Mid-Term Examination
Mathematics
MT-2024-10(B)

Time : 3 hrs.   **M. Marks : 80**

General Instructions:

Read the following instructions carefully and follow them:

(i)   This question paper contains **38** questions. *All* questions are compulsory.

(ii)   Question paper is divided into **FIVE** sections - **Section A, B, C, D** and **E**.

(iii) In **section A** - question numbers **1 to 18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion-Reason based questions of 1 mark each.

(iv)   In **section B** - question numbers **21 to 25** are Very Short Answer (VSA) type questions of 2 marks each.

(v)   In **section C** - question numbers **26 to 31** are Short Answer (SA) type questions carrying 3 marks each.

(vi)   In **section D** - question numbers **32 to 35** are Long Answer (LA) type questions carrying 5 marks each.

(vii) In **section E** - question numbers **36 to 38** are **case based integrated units** of assessment questions carrying 4 marks each. Internal choice is provided in 2 marks question in each case-study.

(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.

(ix)   Draw neat figures wherever required.

SECTION - A

This section consists of 20 questions of 1 mark each.

1. If HCF $(x, 8) = 4$, LCM $(x, 8) = 24$, then x is

    (a) 8   (b) 10

    (c) 12   (d) 14

2. If zeros of the quadratic polynomial $f(x) = (k^2 + 4)x^2 + 7x + 4k$ are reciprocal of each other, then what is the value(s) of k is (are)
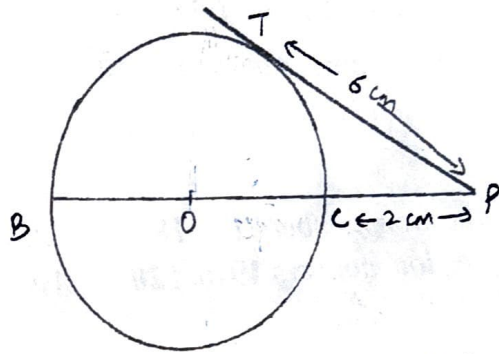
    (a) 1   (b) -1

    (c) ± 2 (d) 2

3. If the median of the data :

$\dfrac{x}{5}, x, \dfrac{x}{3}, \dfrac{2x}{3}, \dfrac{x}{4}, \dfrac{2x}{5}, \dfrac{3x}{4} ; (x > 0)$ is 4, then x is

(a) 5

(b) 10

(c) 8

(d) 7

4. In figure, O is the centre of the circle and PT is a tangent at T,

If PC = 2 cm, PT = 6 cm, then the radius of the circle is

(a) 9 cm

(b) 8 cm

(c) 4 cm·

(d) 7.5 cm

5. A girl calculates that the probability of her winning the first prize in a lottery is 0.06. If 8000 tickets are sold, then how many tickets has she bought?

(a) 420

(b) 480

(c) 840

(d) 48

6. If α and β are the zeros of the polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$, then the value of p is

(a) $\dfrac{-2}{3}$

(b) $\dfrac{2}{3}$

(c) $\dfrac{1}{3}$

(d) $\dfrac{-1}{3}$

7. Two dice are thrown simultaneously. Find the probability of getting the sum as a prime number

(a) $\dfrac{1}{2}$

(b) $\dfrac{5}{12}$

(c) $\dfrac{7}{12}$

(d) $\dfrac{1}{6}$

8. If for some angle θ, $\tan 2\theta = \dfrac{1}{\sqrt{3}}$, then the value of $\sin 3\theta$, where $3\theta \le 90^0$ is

(a) $\dfrac{1}{\sqrt{2}}$

(b) 1

(c) 0

(d) $\dfrac{\sqrt{3}}{2}$

9. It is found that on walking x meters towards a chimney in a horizontal line through its base, the elevation of its top changes from 30^0 to 60^0. The height of the chimney is

(a) $3\sqrt{2}x$

(b) $2\sqrt{3}x$

(c) $\dfrac{\sqrt{3}x}{2}$

(d) $\dfrac{2}{\sqrt{3}}x$

10. The value of k for which the system of equations $kx + y = k^2$ and $x + ky = 1$ has infinitely many solutions, is

(a) 1

(b) 2

(c) 3

(d) ± 1

11. If $\sin\theta - \cos\theta = 0$, then the value of $\sin^6 \theta + \cos^6 \theta$ is

(a) $\dfrac{2}{3}$

(b) $\dfrac{1}{3}$

(c) $\dfrac{3}{4}$

(d) $\dfrac{1}{4}$

12. The pair of equations $x = a$ and $y = b$ graphically represents lines which are :

(a) parallel

(b) intersecting at (b, a)

(c) coincident

(d) intersecting at (a, b)

13. In $\triangle ABC$, DE $\parallel$ AB, If AB = a, DE = x, BE = b and EC = c, then x is

(a) $\dfrac{ac}{b}$

(b) $\dfrac{ac}{b+c}$

(c) $\dfrac{ab}{c}$

(d) $\dfrac{ab}{b+c}$

14. If $x = 2$ and $x = 3$ are roots of the equation $3x^2 - 2kx + 2m = 0$, then

    (a) $k = 2, m = 9$

    (b) $k = \dfrac{15}{2}$ and $m = 9$

    (c) $k = m = 9$

    (d) $k = m = \dfrac{15}{2}$

15. A jar contains 24 marbles out of which some are green and others are blue. If a marble is drawn at random from the jar and the probability that it is green is $\dfrac{2}{3}$, then number of blue marbles are

    (a) 18

    (b) 8

    (c) 16

    (d) 12

16. If in two triangles ABC and DEF,

    $$\dfrac{AB}{DE} = \dfrac{BC}{FE} = \dfrac{CA}{FD}, \text{ then}$$

    (a) $\triangle FDE \sim \triangle CAB$

    (b) $\triangle FDE \sim \triangle ABC$

    (c) $\triangle CBA \sim \triangle FDE$

    (d) $\triangle BCA \sim \triangle FDE$

17. If one root of the equation $3x^2 = 8x + (2k+1)$ is seven times the other, then the value of k is

    (a) $\dfrac{7}{3}$

    (b) $\dfrac{5}{3}$

    (c) $\dfrac{-5}{3}$

    (d) $\dfrac{-7}{3}$

18. The probability of selecting a letter which is not a consonant from the letters of the word 'TRIANGLE' is

    (a) $\dfrac{2}{7}$

    (b) $\dfrac{3}{8}$

    (c) $\dfrac{5}{8}$

    (d) $\dfrac{1}{8}$

Directions : In the Q.19 and Q.20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option out of the following

19. Assertion (A) : The area of the rectangle formed by the lines representing $x = 8$, $y = 6$ with the co-ordinate axis is 48 square units.

    Reason (R) : The system of equations $x = 8$, $y = 6$ is consistent with a unique solution.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

20. Assertion (A) : Let $\triangle ABC$ and $\triangle DEF$ be right triangles, right angled at B and E respectively. If AC = 5 cm, BC = 4 cm, DF = 15 cm and EF = 10 cm, then $\angle A = \angle D$ and $\angle C = \angle F$.

Reason (R) : If in two right triangles, hypotenuse and one side of one triangle are proportional to the hypotenuse and one side of the other triangle, then the triangles are similar.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION - B

This section consists of 5 questions of 2 marks each.

21. A merchant has 120 litres of oil of one kind, 180 litres of another kind and 240 litres of third kind. He wants to sell the oil by filling the three kinds of a oil in tins of equal capacity. What should be the greatest capacity of such a tin?

22. If α and β are the zeros of the quadratic polynomial $f(x) = 2x^2 - 5x + 7$, find a polynomial whose zeros are $2\alpha + 1$ and $2\beta + 1$.

OR

Find the zeros of the polynomial $x^2 - 3$ and verify the relationship between the zeros and the coefficients.

23. If $\tan A = 2$, Evaluate : $\sec A \sin A + \tan^2 A - \csc A$

OR

If $\csc \theta = \dfrac{5}{3}$, then what is the value of $\cos \theta + \tan \theta$.

24. An electrician has to repair an electric fault on a pole of height 4m. He needs to reach a point 1.3m below the top of the pole to undertake the repair work. What should be the length of the ladder that he should use which when inclined at an angle of 60^0 to the horizontal would enable him to reach the required position?

14. If x = ?

25. Three unbaised coins are tossed together. Find the probability of getting :

(a) two tails.

(b) atleast two tails.

SECTION - C

This section consists of 6 questions of 3 marks each.

26. Solve for x :

$$\frac{x-1}{x+2} + \frac{x-3}{x-4} = \frac{10}{3} ; x \neq -2, -4$$

27. Five years later, father's age will be three times the age of his son. Five years ago, father was seven times as old as his son. Find their present ages.
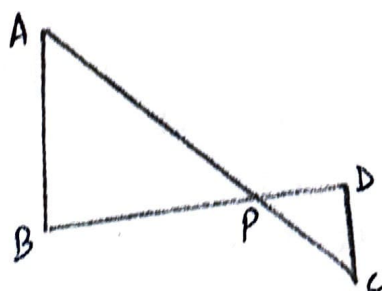
OR

In $\triangle ABC$, $\angle C = 3\angle B = 2(\angle A + \angle B)$. Find the three angles.

28. Find the missing frequency in the following frequency distribution if it is known that the mean of the distribution is 1.46.

x	0	1	2	3	4	5	Total
f	46	a	b	25	10	5	200

29. Prove that the length of two tangents drawn from an external point to the circle are equal.

30. In figure, $\angle A = \angle C$, $AB = 6$ cm, $BP = 15$ cm, $AP = 12$ cm and $CP = 4$ cm, then find the length of PD and CD.

OR

P and Q are points on sides AB and AC respectively of $\triangle ABC$.

If $AP = 3$cm, $PB = 6$ cm, $AQ = 5$ cm and $QC = 10$ cm. Show that $BC = 3$ PQ.

31. For what value of k will the following system of linear equations have no solution?

$3x + y = 1$

$(2k-1)x + (k-1)y = 2k + 1$

SECTION - D

This section consists of 4 questions of 5 marks each.

32. A plane left 30 minutes later than the schedule time and in order to reach its destination 1500 Km away in time it had to increase its speed by 250 Km/hr from its usual speed. Find its usual speed.

OR

If twice the area of a smaller square is subtracted from the area of a larger square, the result is 14 cm². However, if twice the area of the larger square is added to three times the area of the smaller square, the result is 203 cm². Determine the sides of the square.

33. Prove the following identity

$$\frac{\cot\theta + \csc\theta - 1}{\cot\theta - \csc\theta + 1} = \frac{1 + \cos\theta}{\sin\theta}$$

34. A man on a cliff observes a boat at an angle of depression 30° which is approaching towards the shore to the point immediately beneath the observer with a uniform speed. Six minutes later, the angle of depression of the boat is found to be 60°. Find the time taken by the boat to reach the shore from initial position.

35. Find the mean marks of students from the following cumulative frequency distribution:

| Marks	Number of Students
Marks Below 10	5
Marks Below 20	9
Marks Below 30	17
Marks Below 40	29
Marks Below 50	45
Marks Below 60	60
Marks Below 70	70
Marks Below 80	78
Marks Below 90	83
Marks Below 100	85

OR

The median of the following data is 50. Find the value of p and q, if the total frequency is 90. Also find the mode.

Marks	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of Students	p	15	25	20	q	8	10

SECTON - E

This section consists of 3 case study based questions of 4 marks each.

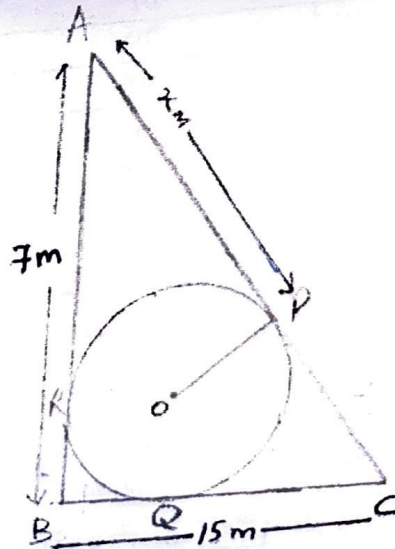36. In the figure given below, PQRS is a quadrilateral. PR is perpendicular to QR and PS.
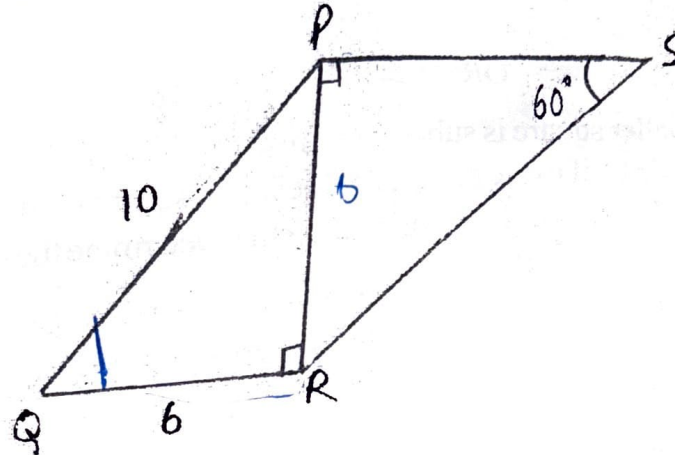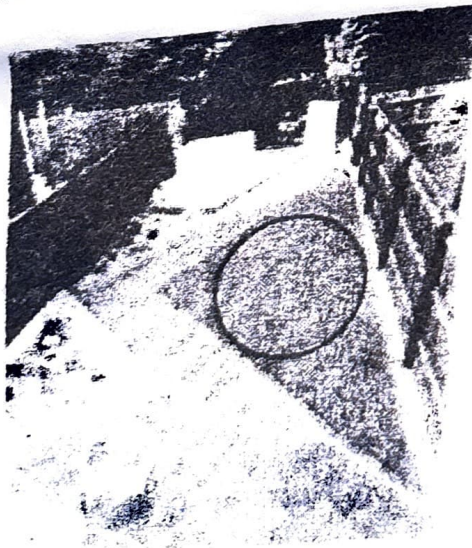

(i) What is the value of cot Q? (1)

(ii) What is the length of PS. (2)

OR

(ii) What is the length of RS? (1)

(iii) Find $\sin^2 Q - \cos^2 Q$?

37. A backyard is in shape of a triangle ABC with $\angle B = 90^0$, AB = 7 m and BC = 15 m. A circular pit was dug inside it in such a way that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m.

Based on the above information, answer the following questions :

(i)   Find the length of AR in terms of x.   (1)

(ii)   Write the type of the quadrilateral BQOR.   (1)

(iii)   Find the length PC in terms of x and hence find the value of x.   (2)

<div align="center">OR</div>

(iii)   Find x and hence find the radius r of circle in terms of x.

38.   Consider the data :

Class	0-10	10-20	20-30	30-40	40-50
Frequency	7	10	15	8	10

Answer the following questions :

(i)   Find the sum of lower limits of the median class and modal class.   (1)

(ii)   Calculate the mean of given data.   (2)

<div align="center">OR</div>

(ii)   Calculate the mode of given data.

(iii)   What is the median value.   (1)