SAMPLE PAPER TEST 1 FOR BOARD EXAM 2025

SUBJECT: MATHEMATICS — **MAX. MARKS : 80**
CLASS : X — **DURATION : 3 HRS**

General Instruction:

1. This Question Paper has 5 Sections A-E.
2. **Section A** has 20 MCQs carrying 1 mark each.
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A

Questions 1 to 20 carry 1 mark each.

1. If the sum of LCM and HCF of two numbers is 1260 and their LCM is 900 more than their HCF, then the product of two numbers is
(a) 205400 (b) 203400 (c) 194400 (d) 198400

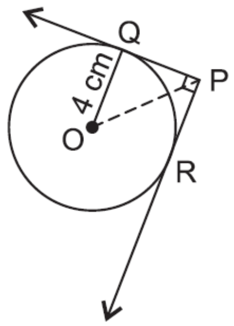
2. If the zeroes of the quadratic polynomial $x^2 + (a + 1)x + b$ are 2 and -3, then
(a) a = -7, b = -1 (b) a = 5, b = -1 (c) a = 2, b = –6 (d) a = 0, b = –6

3. If cos A = 4/5, then the value of tan A is
(a) 3/5 (b) 3/4 (c) 4/3 (d) 5/3

4. If $\cos \theta + \cos^2 \theta = 1$, the value of $\sin^2 \theta + \sin^4 \theta$ is :
(a) –1 (b) 0 (c) 1 (d) 2

5. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is:
(a) 4 (b) 3 (c) 2 (d) 1

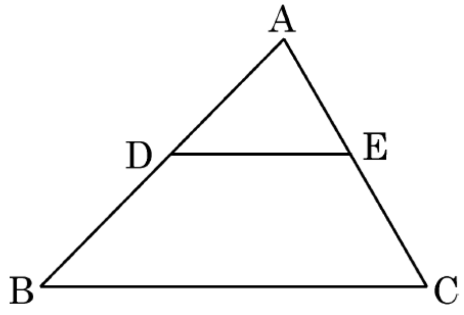
6. In the given figure, from an external point P, two tangents PQ and PR are drawn to a circle of radius 4 cm with centre O. If ∠QPR = 90°, then length of PQ is



(a) 3 cm (b) 4 cm (c) 2 cm (d) 2.2 cm

7. If the diagonals of a quadrilateral divide each other proportionally, then it is a:
(a) parallelogram (b) rectangle (c) square (d) trapezium

8. In ΔABC, DE || BC(as shown in the figure). If AD = 2cm, BD = 3cm, BC = 7.5cm, then the length of DE(in cm) is:
(a) 2.5 (b) 3 (c) 5 (d) 6



9. The HCF and the LCM of 12, 21, 15 respectively are
(a) 3, 140 (b) 12, 420 (c) 3, 420 (d) 420, 3

10. A pair of irrational numbers whose product is a rational number is:
(a) (√16, √4) (b) (√5, √2) (c) (√3, √27) (d) (√36, √2)

11. If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is:
(a) 1/3 (b) 2/3 (c) 4/9 (d) 5/9

12. The pair of linear equations x + 2y + 5 = 0 and - 3x = 6y - 1 has
(a) unique solution (b) exactly two solutions
(c) infinitely many solutions (d) no solution

13. The common difference of the A.P. $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}, ...$ is
(a) -2x (b) -2 (c) 2 (d) 2x

14. Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the dice is 7 is
(a) 7/36 (b) 2/36 (c) 0 (d) 1/36

15. The probability of guessing the correct answer to a certain test question is x/6. If the probability of not guessing the correct answer to this question is 2/3 then the value of x is :
(a) 2 (b) 3 (c) 4 (d) 6

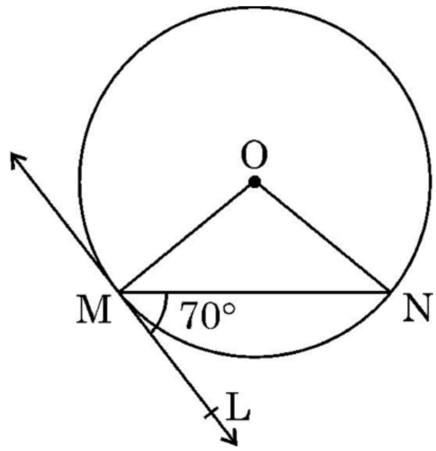
16. Consider the following frequency distribution

Class	0 – 5	6 – 11	12 – 17	18 – 23	24 – 29
Frequency	13	10	15	8	11

The upper limit of the median class is
(a) 7 (b) 17.5 (c) 18 (d) 18.5

17. Perimeter of a sector of a circle whose central angle is 90° and radius 7cm is:
(a) 35cm (b) 11cm (c) 22cm (d) 25cm

18. In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of ∠MON is:
(a) 120° (b) 140° (c) 70° (d) 90°



Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A
(c) A is true and R is false
(d) A is false and R is true

19. Assertion (A): The mid-point of the line segment joining the points A (3, 4) and B (k, 6) is P (x, y) and x + y – 10 = 0, the value of k is 7

Reason (R): Midpoint of line segment is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

20. Assertion(a): In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is 4/5.
Reason(R): P(E) + P(not E) = 1

SECTION-B

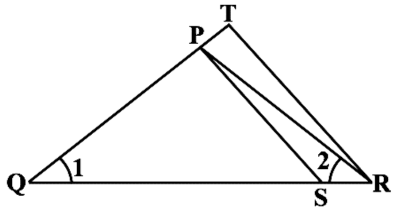
Questions 21 to 25 carry 2M each

21. (a) Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7,1) and B(3,5).

OR

(b) Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle.

22. In the figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, Show that $\Delta PQS \sim \Delta TQR$.



23. If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$, $0^0 < A + B \leq 90^0$, A > B. Find A and B.

24. One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn (i) is queen of hearts; (ii) is not a jack.

25. (a) If 2x + y = 13 and 4x – y = 17, find the value of (x – y).

OR

(b) Sum of two numbers is 105 and their difference is 45. Find the numbers.

SECTION-C

Questions 26 to 31 carry 3 marks each

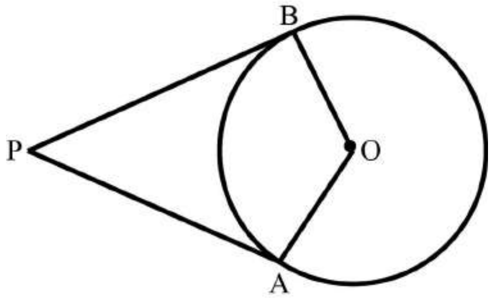
26. If a, b are the zeroes of the polynomial $2x^2 - 5x + 7$, then find a polynomial whose zeroes are 2a + 3b, 3a + 2b

27. Solve the following system of linear equations graphically: x – y + 1 = 0 and x + y = 5

28. Find the ratio in which the line 2x + y – 4 = 0 divides the line segment joining the points A (2, –2) and B (3, 7)

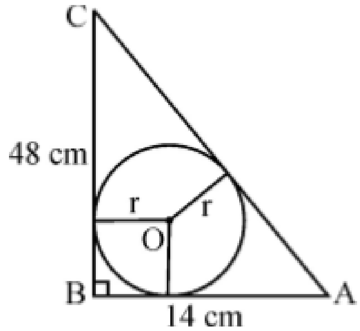
29. Prove that $\frac{\cos A}{1+\sin A}+\frac{1+\sin A}{\cos A}=2\sec A$

30. In the given figure, PA and PB are the tangent segments to a circle with centre O. Show that the points A, O, B and P are concyclic.



OR

In the given figure, ABC is a triangle in which ∠B = 90°, BC = 48 cm and AB = 14 cm. A circle is inscribed in the triangle, whose centre is O. Find radius r of in-circle.



SECTION-D

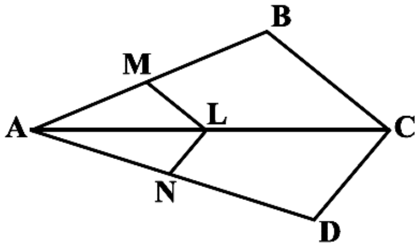
Questions 32 to 35 carry 5M each

31. A train, travelling at a uniform speed for 360 km, would have taken 48 minutes less to travel the same distance if its speed were 5 km/h more. Find the original speed of the train.

OR

Two water taps together can fill a tank in 6 hours. The tap of larger diameter takes 9 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

32. Prove that if a line is a drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio. Using the above theorem. Prove that $\frac{AM}{MB} = \frac{AN}{ND}$ if LM || CB and LN || CD as shown in the figure.

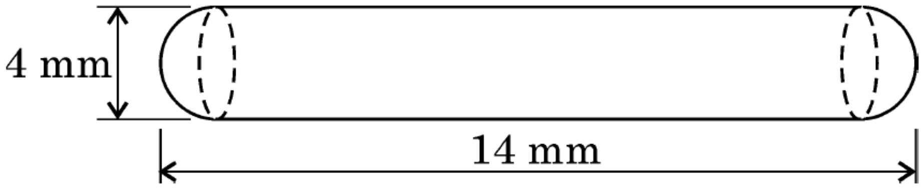


33. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20m high building are 45° and 60° respectively. Find the height of the tower.

34. (a) A solid iron pole consists of a solid cylinder of height 200cm and base diameter 28cm, which is surmounted by another cylinder of height 50cm and radius 7cm. Find the mass of the pole, given that $1cm^3$ of iron has approximately 8g mass.

OR

(b) A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14mm and the diameter of the capsule is 4mm, find its surface area. Also, find its volume.



SECTION-E (Case Study Based Questions)

Questions 36 to 38 carry 4M each

35. Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.

Now, Mukta asked some questions as given below to the students :

(i) What is the least prime number used by students? (1)

(ii) (a) How many students are in the class? (2)

OR

(b) What is the highest prime number used by students? (2)

(iii) Which prime number has been used maximum times ? (1)

36. Mutual Fund : A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds or other securities. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors.

Net Asset Value (NAV) represents a fund's per share market value. It is the price at which the investors buy fund shares from a fund company and sell them to a fund company.

The following table shows the Net Asset Value (NAV) per unit of mutual fund of ICICI mutual funds:

NAV (in Rs.)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Number of mutual funds	13	16	22	18	11

Based on the above information, answer the following questions :

(i) What is the upper limit of modal class of the data? (1)

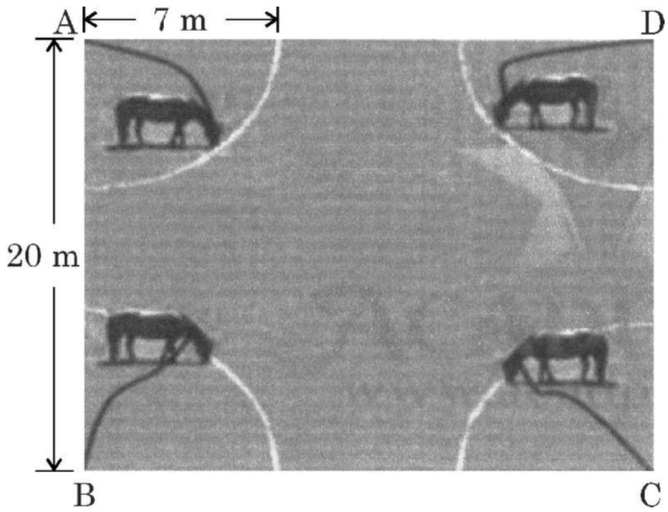
(ii) What is the median class of the data? (1)

(iii) (a) What is the mode NAV of mutual funds ? (2)

OR

(b) What is the median NAV of mutual funds ? (2)

37. A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.



Based on the above, answer the following questions :

(i) Find the area of the square shaped grass field. (1)

(ii) (a) Find the area of the total field in which these horses can graze. (2)

OR

(b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$) (2)

(iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm? (1)

SAMPLE PAPER TEST 1 FOR BOARD EXAM 2025
(ANSWERS)

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SECTION – A
Questions 1 to 20 carry 1 mark each.

1. If the sum of LCM and HCF of two numbers is 1260 and their LCM is 900 more than their HCF, then the product of two numbers is
(a) 205400 (b) 203400 (c) 194400 (d) 198400
Ans: (c) 194400
Let the HCF of the numbers be x and their LCM be y.
It is given that the sum of the HCF and LCM is 1260, therefore
$x + y = 1260$ ....(i)
And, LCM is 900 more than HCF.
$y = x + 900$..... (ii)
Substituting (ii) in (i), we get $x + x + 900 = 1260$
$\Rightarrow 2x + 900 = 1260$
$\Rightarrow 2x = 1260 - 900 \Rightarrow 2x = 360 \Rightarrow x = 180$
Substituting x = 180 in (1), we get:
$y = 180 + 900 \Rightarrow y = 1080$
We also know that the product the two numbers is equal to the product of their LCM and HCF
Thus, product of the numbers = 1080(180) = 194400

2. If the zeroes of the quadratic polynomial $x^2 + (a + 1)x + b$ are 2 and -3, then
(a) a = -7, b = -1 (b) a = 5, b = -1 (c) a = 2, b = –6 (d) a = 0, b = –6
Ans. (d) a = 0, b = –6

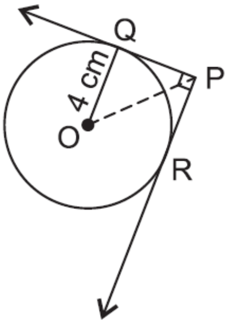
3. If cos A = 4/5, then the value of tan A is
(a) 3/5 (b) 3/4 (c) 4/3 (d) 5/3
Ans: (b) 3/4

4. If $\cos \theta + \cos^2 \theta = 1$, the value of $\sin^2 \theta + \sin^4 \theta$ is :
(a) –1 (b) 0 (c) 1 (d) 2
Ans: (c) 1

5. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is:

(a) 4 (b) 3 (c) 2 (d) 1
Ans. (c) 2

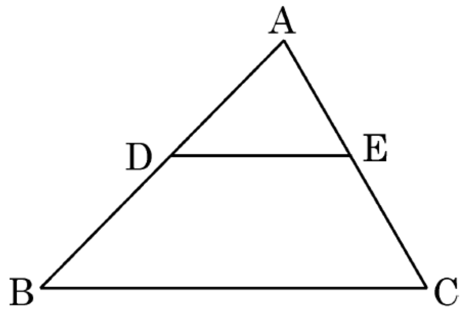
6. In the given figure, from an external point P, two tangents PQ and PR are drawn to a circle of radius 4 cm with centre O. If ∠QPR = 90°, then length of PQ is



(a) 3 cm (b) 4 cm (c) 2 cm (d) 2.2 cm
Ans: (b) 4 cm

7. If the diagonals of a quadrilateral divide each other proportionally, then it is a:
(a) parallelogram (b) rectangle (c) square (d) trapezium
Ans. (d) trapezium

8. In ΔABC, DE || BC(as shown in the figure). If AD = 2cm, BD = 3cm, BC = 7.5cm, then the length of DE(in cm) is:
(a) 2.5 (b) 3 (c) 5 (d) 6



Ans. (b) 3

9. The HCF and the LCM of 12, 21, 15 respectively are
(a) 3, 140 (b) 12, 420 (c) 3, 420 (d) 420, 3
Ans: (c) 3, 420
Here, 12 = 22 × 3
21 = 3 × 7
15 = 3 × 5
So, HCF = 3; LCM = 22 × 3 × 7 i.e., 420

10. A pair of irrational numbers whose product is a rational number is:
(a) (√16, √4) (b) (√5, √2) (c) (√3, √27) (d) (√36, √2)
Ans. (c) (√3, √27)

11. If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is:
(a) 1/3 (b) 2/3 (c) 4/9 (d) 5/9
Ans. (a) 1/3

12. The pair of linear equations x + 2y + 5 = 0 and - 3x = 6y - 1 has
(a) unique solution (b) exactly two solutions

(c) infinitely many solutions (d) no solution
Ans. (d) no solution

13. The common difference of the A.P. $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}, ...$ is
(a) -2x (b) -2 (c) 2 (d) 2x
Ans. (b) -2

14. Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the dice is 7 is
(a) 7/36 (b) 2/36 (c) 0 (d) 1/36
Ans: (c) 0

15. The probability of guessing the correct answer to a certain test question is x/6. If the probability of not guessing the correct answer to this question is 2/3 then the value of x is :
(a) 2 (b) 3 (c) 4 (d) 6
Ans. (a) 2

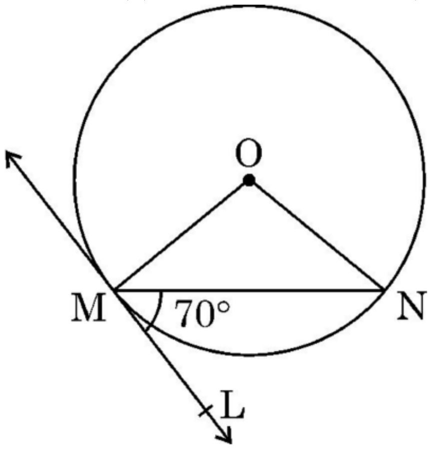
16. Consider the following frequency distribution

Class	0 – 5	6 – 11	12 – 17	18 – 23	24 – 29
Frequency	13	10	15	8	11

The upper limit of the median class is
(a) 7 (b) 17.5 (c) 18 (d) 18.5
Ans: (b) 17.5

17. Perimeter of a sector of a circle whose central angle is 90° and radius 7cm is:
(a) 35cm (b) 11cm (c) 22cm (d) 25cm
Ans. (d) 25cm

18. In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of ∠MON is:
(a) 120° (b) 140° (c) 70° (d) 90°



Ans. (b) 140°

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A
(c) A is true and R is false
(d) A is false and R is true

19. Assertion (A): The mid-point of the line segment joining the points A (3, 4) and B (k, 6) is P (x, y) and x + y – 10 = 0, the value of k is 7

Reason (R): Midpoint of line segment is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A
(c) A is true and R is false
(d) A is false and R is true
Ans: (b) Both A and R are true but R is not the correct explanation of A

20. Assertion(a): In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is 4/5.
Reason(R): P(E) + P(not E) = 1
Ans. (a) Both A and R are true and R is the correct explanation of A

SECTION-B

Questions 21 to 25 carry 2M each

21. (a) Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7,1) and B(3,5).
Ans. PA = PB
$\Rightarrow PA^2 = PB^2$
$\Rightarrow (x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2$
$\Rightarrow -8x + 8y + 16 = 0$ or $x - y - 2 = 0$

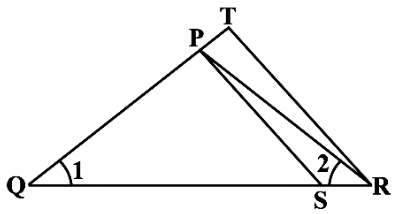
OR

(b) Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle.
Ans. Centre O (2, – 3y) is the mid point of AB

$\therefore \frac{y+7}{2} = -3y \Rightarrow y = -1$

Radius = OB = $\sqrt{(5-2)^2+(7-3)^2} = 5$

22. In the figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and ∠1 = ∠2, Show that ΔPQS ~ ΔTQR.



Ans: In △PQR,
Since, ∠1=∠2
∴ PR=PQ (Opposite sides of equal angles are equal) .....(1)

In △PQS and △TQR, $\frac{QR}{QS} = \frac{QT}{PR} \ldots (Given)$

i.e., $\frac{QR}{QS} = \frac{QT}{PQ} \ldots (From\ 1)$

Also, ∠Q is common
∴ By SAS criterion of similarity, △PQS~△TQR.

23. If $\sin(A-B) = \frac{1}{2}$, $\cos(A+B) = \frac{1}{2}$, $0^0 < A + B \le 90^0$, A > B. Find A and B.

Ans: $\sin(A-B) = \frac{1}{2} \Rightarrow \sin(A-B) = 30^\circ \left[\because \sin 30^\circ = \frac{1}{2}\right]$

On equating both sides

$A - B = 30^\circ \ldots(1)$

$\cos(A+B) = \frac{1}{2} \Rightarrow \cos(A-B) = \cos(60^\circ) \left[\because \cos(60^\circ) = \frac{1}{2}\right]$

On equating both sides

$A + B = 60^\circ ..(2)$

Adding (1) and (2),we get $2A = 90^0 \Rightarrow A = 45^0$

Putting value of A in (i)

$45^0 + B = 60^0 \Rightarrow B = 15^0$

24. One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn (i) is queen of hearts; (ii) is not a jack.

Ans. Total outcomes = 52

(i) P (card is queen of hearts) = 1/52

(ii) P (not a jack) = 48/52 or 12/13

25. (a) If 2x + y = 13 and 4x – y = 17, find the value of (x – y).

Ans. 2x + y = 13 ---- (i)

4x – y = 17 ---- (ii)

Solving (i) and (ii)

x = 5 & y = 3

x – y = 2

OR

(b) Sum of two numbers is 105 and their difference is 45. Find the numbers.

Ans. Let the numbers be x, y (x > y)

x + y = 105 ………. (i)

x – y = 45 ………. (ii)

on solving (i) and (ii)

⇒ x = 75 & y = 30

∴ Numbers are 75, 30

SECTION-C

Questions 26 to 31 carry 3 marks each

26. If a, b are the zeroes of the polynomial $2x^2 - 5x + 7$, then find a polynomial whose zeroes are 2a + 3b, 3a + 2b

Ans: Since a, b are the zeroes of $2x^2 - 5x + 7$

$\therefore a + b = \frac{-(-5)}{2} = \frac{5}{2}$ and $ab = \frac{7}{2}$

The given zeroes of required polynomial are 2a + 3b and 3a + 2b

Sum of the zeroes = 2a + 3b + 3a + 2b = 5a + 5b = 5(a + b) = $5 \times \frac{5}{2} = \frac{25}{2}$

Again, product of the zeroes = $(2a + 3b)(3a + 2b) = 6(a^2 + b^2) + 13ab$

$= 6[(a + b)^2 - 2ab)] + 13ab = 6(a + b)^2 + ab$

= 6(5/2)2 + 7/2 = 75/2 + 7/2 = 82/2 = 41

Now, required polynomial is given by

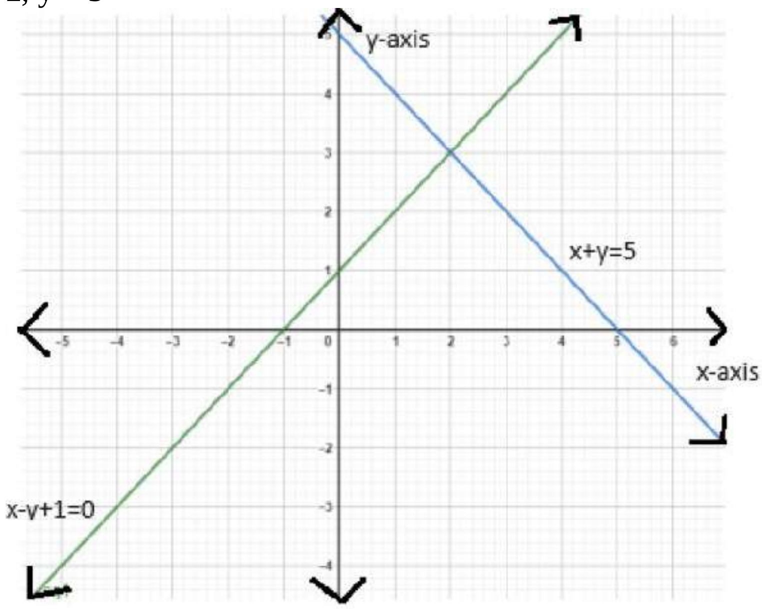
k [x^2 – (Sum of the zeroes) x + Product of the zeroes] = k [$x^2 - \frac{25}{2}x + 41$]

= $\frac{k}{2}[2x^2 - 25x + 82]$, where k is any non-zero real number.

Hence the required polynomial is $2x^2 - 25x + 82$.

27. Solve the following system of linear equations graphically: x – y + 1 = 0 and x + y = 5

Ans. Solution is x = 2, y = 3



28. Find the ratio in which the line 2x + y – 4 = 0 divides the line segment joining the points A (2, –2) and B (3, 7)

Ans: Let P(x, y) be the point on the line 2x + y – 4 = 0 dividing the line segment joining the points A(2, –2) and B(3, 7) in the ratio k : 1.

∴ The coordinate of P are $\left(\frac{3k+2}{k+1}, \frac{7k-2}{k+1}\right)$

Since, point (x, y) lies on the line 2x + y = 4.

$\Rightarrow 2\left(\frac{3k+2}{k+1}\right) + \left(\frac{7k-2}{k+1}\right) = 4 \Rightarrow \frac{6k+4+7k-2}{k+1} = 4$

⇒ 13k + 2 = 4k + 4 ⇒ 9k = 2 ⇒ k = 2/9

Thus, required ratio is 2 : 9.

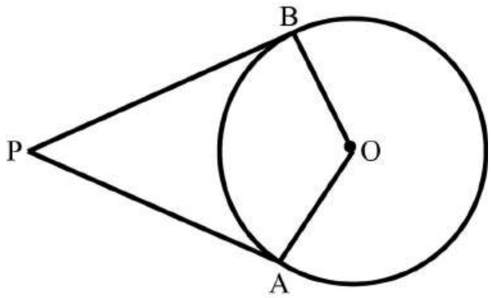
29. Prove that $\frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A} = 2\sec A$

Ans: $LHS = \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A}$

$= \frac{\cos^2 A + (1+\sin A)^2}{\cos A(1+\sin A)} = \frac{\cos^2 A + 1 + \sin^2 A + 2\sin A}{\cos A(1+\sin A)}$

$= \frac{2+2\sin A}{\cos A(1+\sin A)} = \frac{2}{\cos A} = 2\sec A = RHS$

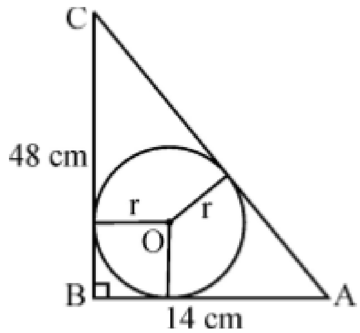
30. In the given figure, PA and PB are the tangent segments to a circle with centre O. Show that the points A, O, B and P are concyclic.



Ans: Here, OA = OB
And OA ⊥ AP, OB ⊥ BP (tangent ⊥ radius)
∴ ∠OAP = 90°,
∠OBP = 90°
∴ ∠OAP + ∠OBP = 90° + 90° = 180°
∴ ∠AOB + ∠APB = 180°
(Since, ∠AOB + ∠OAP + ∠OBP + ∠APB = 360°)
Thus, sum of opposite angle of a quadrilateral is 180°.
Hence, A, O, B and P are concyclic.

OR

In the given figure, ABC is a triangle in which ∠B = 90°, BC = 48 cm and AB = 14 cm. A circle is inscribed in the triangle, whose centre is O. Find radius r of in-circle.



Ans: In ΔABC, $AC^2 = AB^2 + BC^2 = \sqrt{(14)^2 + (48)^2} = 50cm$
∠OQB = 90°⇒ OPBQ is a square ⇒ BQ = r
⇒ QA = 14 - r = AR (tangents from a external point are equal in length)
Again PB = r ⇒ PC = 48 - r
⇒ RC = 48 - r (tangents from a external point are equal in length)
⇒ AR + RC = AC
⇒ 14 - r + 48 - r = 50
⇒ r = 6cm.

SECTION-D

Questions 32 to 35 carry 5M each

31. A train, travelling at a uniform speed for 360 km, would have taken 48 minutes less to travel the same distance if its speed were 5 km/h more. Find the original speed of the train.
Ans: Let original speed of train = x km/h
We know, Time = distance/speed
According to the question, we have Time taken by train = 360/x hour
And, Time taken by train its speed increase 5 km/h = 360/(x + 5)
It is given that,
Time taken by train in first – time taken by train in 2nd case = 48 min = 48/60 hour

$$\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60} = \frac{4}{5} \Rightarrow 360\left(\frac{1}{x} - \frac{1}{x+5}\right) = \frac{4}{5}$$

$$\Rightarrow 360\left(\frac{x+5-x}{x(x+5)}\right)=\frac{4}{5}\Rightarrow 360\left(\frac{5}{x(x+5)}\right)=\frac{4}{5}$$

$$\Rightarrow 360\times\frac{5}{4}\left(\frac{5}{x^2+5x}\right)=1\Rightarrow 450\times 5=x^2+5x$$

$\Rightarrow x^2 + 5x - 2250 = 0 \Rightarrow x^2 + 50x - 45x - 2250 = 0$
$\Rightarrow x(x + 50) - 45(x + 50) = 0 \Rightarrow (x + 50)(x - 45) = 0$
$\Rightarrow x = -50, 45$
But $x \neq -50$ because speed cannot be negative
So, x = 45 km/h
Hence, original speed of train = 45 km/h

OR

Two water taps together can fill a tank in 6 hours. The tap of larger diameter takes 9 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

Ans: Let the time taken by the smaller tap to fill the tank = x hours and
time taken by larger tap = x – 9

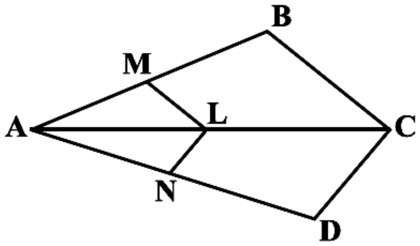
In 1 hour, the smaller tap will fill $\frac{1}{x}$ of tank and the larger tap will fill $\frac{1}{x-9}$ of tank.

In 1 hour both the tank will fill the tank = $\frac{1}{x}+\frac{1}{x-9}$

According to the question, $\frac{1}{x}+\frac{1}{x-9}=\frac{1}{6}\Rightarrow\frac{x-9+x}{x(x-9)}=\frac{1}{6}\Rightarrow\frac{2x-9}{x^2-9x}=\frac{1}{6}$

Solving by cross multiplication, $6(2x - 9) = x^2 - 9x$
$\Rightarrow 12x - 54 = x^2 - 9x \Rightarrow x^2 - 9x - 12x + 54 = 0 \Rightarrow x^2 - 21x + 54 = 0$
$\Rightarrow$ x2−18x−3x+54=0
$\Rightarrow x(x - 18) - 3(x - 18)=0$
$\Rightarrow (x - 18)(x - 3) = 0$
$\Rightarrow x = 18, x = 3$
Neglecting x = 3 as x – 9 can't negative, therefore x = 18
If we take x = 18
Smaller tap = (x) = 18 hrs
Larger tap = (x – 9) = 18 – 9 = 9hrs
Hence, the time taken by the smaller tap to fill the tank = 18 hrs & the time taken by the larger tap to fill the tank = 9 hrs

32. Prove that if a line is a drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio. Using the above theorem. Prove that $\frac{AM}{MB}=\frac{AN}{ND}$ if LM || CB and LN || CD as shown in the figure.



Ans: Given, To Prove, Figure and Construction – 1 ½ marks
Proof - 1 ½ mark
In △ABC, LM || BC

∴ By Basic proportionality theorem, $\frac{AM}{AB}=\frac{AL}{AC}$…………(1)

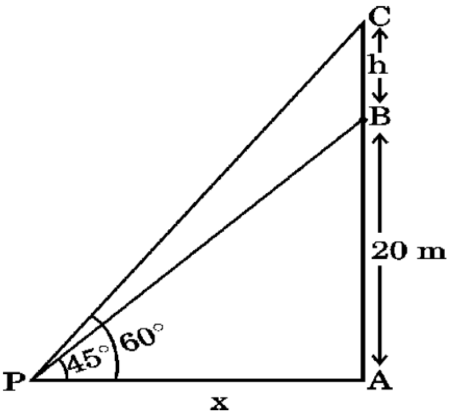
Similarly, In △ADC, LN || CD

∴ By Basic proportionality theorem, $\frac{AN}{AD} = \frac{AL}{AC}$...........(2)

∴ from (1) and (2), $\frac{AM}{AB} = \frac{AN}{AD}$

33. 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 20m high building are 45° and 60° respectively. Find the height of the tower.

Ans.



In ΔBPA

$\tan 45° = 1 = \frac{20}{x} \Rightarrow x = 20$ m ....(i)

Now, In ΔCPA

$\tan 60° = \sqrt{3} = \frac{h+20}{x} \Rightarrow h + 20 = x\sqrt{3}$ ....(ii)

Solving (i) and (ii)

$h = 20(\sqrt{3} - 1)$ m

∴ Height of the tower is $20(\sqrt{3} - 1)$ m.

34. (a) A solid iron pole consists of a solid cylinder of height 200cm and base diameter 28cm, which is surmounted by another cylinder of height 50cm and radius 7cm. Find the mass of the pole, given that 1cm^3 of iron has approximately 8g mass.

Ans. Radius of lower cylinder = 14 cm

Volume of pole = $\frac{22}{7} \times 14 \times 14 \times 200 + \frac{22}{7} \times 7 \times 7 \times 50$

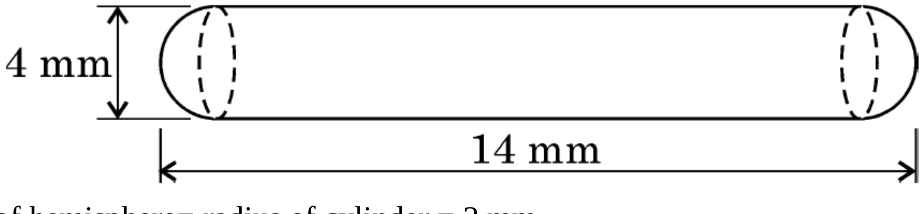
= 130900 cm^3

Mass of the pole = 8 ×130900

=1047200 gm or 1047.2 kg

OR

(b) A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14mm and the diameter of the capsule is 4mm, find its surface area. Also, find its volume.



Ans. Radius of hemisphere= radius of cylinder = 2 mm

Length of cylindrical part = 14 – 4 = 10 mm.

Surface area of the capsule = CSA of cylinder + 2(CSA of hemisphere)

$= 2 \times \frac{22}{7} \times 2 \times 10 + 2 \times 2 \times \frac{22}{7} \times 2 \times 2$

= 176 mm^2

Volume of the capsule = volume of cylinder + 2(volume of hemisphere)

$= \frac{22}{7} \times 2 \times 2 \times 10 + 2 \times \frac{2}{3} \times \frac{22}{7} \times 2 \times 2 \times 2$

= 3344/21 mm^3 or 159.24 mm^3

SECTION-E (Case Study Based Questions)

Questions 36 to 38 carry 4M each

35. Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.

Now, Mukta asked some questions as given below to the students :

(i) What is the least prime number used by students? (1)

(ii) (a) How many students are in the class? (2)

OR

(b) What is the highest prime number used by students? (2)

(iii) Which prime number has been used maximum times ? (1)

Ans. $173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$

(i) 3

(ii) (a) $173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$

Number of students in the class = 3 + 2 + 1 + 1 = 7

OR

(ii) (b) $173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$

Highest prime number used by students = 11

(iii) 5

36. Mutual Fund : A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds or other securities. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors.

Net Asset Value (NAV) represents a fund's per share market value. It is the price at which the investors buy fund shares from a fund company and sell them to a fund company.

The following table shows the Net Asset Value (NAV) per unit of mutual fund of ICICI mutual funds:

NAV (in Rs.)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Number of mutual funds	13	16	22	18	11

Based on the above information, answer the following questions :
(i) What is the upper limit of modal class of the data? (1)
(ii) What is the median class of the data? (1)
(iii) (a) What is the mode NAV of mutual funds ? (2)

OR

(b) What is the median NAV of mutual funds ? (2)
Ans. (i) Upper limit of modal class = 15
(ii) Median class = 10 – 15
(iii)(a) $l = 10, f_0 = 16, f_1 = 22, f_2 = 18, h = 5$

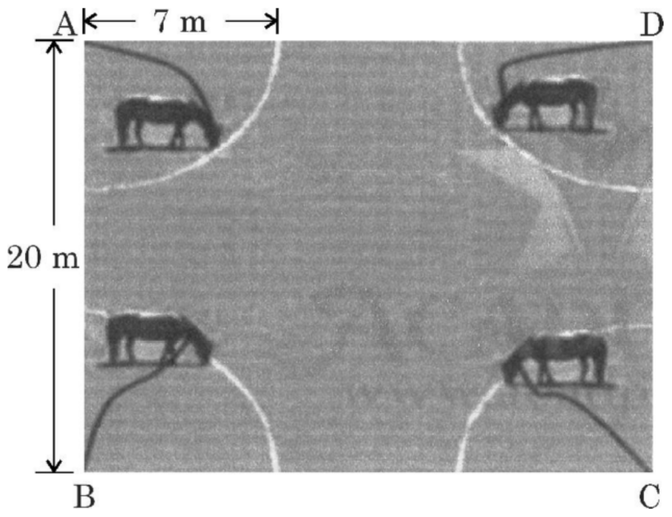
$$Mode = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 10 + \left(\frac{22-16}{44-16-18}\right) \times 5 = 10 + \frac{6}{10} \times 5 = 10 + 3 = 13$$

OR

NAV (in Rs.)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Number of mutual funds	13	16	22	18	11
cf	13	29	51	69	80

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h = 10 + \left(\frac{40-29}{22}\right) \times 5 = 10 + \frac{11}{22} \times 5 = 10 + 2.5 = 12.5$$

37. A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.



Based on the above, answer the following questions :
(i) Find the area of the square shaped grass field. (1)
(ii) (a) Find the area of the total field in which these horses can graze. (2)

OR

(b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use π = 3.14) (2)
(iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm? (1)
Ans. (i) Area of square shaped grass field = 400 m^2
(ii) (a) area of total field that horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = 154\ m^2$

OR

(ii) (b) area grazed by one horse = $\frac{1}{4} \times 3.14 \times 10 \times 10 = 78.5\ m^2$
(iii) Area of the field left ungrazed = area of square field - area of field in which horses can graze.
Area of field in which horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = 154\ cm^2$
Area of the field left ungrazed = $400 - 0.0154 = 399.9846\ m^2$