

**ST. JOSEPH'S COLLEGE, PRAYAGRAJ****HALF YEARLY EXAMINATION 2025 – 26****MATHEMATICS****TIME: 3 Hours****CLASS – X****MM: 80**

1. Answers to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during first 15 minutes.
3. This time is to be spent in reading the question paper.
4. **The time given at the head of this paper is the time allotted for writing the answers.**
5. Attempt all questions from Section A and any four questions from Section B
6. All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.
7. Omission of essential working will result in loss of marks.
8. The intended marks for questions or parts of questions are given in brackets [].
9. Mathematical tables are provided.

SECTION – A [40 Marks]

(Attempt all questions from this section)

Question 1.

Choose the correct answers to the questions from the given options.

[15]

(Do not copy the questions, write the correct answers only)

- 1) $(x + 2)$ and $(3x - 2)$ are the factors of $6x^3 + 17x^2 + 4x - 12$. The third factor of the given polynomial is
a. $(2x - 3)$ b. $(2x + 3)$ c. $(3x + 2)$ d. $(x - 2)$
- 2) Meena has a cumulative time deposit account of ₹340 for 20 months. The qualifying sum of money for the calculation of interest is:
a. ₹71400 b. ₹142800 c. ₹6800 d. ₹13600
- 3) Assertion (A): If $x = a \cos^3 \theta$ & $y = b \sin^3 \theta$, then $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$
Reason (R): $\sin^2 \theta + \cos^2 \theta = 1$
a. (A) is true and (R) is false.
b. (A) is false and (R) is true.
c. Both (A) and (R) are true and (R) is the correct explanation of (A).
d. Both (A) and (R) are true but (R) is not the correct explanation of (A).
- 4) Given that the sum of the squares of the first seven natural numbers is 140, then their mean is
a. 20 b. 70 c. 208 d. 980
- 5) Cards marked with numbers 1 to 100 are placed in a box and mixed thoroughly. A card is drawn at random from the box. The probability that the selected card bears a perfect square number is:
a. $\frac{1}{10}$ b. $\frac{2}{25}$ c. $\frac{9}{100}$ d. $\frac{11}{100}$
- 6) If $A = \begin{bmatrix} 3 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$, then matrix BA is equal to
a. $[-12]$ b. $\begin{bmatrix} 6 & 12 \\ -9 & -18 \end{bmatrix}$ c. $[12]$ d. $\begin{bmatrix} 6 & -12 \\ 9 & -18 \end{bmatrix}$
- 7) If $x, 5.4, 5, 9$ are in proportion, then x is equal to
a. 3 b. 9.72 c. 25 d. $25/3$
- 8) If Kabir invests ₹10320 on ₹100 shares at a discount of ₹14, then the number of shares he buys is:
a. 110 b. 120 c. 150 d. 100
- 9) The roots of the quadratic equation $2x^2 - x - 6 = 0$ are:
a. $-2, \frac{3}{2}$ c. $-2, -\frac{3}{2}$
b. $2, -\frac{3}{2}$ d. $2, \frac{3}{2}$
- 10) The angle of inclination of the line $x - 7 = 0$ is
a. 0° b. 45° c. 90° d. Not defined



- 11) Find the smallest value of x in the following inequation
 $3(x + 4) \leq 5(x - 1) + 4$ and $x \in N$
- a. 5 b. 6 c. 7 d. 8
- 12) For what value of p are $2p + 1, 13, 5p - 3$ three consecutive terms of an A.P.?
- a. 0 b. 1 c. 2 d. 4
- 13) Which of the following point is invariant with respect to the line $y = -2$
- a. (2, 3) b. (-3, 2) c. (-2, 3) d. (3, -2)
- 14) A circle has its centre at (4, 4). If one end of a diameter is (4, 0), then the co-ordinates of the other end are:
- a. (0, 4) b. (4, 8) c. (4, -8) d. (-4, -8)
- 15) The common ratio of the G.P. $\frac{1}{a^3b^3}, ab, a^5b^5, \dots$ is
- a. $\frac{1}{a^2b^2}$ b. $\frac{1}{a^4b^4}$ c. a^2b^2 d. a^4b^4

Question 2.

- 1) If $x^3 - 2x^2 + ax + b$ has a factor $(x + 2)$ and leaves a remainder 9 when divided by $(x + 1)$, find the values of a and b . With these values of a & b , factorise the given polynomial completely. [4]
- 2) A and B are two points on the x-axis and y-axis respectively and P (2, -3) is the midpoint of AB. [4]
- a. The co-ordinates of A and B.
- b. Slope of the line AB.
- c. Equation of the perpendicular bisector of the line segment AB.
- 3) A man observes the angle of elevation of the top of the tower to be 45° . He walks towards it in a horizontal line through its base. On covering 20m, the angle of elevation changes to 60° . Find the height of the tower correct to two significant figures. [4]

Question 3.

- 1) $1, 1\frac{1}{6}, 1\frac{1}{3}, \dots$ are the terms of a progression [4]
- a. What is the type of progression?
- b. How many terms are there in all?
- c. Calculate the value of middle most term.
- 2) Prove the following: $\frac{\cos^3 A + \sin^3 A}{\cos A + \sin A} + \frac{\cos^3 A - \sin^3 A}{\cos A - \sin A} = 2$ [4]
- 3) Use a graph paper for this question taking 1cm = 1 unit along both x and y axes. [5]
- a. Plot the points A(0, 5), B (2, 5), C (5, 2), D (5, -2), E (2, -5) and F (0, -5)
- b. Reflect the points B, C, D and E on y-axis and name them respectively as B', C', D' & E'
- c. Name the invariant point(s) from A, B, C, D, E and F when reflected about the line $x = 0$
- d. Name the closed figure formed by $BCDEE'D'C'B'$
- e. Name a line of symmetry for the figure formed.
- f.

SECTION – B [40 Marks]

(Attempt any four questions from this section)

Question 4.

- 1) Vivek invests ₹4500 in 8%, ₹10 shares at ₹15. He sells the shares when the price rises to ₹30 and invests the proceeds in 12%, ₹100 shares at ₹125. Calculate: [3]
- a. The sale proceeds
- b. The number of ₹125 shares he buys
- c. The change in his annual income from dividend.
- 2) Solve the following inequation, write the solution set and represent it on the real number line. [3]
- $4x - 19 < \frac{3x}{5} - 2 \leq \frac{-2}{5} + x, x \in R$



- 3) Prove the following trigonometric identity:

$$\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} = \frac{1 + \sin \theta}{\cos \theta}$$

[4]

Question 5.

- 1) Using the properties of proportion find the value of x .

[3]

$$\frac{\sqrt{x+5} + \sqrt{x-16}}{\sqrt{x+5} - \sqrt{x-16}} = \frac{7}{3}$$

- 2) Mr. Sonu has a recurring deposit account and deposits ₹750 per month for 2 years. If he gets ₹19125 at the time of maturity, find the rate of interest earned by him.

[3]

- 3) Given below are the monthly wages of 200 workers in a factory:

[4]

Monthly Wages (in ₹1000)	24 – 30	30 – 36	36 – 42	42 – 48	48 – 54
Number of workers	20	30	20	40	90

Using **step – deviation method**, calculate the mean wages.

[Take assumed mean as 39]

Question 6.

- 1) Find the co-ordinates of the centroid P of the ΔABC , whose vertices are A (–7, 5), B(–1, –3) and C (5, 7). Hence find the equation of a line passing through P and parallel to AB.

[3]

- 2) Solve the following quadratic equation and give your answer correct to 2 decimal places.

[3]

$$4x^2 - 7x + 2 = 0$$

- 3) If $\frac{7m+2n}{7m-2n} = \frac{5}{3}$, use properties of proportion to find:

[4]

a. $m : n$

b. $\frac{m^2+n^2}{m^2-n^2}$

Question 7.

- 1) Draw the necessary diagram for this question.

[5]

The angles of elevation and depression of the top and bottom of a light house from the top of a 50m high building are 36° and 45° respectively. Find the height of the light house. Give your answer correct to the nearest metre.

(Use mathematical tables where necessary).

- 2) The monthly income of a group of 320 employees in a company is given below:

[5]

Monthly Income (in ₹)	6000 – 7000	7000 – 8000	8000 – 9000	9000 – 10000	10000 – 11000	11000 – 12000	12000 – 13000
Number of employees	20	45	65	95	60	30	5

Draw an ogive of the given distribution on a graph sheet taking 1cm = ₹1000 on one axis and 1cm = 50 employees on the other axis. From the graph, determine:

- The median wage
- The number of employees whose income is below ₹8500
- If the salary of a senior employee is above is ₹11500, find the number of senior employees of the company.
- The upper quartile.

Question 8.

- 1) A spinner has only red, blue and green sectors. The probability of spinner stopping on a sector of a particular colour is given as:

[3]

Colour	Red (R)	Green (G)	Blue (B)
Probability	$\frac{3}{10}$	x	$\frac{2}{5}$



[3]



- a. Find the value of 'x', the probability of spinner stopping on green sector.
b. Probability of spinner stopping on a colour other than blue.
- 2) If a, b and c are in continued proportion, prove that: [3]
$$\frac{a+b}{b+c} = \frac{a^2(b-c)}{b^2(a-b)}$$
- 3) A trader buys x articles for a total cost of ₹600. [4]
a. Write down the cost of one article in terms of x.
b. If the cost per article were ₹5 more, the number of articles that can be bought for ₹600 would be four less. Write the equation in 'x' for the above situation.
c. How many articles were bought when the price per article was increased by ₹5.

Question 9.

- 1) The 4th term and 7th term of a G.P. are 10 and 80 respectively. Find: [3]
a. The first term
b. The common ratio
c. Sum of first 5 terms of the progression.
- 2) Without solving the quadratic equation, find the value of 'm' for which the roots are real and equal. [3]
 $(m-2)x^2 - (m+5)x + 16 = 0$
- 3) Use graph sheet for this question. Draw a histogram for the following data. Take 2cm = 5kgf along the x-axis and 2cm = 2 students along the y-axis. [4]

Weight (in kgf)	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Number of students	6	11	20	15	9

- a. Find the modal class
b. Estimate the mode.

Question 10.

- 1) Using the remainder theorem, factorise the following expression completely. [3]
 $3x^3 - 7x^2 + 4$
- 2) If $A = \begin{bmatrix} 3 & x \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 9 & 16 \\ 0 & -y \end{bmatrix}$, find x & y when $A^2 = B$. [3]
- 3) If $\frac{x+1}{x-1} = \frac{\sqrt{3y+2} + \sqrt{3y-2}}{\sqrt{3y+2} - \sqrt{3y-2}}$, using properties of proportion, show that: $y = \frac{2(x^2+1)}{3(x^2-1)}$ [4]

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