



KUMAR CLASSES

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ICSE • Class X

Mathematics

Sample Paper — Set 2

MATHEMATICS — ICSE BOARD PATTERN

Class X • Sample / Preboard Paper • SET 2 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) For an intra-state sale of an article costing ₹5,000 at GST rate 18%, the CGST is:

- | | |
|----------|----------|
| (a) ₹900 | (b) ₹450 |
| (c) ₹500 | (d) ₹250 |

(ii) In a recurring deposit of ₹150 per month for 20 months, the total sum deposited is:

- | | |
|------------|------------|
| (a) ₹3,000 | (b) ₹1,500 |
| (c) ₹300 | (d) ₹150 |

(iii) The smallest integer x satisfying $5 - 2x \leq 1$ is:

- | | |
|-------|-------|
| (a) 1 | (b) 2 |
| (c) 3 | (d) 0 |

(iv) The value of k for which $x^2 + kx + 9 = 0$ has equal roots is:

- | | |
|-------------|-------|
| (a) 6 | (b) 9 |
| (c) ± 6 | (d) 3 |

(v) The roots of $x^2 - 7x + 12 = 0$ are:

- | | |
|----------|------------|
| (a) 3, 4 | (b) -3, -4 |
| (c) 2, 6 | (d) 1, 12 |

(vi) If $a : b = 2 : 3$ and $b : c = 4 : 5$, then $a : c =$

- | | |
|------------|------------|
| (a) 8 : 15 | (b) 2 : 5 |
| (c) 8 : 5 | (d) 6 : 20 |

(vii) The remainder when $x^3 + 3x^2 - 4x + 2$ is divided by $(x + 1)$ is:

- (a) 8 (b) 0
(c) 2 (d) -8

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

- (a) 5 (b) 2
(c) 10 (d) -5

(ix) A matrix having 6 elements cannot be of the order:

- (a) 2×3 (b) 1×6
(c) 6×1 (d) 4×2

(x) If $\begin{vmatrix} x & 0 \\ 0 & x \end{vmatrix} = 31$, then $x =$

- (a) 3 (b) 1
(c) 0 (d) 9

(xi) The common difference of an A.P. whose first term is 7 and third term is 17 is:

- (a) 5 (b) 10
(c) 2 (d) 3

(xii) The sum of the first n natural numbers is:

- (a) $\frac{n(n+1)}{2}$ (b) $\frac{n(n-1)}{2}$
(c) n^2 (d) $n(n+1)$

(xiii) If $\triangle ABC \sim \triangle PQR$ and $AB : PQ = 3 : 4$, the ratio of their areas is:

- (a) $3 : 4$ (b) $4 : 3$
(c) $9 : 16$ (d) $16 : 9$

(xiv) In two similar triangles, the ratio of the perimeters equals the ratio of the:

- (a) areas (b) corresponding sides
(c) squares of the sides (d) none of these

(xv) On a cumulative frequency curve, the median corresponds to the cumulative frequency:

- (a) N (b) $N/2$
(c) $N/4$ (d) $3N/4$

Q2.

[12]

(i) Mr. Gupta buys a washing machine for ₹18,000 (price before tax). If the rate of GST is 18% and the sale is within the state, find the CGST, the SGST and the total amount he pays.

[4]

(ii) Rohit deposits ₹600 per month in a recurring deposit account for 3 years at 8% per annum. Find the maturity value of his account.

[4]

(iii) If $A = \begin{vmatrix} 3 & -2 \\ 4 & 1 \end{vmatrix}$ and $B = \begin{vmatrix} 1 & 0 \\ -2 & 3 \end{vmatrix}$, find $2A + B$.

[4]

Q3.

[13]

(i) Solve the following inequations, write the solution set and represent it on a number line: $3(x - 2) \leq 2(x + 1)$ and $-(x + 7) < 2x - 4$, $x \in \mathbb{R}$.

[4]

(ii) The 7th term of an A.P. is 20 and the 13th term is 38. Find the A.P. and its 25th term.

[4]

(iii) The product of two consecutive positive even numbers is 168. Form a quadratic equation and find the numbers.

[5]

SECTION B — 40 Marks

(Attempt any FOUR questions from this Section.)

Q4.

[10]

- (i) Solve $2x^2 - 7x - 3 = 0$ and give your answer correct to two decimal places. [3]
- (ii) What number must be subtracted from each of 23, 30, 57 and 78 so that the remainders are in proportion? [3]
- (iii) Using componendo and dividendo, solve for x : $\frac{3x + \sqrt{9x^2 - 5}}{3x - \sqrt{9x^2 - 5}} = 5$. [4]

Q5.

[10]

- (i) Find the remainder when $x^3 - 3x^2 + 2x + 5$ is divided by $(x - 2)$. [3]
- (ii) Using the factor theorem, factorise completely: $2x^3 - x^2 - 13x - 6$. [4]
- (iii) If $A = \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix}$, find A^2 . [3]

Q6.

[10]

- (i) A manufacturer sells a television to a wholesaler for ₹22,000. The wholesaler sells it to a retailer at a profit of ₹3,000, and the retailer sells it to a consumer at a profit of ₹2,000. All sales are within the same state and the GST rate is 18%. Find (a) the amount paid by the consumer inclusive of GST, and (b) the GST paid by the retailer to the government. [6]
- (ii) Anita deposits ₹1,000 per month in a recurring deposit account for 2 years and receives ₹25,500 at maturity. Find the rate of interest per annum. [4]

Q7.

[10]

- (i) The areas of two similar triangles are 100 cm^2 and 64 cm^2 . (a) If a median of the larger triangle is 20 cm, find the corresponding median of the smaller triangle. (b) If a side of the smaller triangle is 12 cm, find the corresponding side of the larger triangle. [6]
- (ii) Find the sum of all two-digit natural numbers which are divisible by 3. [4]

Q8. (Use graph paper for this question.)

[10]

The marks obtained by 100 students in an examination are given below.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	7	10	23	28	18	9	5

Draw an ogive for this distribution and use it to estimate (i) the median, (ii) the upper quartile (Q_3), and (iii) the number of students who scored more than 40 marks.

Q9.

[10]

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

Class	10-20	20-30	30-40	40-50	50-60
Frequency	5	12	20	9	4

- (ii) If $A = \begin{vmatrix} 1 & 4 \\ 2 & 3 \end{vmatrix}$ and I is the 2×2 identity matrix, show that $A^2 - 4A - 5I = 0$. [4] [6]

SOLUTIONS & MARKING SCHEME — SET 2

Q1. MCQ answers

(i) (b) ₹450 — CGST = 9% of 5000. (ii) (a) ₹3,000 — 150×20 . (iii) (b) $2 - 5 - 2x \leq 1 \Rightarrow x \geq 2$. (iv) (c) $\pm 6 - k^2 = 36$. (v) (a) 3, 4. (vi) (a) 8 : 15. (vii) (a) $8 - p(-1)$. (viii) (a) $5 - 8 - 2k + 2 = 0$. (ix) (d) 4×2 — that needs 8 elements. (x) (a) 3. (xi) (a) 5. (xii) (a) $n(n+1)/2$. (xiii) (c) 9 : 16. (xiv) (b) corresponding sides. (xv) (b) $N/2$.

Q2 (i) — GST

GST = 18% of 18000 = ₹3,240. Intra-state $\Rightarrow$ CGST = SGST = 9% of 18000 = ₹1,620 each.
Total amount paid = 18000 + 3240 = ₹21,240.

Q2 (ii) — Recurring Deposit

$n = 36, P = 600, r = 8$. $I = P \times \frac{n(n+1)}{2} \times \frac{r}{1200} = 600 \times \frac{36 \times 37}{2} \times \frac{8}{1200} = 600 \times 666 \times \frac{8}{1200} = ₹2,664$.

Maturity value = $600 \times 36 + 2664 = 21600 + 2664 = ₹24,264$.

Q2 (iii) — Matrices

$$2A = \begin{vmatrix} 6 & -4 \\ 8 & 2 \end{vmatrix}, \quad 2A + B = \begin{vmatrix} 6 & -4 \\ 8 & 2 \end{vmatrix} + \begin{vmatrix} 1 & 0 \\ -2 & 3 \end{vmatrix} = \begin{vmatrix} 7 & -4 \\ 6 & 5 \end{vmatrix}.$$

Q3 (i) — Inequations

$3(x - 2) \leq 2(x + 1) \Rightarrow 3x - 6 \leq 2x + 2 \Rightarrow x \leq 8$. $-(x + 7) < 2x - 4 \Rightarrow -x - 7 < 2x - 4 \Rightarrow -3 < 3x \Rightarrow x > -1$.

$\therefore$ solution set = $(-1, 8]$ ($-1 < x \leq 8$).



Q3 (ii) — A.P.

$a + 6d = 20$... (1), $a + 12d = 38$... (2). (2) - (1): $6d = 18 \Rightarrow d = 3$; $a = 20 - 18 = 2$. A.P.: 2, 5, 8, 11, ...
 $t_{25} = a + 24d = 2 + 24(3) = 74$.

Q3 (iii) — Quadratic (word problem)

Let the numbers be x and $(x + 2)$. $x(x + 2) = 168 \Rightarrow x^2 + 2x - 168 = 0 \Rightarrow (x + 14)(x - 12) = 0$.
 $x = 12$ (reject -14). $\therefore$ the numbers are 12 and 14.

Q4 (i) — Quadratic formula

$2x^2 - 7x - 3 = 0$, $a=2, b=-7, c=-3$. $D = 49 + 24 = 73$, $\sqrt{73} \approx 8.544$.

$$x = \frac{7 \pm 8.544}{4} \Rightarrow x = \frac{15.544}{4} \text{ or } \frac{-1.544}{4} \Rightarrow x \approx 3.89 \text{ or } x \approx -0.39.$$

Q4 (ii) — Proportion

$$\text{Let } x \text{ be subtracted} \Rightarrow \frac{23-x}{30-x} = \frac{57-x}{78-x} \Rightarrow (23-x)(78-x) = (30-x)(57-x).$$

$$1794 - 101x + x^2 = 1710 - 87x + x^2 \Rightarrow 84 = 14x \Rightarrow \boxed{x = 6}. \text{ (Check: } 17, 24, 51, 72 \rightarrow 17:24 = 51:72, \checkmark)$$

Q4 (iii) — Componendo & Dividendo

$$\frac{3x + \sqrt{9x^2 - 5}}{3x - \sqrt{9x^2 - 5}} = \frac{5}{1}. \text{ By C \& D: } \frac{2 \cdot 3x}{2\sqrt{9x^2 - 5}} = \frac{5+1}{5-1} = \frac{6}{4} \Rightarrow \frac{3x}{\sqrt{9x^2 - 5}} = \frac{3}{2}.$$

$$\Rightarrow 6x = 3\sqrt{9x^2 - 5} \Rightarrow 2x = \sqrt{9x^2 - 5} \Rightarrow 4x^2 = 9x^2 - 5 \Rightarrow 5x^2 = 5 \Rightarrow x^2 = 1 \Rightarrow \boxed{x = 1} \text{ (} x = -1 \text{ rejected).}$$

Q5 (i) — Remainder theorem

$$x - 2 = 0 \Rightarrow x = 2. \text{ Remainder} = p(2) = 8 - 12 + 4 + 5 = \boxed{5}.$$

Q5 (ii) — Factor theorem

$$p(x) = 2x^3 - x^2 - 13x - 6. \quad p(-2) = 2(-8) - 4 + 26 - 6 = 0 \Rightarrow (x + 2) \text{ is a factor.}$$

$$2x^3 - x^2 - 13x - 6 = (x + 2)(2x^2 - 5x - 3) = (x + 2)(2x + 1)(x - 3). \quad \therefore \boxed{(x + 2)(2x + 1)(x - 3)}.$$

Q5 (iii) — Matrices

$$A^2 = \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix} \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix} = \begin{vmatrix} 1-2 & 2+6 \\ -1-3 & -2+9 \end{vmatrix} = \begin{vmatrix} -1 & 8 \\ -4 & 7 \end{vmatrix}.$$

Q6 (i) — GST (chain of dealers)

$$\text{Price to consumer before GST} = 22000 + 3000 + 2000 = ₹27,000. \quad \text{GST} = 18\% \text{ of } 27000 = ₹4,860.$$

$$(a) \text{ Amount paid by consumer} = 27000 + 4860 = \boxed{₹31,860}.$$

$$(b) \text{ GST paid by the retailer} = \text{tax on his value addition} = 18\% \text{ of } ₹2,000 = \boxed{₹360}.$$

Q6 (ii) — Recurring Deposit (find rate)

$$\text{Deposits} = 1000 \times 24 = ₹24,000. \quad \text{Interest} = 25500 - 24000 = ₹1,500.$$

$$1500 = 1000 \times \frac{24 \times 25}{2} \times \frac{r}{1200} = 250r \Rightarrow r = \frac{1500}{250} = \boxed{6\% \text{ per annum}}.$$

Q7 (i) — Similarity

$$\text{Ratio of areas} = 100 : 64 \Rightarrow \text{ratio of corresponding sides (and medians)} = \sqrt{100} : \sqrt{64} = 10 : 8 = 5 : 4.$$

$$(a) \text{ Median of smaller} = 20 \times \frac{4}{5} = \boxed{16 \text{ cm}}. \quad (b) \text{ Side of larger} = 12 \times \frac{5}{4} = \boxed{15 \text{ cm}}.$$

Q7 (ii) — A.P. (sum)

$$\text{Two-digit multiples of 3: } 12, 15, \dots, 99. \quad a = 12, d = 3, l = 99. \quad n = \frac{99 - 12}{3} + 1 = 30.$$

$$\text{Sum} = \frac{n}{2}(a + l) = \frac{30}{2}(12 + 99) = 15 \times 111 = \boxed{1665}.$$

Q8 — Ogive (N = 100)

Cumulative frequencies (upper boundary vs c.f.):

≤	10	20	30	40	50	60	70
c.f.	7	17	40	68	86	95	100

(i) Median = value at $\frac{N}{2} = 50$ th student (class 30–40): $30 + \frac{50 - 40}{28} \times 10 \approx \boxed{33.6 \text{ marks}}$.

(ii) $Q_3 =$ value at $\frac{3N}{4} = 75$ th student (class 40–50): $40 + \frac{75 - 68}{18} \times 10 \approx \boxed{43.9 \text{ marks}}$.

(iii) Students scoring more than 40 = $100 - (\text{c.f. up to } 40) = 100 - 68 = \boxed{32 \text{ students}}$.

Q9 (i) — Histogram & mode

Modal class = 30–40 (highest frequency 20). By the intersecting-lines construction on the histogram, the mode is read where the two diagonals meet.

Check by formula: mode = $L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 30 + \frac{20 - 12}{40 - 12 - 9} \times 10 = 30 + \frac{80}{19} \approx \boxed{34.2}$.

Q9 (ii) — Matrix identity

$$A^2 = \begin{vmatrix} 1 & 4 \\ 2 & 3 \end{vmatrix} = \begin{vmatrix} 1+8 & 4+12 \\ 2+6 & 8+9 \end{vmatrix} = \begin{vmatrix} 9 & 16 \\ 8 & 17 \end{vmatrix}.$$

$$4A = \begin{vmatrix} 4 & 16 \\ 8 & 12 \end{vmatrix}, \quad 5I = \begin{vmatrix} 5 & 0 \\ 0 & 5 \end{vmatrix}, \quad A^2 - 4A - 5I = \begin{vmatrix} 9-4-5 & 16-16 \\ 8-8 & 17-12-5 \end{vmatrix} = \begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix} = \boxed{0}. \quad \checkmark$$