



KUMAR CLASSES

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ICSE • Class X

Mathematics

Sample Paper — Set 3

MATHEMATICS — ICSE BOARD PATTERN

Class X • Sample / Preboard Paper • SET 3 of 3 • GST • Banking • Inequations • Quadratics • Proportion • Factorisation
• Matrices • A.P. • Similarity • Statistics

Maximum Marks : 80

Time : Two & a half Hours (2½ h)

Reading time : 15 min

Name : _____ Roll No : _____ Date : _____ Marks : _____ / 80

General Instructions

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

SECTION A — 40 Marks

(Attempt ALL questions from this Section.)

Q1. Choose the correct answers to the questions from the given options.

[15]

(i) The GST on a bill of ₹1,200 at the rate 5% is:

(a) ₹6

(b) ₹60

(c) ₹120

(d) ₹600

(ii) In a recurring deposit of ₹200 per month for 12 months, the total sum deposited is:

(a) ₹2,400

(b) ₹1,200

(c) ₹200

(d) ₹2,600

(iii) If $x \in \mathbb{W}$ and $2x + 1 < 7$, the solution set is:

(a) $\{0, 1, 2\}$

(b) $\{1, 2\}$

(c) $\{0, 1, 2, 3\}$

(d) $\{1, 2, 3\}$

(iv) The roots of $x^2 - px + 4 = 0$ are equal if $p =$

(a) ± 4

(b) 4

(c) ± 2

(d) 16

(v) The sum of the roots of $2x^2 - 5x + 3 = 0$ is:

(a) $\frac{5}{2}$

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

(c) $-\frac{5}{2}$

(d) 3

(vi) If 4, x, 9 are in continued proportion, then $x =$

(a) 6

(b) 36

(c) 13

(d) $\sqrt{13}$ (vii) The remainder when $2x^2 + 3x - 5$ is divided by $(x + 2)$ is:

(a) -3

(b) 3

(c) -5

(d) 0

(viii) If $(x + 1)$ is a factor of $x^3 + 2x^2 - x + k$, then $k =$

(a) -2

(b) 2

(c) 0

(d) 1

(ix) The product $\begin{vmatrix} 2 & 3 \end{vmatrix} \begin{vmatrix} 1 \\ 2 \end{vmatrix}$ equals:(a) $\begin{vmatrix} 8 \end{vmatrix}$ (b) $\begin{vmatrix} 5 \end{vmatrix}$ (c) $\begin{vmatrix} 2 & 6 \end{vmatrix}$ (d) $\begin{vmatrix} 3 & 4 \end{vmatrix}$ (x) The additive identity for 2×2 matrices is:(a) the identity matrix I (b) the null (zero) matrix O (c) $\begin{vmatrix} 1 & 1 \\ 1 & 1 \end{vmatrix}$

(d) none of these

(xi) The 15th term of the A.P. 7, 4, 1, ... is:

(a) -35

(b) -28

(c) -32

(d) 35

(xii) For the A.P. 1, 3, 5, ..., the sum of the first n terms is:(a) n^2 (b) $n(n + 1)$ (c) $2n$ (d) $n(n - 1)$

(xiii) If the ratio of the areas of two similar triangles is 16 : 25, the ratio of their corresponding sides is:

(a) 4 : 5

(b) 16 : 25

(c) 256 : 625

(d) 5 : 4

(xiv) In $\triangle ABC$, $DE \parallel BC$ with D on AB and E on AC . If $AD = 3$ cm and $AB = 9$ cm, then $DE : BC =$

(a) 1 : 3

(b) 1 : 2

(c) 2 : 3

(d) 3 : 1

(xv) The abscissa of the point where the 'less than' and 'more than' ogives intersect gives the:

(a) mean

(b) mode

(c) median

(d) range

Q2.

[12]

(i) A retailer buys an article for ₹5,000 and marks it up by 30%. He then sells it at a discount of 10% on the marked price. If the rate of GST is 12%, find the total amount (inclusive of GST) paid by the customer. [4]

(ii) Manoj deposits ₹1,200 per month in a recurring deposit account for 18 months at 6% per annum. Find the interest earned and the maturity value. [4]

(iii) If $A = \begin{vmatrix} 2 & -1 \\ 3 & 0 \end{vmatrix}$ and $B = \begin{vmatrix} 1 & 4 \\ -2 & 5 \end{vmatrix}$, find the product AB . [4]

Q3.

[13]

(i) Solve the inequation, write the solution set and represent it on a number line: $-1 < \frac{2x + 1}{3} \leq 3$, $x \in \mathbb{R}$. [4]

(ii) The sum of the first n terms of an A.P. is $S_n = 3n^2 + 5n$. Find the A.P. and its 10th term. [4]

(iii) The speed of a boat in still water is 15 km/h. It goes 30 km upstream and returns to the starting point in a total of 4 hours 30 minutes. Find the speed of the stream. [5]

SECTION B — 40 Marks

(Attempt any FOUR questions from this Section.)

Q4.

[10]

(i) Solve $x^2 - 4x - 8 = 0$ and give your answer correct to two decimal places. [3]

(ii) The ratio of two numbers is 3 : 5. If each number is increased by 10, the ratio becomes 5 : 7. Find the numbers. [4]

(iii) Using componendo and dividendo, solve for x : $\frac{\sqrt{x+4} + \sqrt{x-4}}{\sqrt{x+4} - \sqrt{x-4}} = 2$. [3]

Q5.

[10]

(i) Using the remainder theorem, find the remainder when $x^4 - 3x^2 + 2x + 1$ is divided by $(x - 1)$. [3]

(ii) Using the factor theorem, factorise completely: $x^3 + 2x^2 - 5x - 6$. [4]

(iii) If $A = \begin{vmatrix} 3 & 1 \\ -1 & 2 \end{vmatrix}$, find $A^2 - SA$. [3]

Q6.

[10]

(i) The printed price of an article is ₹6,000. A shopkeeper sells it to a customer at a discount of 20% on the printed price and charges GST at 12%. Find (a) the discount, (b) the selling price before GST, (c) the amount of GST, and (d) the total amount paid by the customer. [6]

(ii) Priya deposits ₹500 per month in a recurring deposit account for 4 years at 9% per annum. Find the maturity value of her account. [4]

Q7.

[10]

(i) In $\triangle ABC$, D and E are points on AB and AC respectively such that $DE \parallel BC$. Given $AD = 3$ cm, $DB = 5$ cm and $AE = 2.4$ cm, find (a) AB, (b) AC, and (c) DE if $BC = 6.4$ cm. [6]

(ii) How many terms of the A.P. 18, 16, 14, ... are required to give a sum of 78? Explain why there are two answers. [4]

Q8. (Use graph paper for this question.) [10]

The marks obtained by 50 students are given below.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	4	6	10	14	9	5	2

Draw an ogive for the distribution and use it to estimate (i) the median, (ii) the lower quartile (Q_1), and (iii) the number of students who scored more than 30 marks.

Q9.

[10]

(i) (Use graph paper.) Draw a histogram for the following distribution and hence estimate the mode. [6]

Class	0-10	10-20	20-30	30-40	40-50
Frequency	3	8	15	12	6

(ii) If $A = \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix}$ and $A^2 = aA + bI$, where I is the 2×2 identity matrix, find the values of a and b .

[4]

SOLUTIONS & MARKING SCHEME — SET 3

Q1. MCQ answers

- (i) (b) ₹60 — 5% of 1200. (ii) (a) ₹2,400 — 200×12 . (iii) (a) $\{0, 1, 2\}$ — $x < 3, x \in \mathbb{W}$. (iv) (a) ± 4 — $p^2 = 16$. (v) (a) $5/2$ — $-b/a$. (vi) (a) 6 — $x^2 = 4 \times 9$. (vii) (a) -3 — $p(-2)$. (viii) (a) -2 — $p(-1) = 0$. (ix) (a) $[8]$ — $2+6$. (x) (b) the null matrix O . (xi) (a) -35 — $7 + 14(-3)$. (xii) (a) n^2 . (xiii) (a) $4 : 5$. (xiv) (a) $1 : 3$ — BPT. (xv) (c) median.

Q2 (i) — GST

Marked price = $5000 \times (1 + 30/100) = ₹6,500$. Discount 10% $\Rightarrow$ selling price = $6500 \times \frac{90}{100} = ₹5,850$.

GST = 12% of 5850 = ₹702. Total amount paid = $5850 + 702 = ₹6,552$.

Q2 (ii) — Recurring Deposit

$$n = 18, P = 1200, r = 6. \quad I = 1200 \times \frac{18 \times 19}{2} \times \frac{6}{1200} = 1200 \times 171 \times \frac{6}{1200} = ₹1,026.$$

$$\text{Maturity value} = 1200 \times 18 + 1026 = 21600 + 1026 = ₹22,626.$$

Q2 (iii) — Matrices

$$AB = \begin{vmatrix} 2 \cdot 1 + (-1)(-2) & 2 \cdot 4 + (-1) \cdot 5 \\ 3 \cdot 1 + 0 \cdot (-2) & 3 \cdot 4 + 0 \cdot 5 \end{vmatrix} = \begin{vmatrix} 4 & 3 \\ 3 & 12 \end{vmatrix}.$$

Q3 (i) — Inequation

$$-1 < \frac{2x+1}{3} \leq 3 \Rightarrow \text{multiply by 3: } -3 < 2x+1 \leq 9 \Rightarrow -4 < 2x \leq 8 \Rightarrow -2 < x \leq 4. \quad \text{Solution} = (-2, 4].$$



Q3 (ii) — A.P. from S_n

$$t_n = S_n - S_{n-1} = (3n^2 + 5n) - [3(n-1)^2 + 5(n-1)] = 6n + 2. \quad \text{So } t_1 = 8, t_2 = 14 \Rightarrow d = 6.$$

$$\text{A.P.: } 8, 14, 20, \dots \quad t_{10} = 6(10) + 2 = 62.$$

Q3 (iii) — Quadratic (boat & stream)

Let the speed of the stream = s km/h. Upstream speed = $(15 - s)$, downstream = $(15 + s)$. Total time = $4\frac{1}{2}$ h = $\frac{9}{2}$ h.

$$\frac{30}{15-s} + \frac{30}{15+s} = \frac{9}{2} \Rightarrow 30(15+s) + 30(15-s) = \frac{9}{2}(225 - s^2) \Rightarrow 900 = \frac{9}{2}(225 - s^2).$$

$$\Rightarrow 200 = 225 - s^2 \Rightarrow s^2 = 25 \Rightarrow s = 5 \text{ km/h (reject } -5).$$

Q4 (i) — Quadratic formula

$$x^2 - 4x - 8 = 0, a=1, b=-4, c=-8. \quad D = 16 + 32 = 48, \sqrt{48} \approx 6.928.$$

$$x = \frac{4 \pm 6.928}{2} \Rightarrow x = \frac{10.928}{2} \text{ or } \frac{-2.928}{2} \Rightarrow \boxed{x \approx 5.46 \text{ or } x \approx -1.46}.$$

Q4 (ii) — Ratio & Proportion

Let the numbers be $3k$ and $5k$. $\frac{3k+10}{5k+10} = \frac{5}{7} \Rightarrow 7(3k+10) = 5(5k+10) \Rightarrow 21k+70 = 25k+50 \Rightarrow 4k =$

$$20 \Rightarrow k = 5.$$

$\therefore$ the numbers are $\boxed{15 \text{ and } 25}$.

Q4 (iii) — Componendo & Dividendo

$$\frac{\sqrt{x+4} + \sqrt{x-4}}{\sqrt{x+4} - \sqrt{x-4}} = \frac{2}{1}. \quad \text{By C \& D: } \frac{2\sqrt{x+4}}{2\sqrt{x-4}} = \frac{2+1}{2-1} = \frac{3}{1} \Rightarrow \frac{\sqrt{x+4}}{\sqrt{x-4}} = 3.$$

Squaring: $\frac{x+4}{x-4} = 9 \Rightarrow x+4 = 9x-36 \Rightarrow 8x = 40 \Rightarrow \boxed{x = 5}.$

Q5 (i) — Remainder theorem

$$x-1 = 0 \Rightarrow x = 1. \quad \text{Remainder} = p(1) = 1 - 3 + 2 + 1 = \boxed{1}.$$

Q5 (ii) — Factor theorem

$$p(x) = x^3 + 2x^2 - 5x - 6. \quad p(2) = 8 + 8 - 10 - 6 = 0 \Rightarrow (x-2) \text{ is a factor.}$$

$$x^3 + 2x^2 - 5x - 6 = (x-2)(x^2 + 4x + 3) = (x-2)(x+1)(x+3). \quad \therefore \boxed{(x-2)(x+1)(x+3)}.$$

Q5 (iii) — Matrices

$$A^2 = \begin{vmatrix} 3 & 1 \\ -1 & 2 \end{vmatrix} \begin{vmatrix} 3 & 1 \\ -1 & 2 \end{vmatrix} = \begin{vmatrix} 9-1 & 3+2 \\ -3-2 & -1+4 \end{vmatrix} = \begin{vmatrix} 8 & 5 \\ -5 & 3 \end{vmatrix}. \quad SA = \begin{vmatrix} 15 & 5 \\ -5 & 10 \end{vmatrix}.$$

$$A^2 - SA = \begin{vmatrix} 8-15 & 5-5 \\ -5+5 & 3-10 \end{vmatrix} = \begin{vmatrix} -7 & 0 \\ 0 & -7 \end{vmatrix} = \boxed{-7I}.$$

Q6 (i) — GST

(a) Discount = 20% of 6000 = $\boxed{\text{₹1,200}}$. (b) Selling price before GST = 6000 - 1200 = $\boxed{\text{₹4,800}}$.

(c) GST = 12% of 4800 = $\boxed{\text{₹576}}$. (d) Total amount paid by customer = 4800 + 576 = $\boxed{\text{₹5,376}}$.

Q6 (ii) — Recurring Deposit

$$n = 48, P = 500, r = 9. \quad I = 500 \times \frac{48 \times 49}{2} \times \frac{9}{1200} = 500 \times 1176 \times \frac{9}{1200} = \boxed{\text{₹4,410}}.$$

Maturity value = 500 × 48 + 4410 = 24000 + 4410 = $\boxed{\text{₹28,410}}.$

Q7 (i) — Similarity (BPT)

(a) AB = AD + DB = 3 + 5 = $\boxed{8 \text{ cm}}$. Since DE || BC, $\triangle ADE \sim \triangle ABC$ with ratio $\frac{AD}{AB} = \frac{3}{8}$.

(b) $\frac{AE}{AC} = \frac{3}{8} \Rightarrow AC = 2.4 \times \frac{8}{3} = \boxed{6.4 \text{ cm}}$. (c) $\frac{DE}{BC} = \frac{3}{8} \Rightarrow DE = 6.4 \times \frac{3}{8} = \boxed{2.4 \text{ cm}}$.

Q7 (ii) — A.P.

$$a = 18, d = -2. \quad S_n = \frac{n}{2} [2(18) + (n-1)(-2)] = \frac{n}{2} (38 - 2n) = n(19 - n) = 78.$$

$\Rightarrow n^2 - 19n + 78 = 0 \Rightarrow (n - 6)(n - 13) = 0 \Rightarrow \boxed{n = 6 \text{ or } n = 13}$. Both are valid because the 7th to 13th terms (18-12=6, 4, 2, 0, -2, -4, -6) add up to 0, so $S_6 = S_{13} = 78$.

Q8 — Ogive (N = 50)

Cumulative frequencies:

$\leq$	10	20	30	40	50	60	70
c.f.	4	10	20	34	43	48	50

(i) Median = value at $\frac{N}{2} = 25\text{th student}$ (class 30-40): $30 + \frac{25 - 20}{14} \times 10 \approx \boxed{33.6 \text{ marks}}$.

(ii) Q_1 = value at $\frac{N}{4} = 12.5\text{th student}$ (class 20-30): $20 + \frac{12.5 - 10}{10} \times 10 = \boxed{22.5 \text{ marks}}$.

(iii) Students scoring more than 30 = $50 - 20 = \boxed{30 \text{ students}}$.

Q9 (i) — Histogram & mode

Modal class = 20-30 (highest frequency 15). By the intersecting-lines construction the mode is read off the graph.

Check by formula: mode = $L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 20 + \frac{15 - 8}{30 - 8 - 12} \times 10 = 20 + \frac{70}{10} = \boxed{27}$.

Q9 (ii) — Matrices

$$A^2 = \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} = \begin{vmatrix} 4+9 & 6+6 \\ 6+6 & 9+4 \end{vmatrix} = \begin{vmatrix} 13 & 12 \\ 12 & 13 \end{vmatrix}.$$

$$aA + bI = \begin{vmatrix} 2a+b & 3a \\ 3a & 2a+b \end{vmatrix}. \quad \text{Comparing: } 3a = 12 \Rightarrow \boxed{a = 4}; \quad 2a + b = 13 \Rightarrow 8 + b = 13 \Rightarrow \boxed{b = 5}.$$