\frac{61 - 52}{2(61) - 52 - 38}\right] \times 20$$

$$= 60 + \left[\frac{9}{32}\right] \times 20$$

$$= 60 + 5.625$$

$$= 65.625$$

56.

Here class interval of the mode is 20 -30

C.I	f
0-10	6
10-20	9
20-30	15
30-40	9
40-50	1

L =20

f_0 =9

f_1 =15

f_2 =9

h =10

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 20 + \left[\frac{15 - 9}{2(15) - 9 - 9}\right] \times 10 = 20 + \left[\frac{6}{12}\right] \times 10 = 20 + 5 = 25$$

57.

Here class interval of the mode is 20 - 30

C.I	f
0-10	7
10-20	9
20-30	15
30-40	11
40-50	8

L =20

f_0 =9

f_1 =15

f_2 =11

h =10

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h \ = 20 + \left[\frac{15 - 9}{2(15) - 9 - 11}\right] \times 10 = 20 + \left[\frac{6}{10}\right] \times 10 = 20 + 6 = 6$$

58.

Here class interval of the mode is 10 - 20

C.I	f
0-10	7
10-20	8
20-30	2
30-40	2
40-50	1

L =10

f_0 =7

f_1 =8

f_2 =2

h =10

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 10 + \left[\frac{8-7}{2(8)-7-2}\right] \times 10 = 10 + \left[\frac{1}{7}\right] \times 10 = 10 + 1.42 = 11.42$$

59.

C.I	f
1-3	7
4-6	8
7-9	2
10-12	2
13-15	1

Here class interval of the mode is 4 - 6

L =3.5

f_0 =7

f_1 =8

f_2 =2

h =2

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h \ = 3.5 + \left[\frac{8-7}{2(8)-7-2}\right] \times 2 = 3.5 + \left[\frac{1}{7}\right] \times 2 = 3.5 + 0.28 = 3.78$$

60.

Here class interval of the mode is 25 - 35

C.I	f
5-15	3
15-25	4
25-35	8
35-45	7
45-55	3

L =25

f_0 =4

f_1 =8

f_2 =7

$h = 10$

$$Mode \ = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 25 + \left[\frac{8-4}{2(8)-4-7}\right] \times 10$$

$$= 25 + \left[\frac{4}{5}\right] \times 10$$

$$= 25 + 8$$

$$= 33$$

61.

Here class interval of the mode is 20 - 30

C.I	f
10-20	3
20-30	9
30-40	6
40-50	7
50-60	5

L =20

f_0 =3

f_1 =9

f_2 =6

h =10

$$Mode = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 20 + \left[\frac{9 - 3}{2(9) - 3 - 6}\right] \times 10$$

$$= 20 + \left[\frac{6}{9}\right] \times 10$$

$$= 20 + 6.66$$

$$= 26.66$$

Unit – 14 Probability

I. Multiple choice questions :

1) A) 1

2) B) 0

3) B) 2

4) C) 4

5) D) 6

6) B) -1.5

7) A) $\frac{1}{5}$

8) A) $\frac{3}{6}$

9) B) 0.95

10) B) $\frac{5}{26}$

11) B) 0.25

12) C) 36

13) C) $\frac{1}{4}$

14) A) $\frac{2}{6}$

15) B) $\frac{21}{28}$

16) C) $\frac{4}{12}$

17) B) $\frac{1}{365}$

18) B) $0 \leq P(E) \leq 1$

19) D) 0

20) C) 0.5

21) A) $\frac{1}{2}$

22) C) 0.7

23) C) 1

24) A)$\frac{1}{5}$

25) B) $\frac{2}{3}$

26) C) $\frac{3}{7}$

II. One Mark Questions :

27) S={T,R,I,A,N,G,L,E} n(S)=8

A= {A, I , E} n(A)=3 ∴P(A)=$\frac{n(A)}{n(S)}$= $\frac{3}{8}$

28) P(A) + P$(\overline{A})$=1

29) P(E) + P$(\overline{E})$= 1 , P$(\overline{E})$=1-0.05=0.95

30) P(E) + P$(\overline{E})$= 1 , Probability of not raining = P$(\overline{E})$=1-0.75=0.25

31) P(A) + P$(\overline{A})$= 1 , P$(\overline{A})$=1 - $\frac{2}{3}$ = $\frac{1}{3}$

32) P(B) + P$(\overline{B})$= 1 , P$(\overline{B})$ = 1-0.65=0.35

33) S={1,2,3,4,5,6} , n(S)=6

A= {6} n(A)=1

∴Probability of getting number 6 =P(A)=$\frac{n(A)}{n(S)}$=$\frac{1}{6}$

34) S={ H,T } n(S)=2

A={H} n(A)=1

∴Probability of getting head=P(A)=$\frac{n(A)}{n(S)}$= $\frac{1}{2}$

35) P(E) + P$(\overline{E})$= 1 , Probability of losing the same game= P$(\overline{E})$= 1-0.8 = 0.2

36) P$(\overline{A})$ $= 1 - P(A)$

=1-80%

=1-80/100g

=1-4/5

= 1/5

37) All possible outcomes={ HH,HT,TH,TT}

n(S)=4

III. **Two marks questions :**

38) S={ HH,HT,TH,TT} n(S)=4

i) A={HT,TH} n(A)=2 ∴P(A)=$\frac{n(A)}{n(S)}$= $\frac{2}{4}$= $\frac{1}{2}$

ii) B={HH,HT,TH} n(B)=3 ∴ P(A)=$\frac{n(B)}{n(S)}$= $\frac{3}{4}$

39) S={1,2,3,4,5,6}n(S)=6

A= {3,4,5} n(A)=3 ∴P(A)=$\frac{n(A)}{n(S)}$= $\frac{3}{6}$= $\frac{1}{2}$

40) S={(1,1),(1,2) ,(1,3),(1,4),(1,5),(1,6)
(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
(3,1),(3,2) ,(3,3),(3,4),(3,5),(3,6)
(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2) ,(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)} n(S)=36

A={ (3,2)(2,3),(4,1)(1,4)} n(A)= 4

∴P(A)=$\frac{n(A)}{n(S)}$= $\frac{4}{36}$= $\frac{1}{9}$

41) S={(1,1),(1,2) ,(1,3),(1,4),(1,5),(1,6)
(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
(3,1),(3,2) ,(3,3),(3,4),(3,5),(3,6)
(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2) ,(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)}
n(S)=36

A={ (4,6),(6,4),(5,5)} n(A)= 3

∴P(A)=$\frac{n(A)}{n(S)}$= $\frac{3}{36}$= $\frac{1}{12}$

42) S={(1,1),(1,2) ,(1,3),(1,4),(1,5),(1,6)

(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
(3,1),(3,2) ,(3,3),(3,4),(3,5),(3,6)
(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2) ,(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)}

n(S)=36

A={(4,4),(4,5),(5,4),(5,5),(4,6),(6,4),(6,5),(5,6),(6,6)}

n(A)=9

$\square$P(A)=$\frac{n(A)}{n(S)}$= $\frac{9}{36}$= $\frac{1}{4}$

43)

P(A) + P($\overline{A}$)= 1 $\frac{1}{2}$ P($\overline{A}$)+ P($\overline{A}$)=1 $\Rightarrow$ P($\overline{A}$)= $\frac{2}{3}$	$\frac{P(A)}{P(\overline{A})} = \frac{1}{2}$ P($\overline{A}$)= 2 P(A) $\Rightarrow$P(A)= $\frac{1}{2}$ P($\overline{A}$)

44) S={1,2,3,4,5,6,7,8}n(S)=8

A= {2,4,6,8} n(A)= 4 $\square$P(A)= $\frac{n(A)}{n(S)}$= $\frac{4}{8}$= $\frac{1}{2}$

45) S={2,3,4,5,6,.....25} n(S) = 24

i) n(A) ={2,4,6,8,.....,24} n(A) = 9

$\square$ P(A)=$\frac{n(A)}{n(S)}$= $\frac{9}{24}$

ii) n(B) = { 4,9,16,25} n(B)=4

$\square$ P(B)=$\frac{n(B)}{n(S)}$= $\frac{4}{24}$

46) n(S)=6+5+4=15

i) n(A)=6+5=11

 P(A)=$\frac{n(A)}{n(S)}$= $\frac{11}{15}$

ii) n(B) = 6

 P(B)=$\frac{n(B)}{n(S)}$= $\frac{6}{15}$=$\frac{2}{5}$

47) n(S)=3 Number of defective mangoes = 36× $\frac{1}{4}$ = 9

⇒Number of good mangoes = 36-9 =27

n(A)=27

Probability of drawing a good mango= P(A)= $\frac{n(A)}{n(S)}$= $\frac{27}{36}$

48) P(A) + P($\overline{A}$)= 1 P(A) : P($\overline{A}$)= 5 : 11

P(A) + P($\overline{A}$)= 1 $\frac{5}{11}$ P($\overline{A}$)+ P($\overline{A}$)=1 ⇒P($\overline{A}$) $\frac{60}{11}$ =1 ⇒ P($\overline{A}$)=$\frac{11}{60}$ ∴ P(A)=$\frac{5}{60}$	$\frac{P(A)}{\mathrm{P}(\overline{A})} = \frac{5}{11}$ ⇒P(A) =P($\overline{A}$) $\frac{5}{11}$

49) Probability of drawing a defective watch = P (A)=$\frac{50}{500}$ =$\frac{1}{10}$

50) S={1,2,3,4,5,6} n(S)=6

A={2,4,5,6} n(A)= 4 P(A)=$\frac{n(A)}{n(S)}$=$\frac{4}{6}$ = $\frac{2}{3}$

51) S={(1,1),(1,2) ,(1,3),(1,4),(1,5),(1,6)
(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
(3,1),(3,2) ,(3,3),(3,4),(3,5),(3,6)

(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2) ,(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)} n(S)=36

A={(1,5),(5,1),(2,4),(4,2),(3,3)} n(A)=5

P(A)=$\frac{n(A)}{n(S)}=\frac{5}{36}$

52) S={ HH,HT,TH,TT} n(S)=4

i) A={HH,} n(A)=1 P(A)=$\frac{n(A)}{n(S)}=\frac{1}{4}$

ii) B={HT,TH} n(B)=2 P(A)=$\frac{n(B)}{n(S)}=\frac{2}{4}=\frac{1}{2}$

53) S={1,2,3,4,5,6} n(S)=6

a) A={2,4,6} n(A)=3 P(A)=$\frac{n(A)}{n(S)}=\frac{3}{6}=\frac{1}{2}$

b) B={1,4} n(B)=2 P(B)=$\frac{n(B)}{n(S)}=\frac{2}{6}=\frac{1}{3}$

54) S={A,B,C,D,E,I} n(S)=6

A={A,E,I } n(A)=3,

P(A)=$\frac{n(A)}{n(S)}=\frac{3}{6}=\frac{1}{2}$

55) n(B)=6 n(R) =? n(S)=?

P(B)=$\frac{n(B)}{n(S)}\frac{3}{8}=\frac{6}{n(s)}\Longrightarrow$n(S)=16 $\therefore n(R)=16-6=10$

P(R)=$\frac{n(R)}{n(S)}$

P(R) =$\frac{5}{8}$

56) S={1,2,3,4,1,5} n(S)=6

A={1,1,4} n(A)=3 P(A)= $\frac{n(A)}{n(S)}=\frac{3}{6}=\frac{1}{2}$

57) n(S)=20 A={1,8} n(A)=2

P(A)=$\frac{n(A)}{n(S)}=\frac{2}{20}=\frac{1}{10}$

IV. Three marks questions

58) S={1,2,3,4,5,6} n(S)=6

i) A=Greater than 2= {3,4,5,6} n(A) =4 ⇒ P(A)=$\frac{n(A)}{n(S)}$= $\frac{4}{6}$ =$\frac{2}{3}$

ii) B= Less than or equal to 2={1,2} n(B) =2 ⇒ P(B)=$\frac{n(B)}{n(S)}$= $\frac{2}{6}$ =$\frac{1}{3}$

iii) C= Not more than 2 is same as 'less than or equal to 2= {1,2} n(C) = 2 ⇒ P(C)=$\frac{n(C)}{n(S)}$= $\frac{2}{6}$ = $\frac{1}{3}$

59) S = { HH,HT,TH,TT} n(S)=4

i)A={HH,HT,TH} n(A)=3 ⇒ P(A)=$\frac{n(A)}{n(S)}$= $\frac{3}{4}$

ii) B={HH} n(B) = 1 P(B)=$\frac{n(B)}{n(S)}$= $\frac{1}{4}$

iii) C={TT} n(C) = 1 P(B)=$\frac{n(C)}{n(S)}$= $\frac{1}{4}$

60) S={5,6,7,8,……,30} n(S)=26

i) A={6,12,18,24,30} n(A)=5 P(A)=$\frac{n(A)}{n(S)}$ =$\frac{5}{26}$

ii) B= {9,16,25 } n(B) = 3 ⇒ P(B)=$\frac{n(B)}{n(S)}$= $\frac{3}{26}$

iii) C={6,9,12,15,18,21,24,27,30} n(C) =9 ⇒ P(C)=$\frac{n(C)}{n(S)}$= $\frac{9}{26}$

61) n(S)= 3+5+8=16

a) A= Getting a red ball n(A) =3

P(A)=$\frac{n(A)}{n(S)}$ =$\frac{3}{16}$

b) B= Not getting a white ball n(B)=11,

⇒ P(B)=$\frac{n(B)}{n(S)}$= $\frac{11}{16}$

62) S={1,2,3,4,……,20} n(S)=20

i) A= {1,4,9,16 } n(A) = 4 ⇒ P(A)=$\frac{n(A)}{n(S)}$= $\frac{4}{20}$

ii) B= {6,12,18} n(B)=3 ⇒ P(B)=$\frac{n(B)}{n(S)}$=$\frac{3}{20}$

63) P(W)+P(B)+P(R) = 1

$\frac{3}{10}+\ \frac{2}{5}+\ P(R)=1$

$P(R)=\frac{3}{10}$

P(B)=$\frac{2}{5}$ ∵ n(B)=20

$\frac{n(B)}{n(S)}=\frac{2}{5}\Rightarrow\frac{20}{n(S)}=\frac{2}{5}\Rightarrow$ n(S)=50

64) n(S) = 50,

i) A= less than 34 n(A)=8 ∴ P(A)=$\frac{n(A)}{n(S)}=\frac{8}{50}$

ii) B= Between 71-90 , n(B)=11 ∴ P(B)=$\frac{n(B)}{n(S)}=\frac{11}{50}$

iii)C= more than 90 , n(C)=8 ∴ P(C)=$\frac{n(C)}{n(S)}=\frac{8}{50}$

65) S = { 1, 2, 3, 4, ……., 20} n(S) = 20

(i) A= {2,4,8,10,14,16,20} n(A) = 7

P(A) = $\frac{n(A)}{n(S)}=\frac{7}{20}$

(ii) B={1} n(B) = 1

P(A) = $\frac{n(B)}{n(S)}=\frac{1}{20}$

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