MARKING SCHEME AND SOLUTION KEY

KENDRIYA VIDYALAYA SANGATHAN — ERNAKULAM REGION

PRE-BOARD / PRACTICE TEST I (2026–27)

Class & Subject:	Class X — Mathematics (Basic 241)	**Max. Marks:**	80 Marks
Duration:	3 Hours (180 Minutes)	**Total Questions:**	38 Questions (5 Sections)

Question Paper Structure & Scheme Summary

Section	Question Types	No. of Questions	Marks per Qn	Total Marks
Section A	Multiple Choice Questions (MCQs)	20 (Q1 – Q20)	1	**20**
Section B	Short Answer Questions - I (SA-I)	5 (Q21 – Q25)	2	**10**
Section C	Short Answer Questions - II (SA-II)	6 (Q26 – Q31)	3	**18**
Section D	Long Answer Questions (LA)	4 (Q32 – Q35)	5	**20**
Section E	Case-Based Integrated Units	3 (Q36 – Q38)	4 (1+1+2)	**12**

SECTION A: Multiple Choice Questions (20 Marks)

Q.No	Correct Option	Brief Explanation & Steps	Marks
1	**(a) 2**	Smallest prime number = 2; Smallest 2-digit number = 10. HCF(2, 10) = 2.	**1**
2	**A) 25°**	∠AOP = 180° - 115° = 65°. In ΔOAP, ∠OAP = 90° (radius ⊥ tangent). ∠APO = 90° - 65° = 25°.	**1**
3	**(b) a=3, b=-3, c=1**	Standard quadratic form: $ax^2 + bx + c = 0$. Comparing $3x^2 - 3x + 1 = 0$ gives a=3, b=-3, c=1.	**1**
4	**(a) / (d) m = -7**	For A.P.: 2(2m - 2) = (m + 4) + (5m + 6) => 4m - 4 = 6m +	**1**

		10 => -2m = 14 => m = -7.	
5	**(d) 145°**	In quadrilateral OQPR, ∠QOR + ∠QPR = 180°. ∠QOR = 180° - 35° = 145°.	**1**
6	**(a) 2**	Product of zeroes α · (1/α) = 1 = c/a = k/2 => k = 2.	**1**
7	**(d) infinitely many**	Equation $x^2 + y^2 = 25$. The circular arc in the 3rd quadrant contains infinitely many points.	**1**
8	**(b) 7**	Midpoint of PR = Midpoint of QS. ((2+3)/2, (4+6)/2) = ((0+5)/2, (3+y)/2) => (3+y)/2 = 5 => y = 7.	**1**
9	**(d) From inside point...**	Statement (d) is false because no tangents can be drawn from an interior point of a circle.	**1**
10	**(a) ΔAED**	By angle correspondence and similarity criterion, ΔBAC ~ ΔAED.	**1**
11	**(c) ∠B = ∠D**	AB/DE = BC/FD. Included angles between corresponding sides are ∠B and ∠D.	**1**
12	**(b) (3, 4)**	Section formula (1:2): P(x,y) = ((1×7 + 2×1)/3, (1×8 + 2×2)/3) = (9/3, 12/3) = (3, 4).	**1**
13	**(b) 24**	Ratio of perimeters equals ratio of corresponding sides of similar triangles.	**1**
14	**(d) 77 Sq cm**	In 30 mins, minute hand sweeps 180°. Area = (180/360) × (22/7) × 7^2 = (1/2) × 154 = 77 cm^2.	**1**
15	**(b) 1 : 2√2**	S1/S2 = $r1^2/r2^2$ = 1/2 => r1/r2 = 1/√2. V1/V2 = $(r1/r2)^3$ = 1/(2√2).	**1**
16	**(d) 462**	TSA of solid hemisphere = $3\pi r^2$ = 3 × (22/7) × 7^2 = 3 × 154 = 462 cm^2.	**1**
17	**(c) 10 cm**	Area $\pi r^2 = 25\pi$ => r = 5 cm. Distance AB = Diameter = 2r = 10 cm.	**1**
18	**(a) 19 cm**	Perimeter of triangle = 2 × AP = 38 cm => AP = 19 cm.	**1**
19	**(b) Both A and R true...**	Assertion is true by section formula. Reason is the distance formula (true, but not correct explanation).	**1**

20	**(a) Both A and R true...**	$\cos A = 1 - \cos^2 A = \sin^2 A$. So $\sin^2 A + \sin^4 A = \sin^2 A + \cos^2 A = 1$. R correctly explains A.	**1**

SECTION B: Short Answer Questions - I (10 Marks)

Question 21: Solve: 49x + 51y = 499 and 51x + 49y = 501 [2 Marks]

Step-by-Step Solution & Working Details	Marks
Given equations: 49x + 51y = 499 ... (1) and 51x + 49y = 501 ... (2)	—
Adding (1) and (2): 100x + 100y = 1000 => x + y = 10 ... (3)	**0.5 Mark**
Subtracting (1) from (2): 2x - 2y = 2 => x - y = 1 ... (4)	**0.5 Mark**
Solving (3) and (4) simultaneously: x = 5.5 and y = 4.5	**1.0 Mark**

Question 22 (a): Will 6^n end in zero for any natural number n? Explain. [2 Marks]

Step-by-Step Solution & Working Details	Marks
Prime factorization of 6^n = (2 × 3)^n = 2^n × 3^n.	**0.5 Mark**
For a number to end with digit 0, its prime factorization must contain the prime factor 5.	**0.5 Mark**
By Fundamental Theorem of Arithmetic, prime factorization of 6^n contains only 2 and 3. Hence 5 is not a factor.	**0.5 Mark**
Conclusion: 6^n cannot end with the digit zero for any natural number n.	**0.5 Mark**

Question 22 (b) [OR]: Explain why 7 × 3 × 5 × 11 + 3 × 11 is a composite number. [2 Marks]

Step-by-Step Solution & Working Details	Marks
Expression = 7 × 3 × 5 × 11 + 3 × 11 = 3 × 11 × (7 × 5 + 1)	**0.5 Mark**
= 33 × (35 + 1) = 33 × 36 = 1188.	**0.5 Mark**
Prime factorization: $1188 = 2^2 \times 3^3 \times 11$.	**0.5 Mark**
Since it has prime factors other than 1 and itself, it is a composite number.	**0.5 Mark**

Question 23: If $\tan\theta + \cot\theta = 5$, find the value of $\tan^2\theta + \cot^2\theta$. [2 Marks]

Step-by-Step Solution & Working Details	Marks
Given: $\tan\theta + \cot\theta = 5$.	—
Squaring both sides: $(\tan\theta + \cot\theta)^2 = 5^2 \Rightarrow \tan^2\theta + \cot^2\theta + 2\tan\theta\cot\theta = 25$	1.0 Mark
Since $\tan\theta \cdot \cot\theta = 1$, we get: $\tan^2\theta + \cot^2\theta + 2(1) = 25$	0.5 Mark
$\tan^2\theta + \cot^2\theta = 25 - 2 = 23$.	0.5 Mark

Question 24: Find the value of x for which DE || AB in ΔABC. [2 Marks]

Step-by-Step Solution & Working Details	Marks
By Basic Proportionality Theorem (BPT / Thales Theorem): CD/DA = CE/EB	0.5 Mark
Substituting given expressions in terms of x and setting up algebraic equation.	0.5 Mark
Cross-multiplying and simplifying quadratic equation.	0.5 Mark
Solving for x correctly to obtain final numerical value.	0.5 Mark

Question 25: Sector table top with ∠AOB = 90° and AO = OB = 42 cm. Find perimeter. [2 Marks]

Step-by-Step Solution & Working Details	Marks
Reflex central angle $\theta = 360° - 90° = 270°$.	0.5 Mark
Length of major arc $= (\theta/360°) \times 2\pi r = (270/360) \times 2 \times (22/7) \times 42 = (3/4) \times 264 = 198$ cm.	1.0 Mark
Total Perimeter = Arc length + OA + OB = 198 + 42 + 42 = 282 cm.	0.5 Mark

SECTION C: Short Answer Questions - II (18 Marks)

Question 26: Prove that $3 - 2\sqrt{5}$ is irrational. [3 Marks]

Step-by-Step Solution & Working Details	Marks

Let us assume on the contrary that 3 - 2√5 is rational.	**0.5 Mark**
Then 3 - 2√5 = a/b, where a and b are co-prime integers, b ≠ 0.	**0.5 Mark**
Rearranging: 2√5 = 3 - (a/b) = (3b - a)/b => √5 = (3b - a)/(2b)	**1.0 Mark**
Since a and b are integers, (3b - a)/(2b) is rational, which implies √5 is rational.	**0.5 Mark**
This contradicts the known fact that √5 is irrational. Hence, 3 - 2√5 is irrational.	**0.5 Mark**

Question 27 (a): Find zeroes of $p(x) = 2x^2 - x - 6$ and verify relationship with coefficients. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Factorization: $2x^2 - x - 6 = 2x^2 - 4x + 3x - 6 = 2x(x - 2) + 3(x - 2) = (2x + 3)(x - 2) = 0$	**1.0 Mark**
Zeroes: $\alpha = 2$ and $\beta = -3/2$.	**0.5 Mark**
Verification of Sum: $\alpha + \beta = 2 + (-3/2) = 1/2$. From formula: $-b/a = -(-1)/2 = 1/2$. (Verified)	**0.75 Mark**
Verification of Product: $\alpha \cdot \beta = 2 \times (-3/2) = -3$. From formula: $c/a = -6/2 = -3$. (Verified)	**0.75 Mark**

Question 27 (b) [OR]: Find quadratic polynomial with zeroes -2 and -5, and verify relationship. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Sum of zeroes $S = \alpha + \beta = -2 + (-5) = -7$; Product $P = \alpha \cdot \beta = (-2) \times (-5) = 10$.	**1.0 Mark**
Required Polynomial $p(x) = k[x^2 - Sx + P] = x^2 + 7x + 10$ (taking k=1).	**0.5 Mark**
Verification of Sum: $-b/a = -7/1 = -7 = \alpha + \beta$.	**0.75 Mark**
Verification of Product: $c/a = 10/1 = 10 = \alpha \cdot \beta$.	**0.75 Mark**

Question 28 (a): A fraction becomes 5/7 if 2 is added to both, and 1/2 if 1 is subtracted. Find fraction. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Let the fraction be x/y.	—

Condition 1: (x+2)/(y+2) = 5/7 => 7(x+2) = 5(y+2) => 7x - 5y = -4 ... (1)	**1.0 Mark**
Condition 2: (x-1)/(y-1) = 1/2 => 2(x-1) = y - 1 => 2x - y = 1 => y = 2x - 1 ... (2)	**1.0 Mark**
Substituting (2) in (1): 7x - 5(2x - 1) = -4 => -3x + 5 = -4 => -3x = -9 => x = 3.	**0.5 Mark**
y = 2(3) - 1 = 5. Hence, the fraction is 3/5.	**0.5 Mark**

Question 28 (b) [OR]: Solve graphically: x - 2y = 0 and 3x + 4y = 20. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Table of values for x - 2y = 0: Points (0,0), (2,1), (4,2).	**1.0 Mark**
Table of values for 3x + 4y = 20: Points (0,5), (4,2), (8,-1).	**1.0 Mark**
Plotting both lines accurately on graph paper and identifying intersection point (4, 2). Solution: x = 4, y = 2.	**1.0 Mark**

Question 29: Find angles A and B given trigonometric conditions. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Setting up first trigonometric relation to get equation A + B or A - B.	**1.0 Mark**
Setting up second relation to get complementary equation.	**1.0 Mark**
Solving the pair of linear equations to get A = 60° and B = 30°.	**1.0 Mark**

Question 30: Prove that ∠AOB = 90° for parallel tangents XY, X'Y' and tangent AB. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Construction: Join OC. Proof that ΔAOP ≅ΔAOC (RHS congruence).	**1.0 Mark**
∠PAO = ∠CAO => ∠PAC = 2 ∠CAO. Similarly, ΔBO'Q ≅ΔBOC => ∠QBC = 2 ∠CBO.	**1.0 Mark**
∠PAC + ∠QBC = 180° (co-interior angles) => 2 ∠CAO + 2 ∠CBO = 180° => ∠CAO + ∠CBO = 90°.	**0.5 Mark**
In ΔAOB: ∠AOB = 180° - (∠CAO + ∠CBO) = 180° - 90° = 90°. Hence proved.	**0.5 Mark**

Question 31: Cylindrical bottle of radius 3.5 cm, height 20 cm filled to 3/4 capacity. Find volume. [3 Marks]

Step-by-Step Solution & Working Details	Marks
Total Volume of Cylinder $V = \pi r^2 h = (22/7) \times (3.5)^2 \times 20 = (22/7) \times 12.25 \times 20$	1.0 Mark
$V = 22 \times 1.75 \times 20 = 770\ cm^3$.	0.5 Mark
Volume of medicine = (3/4) × Total Volume = (3/4) × 770 = 577.5 cm^3.	1.5 Marks

SECTION D: Long Answer Questions (20 Marks)

Question 32 (a): Books bought for ₹80. If 4 more bought, each costs ₹1 less. Find number of books. [5 Marks]

Step-by-Step Solution & Working Details	Marks
Let original number of books bought = x. Cost per book = 80/x.	1.0 Mark
If 4 more books bought, new cost per book = 80/(x+4).	0.5 Mark
Given: (80/x) - (80/(x+4)) = 1 => 80[(x+4 - x) / x(x+4)] = 1	1.0 Mark
$80(4) = x(x+4) \Rightarrow 320 = x^2 + 4x \Rightarrow x^2 + 4x - 320 = 0$	1.0 Mark
Factorization: $x^2 + 20x - 16x - 320 = 0 \Rightarrow (x + 20)(x - 16) = 0$	1.0 Mark
x = 16 (rejecting x = -20 as books count cannot be negative). Original number of books = 16.	0.5 Mark

Question 32 (b) [OR]: Train travels 180 km at uniform speed. If speed 9 km/h more, takes 1 hr less. Find speed. [5 Marks]

Step-by-Step Solution & Working Details	Marks
Let uniform speed of train = x km/h. Time taken = 180/x hours.	1.0 Mark
New speed = (x + 9) km/h. New time taken = 180/(x+9) hours.	0.5 Mark
Given: (180/x) - (180/(x+9)) = 1 => 180[(x+9 - x) / x(x+9)] = 1	1.0 Mark
$180(9) = x(x+9) \Rightarrow 1620 = x^2 + 9x \Rightarrow x^2 + 9x - 1620 = 0$	1.0 Mark

(x + 45)(x - 36) = 0 => x = 36 km/h (rejecting x = -45). Speed of train = 36 km/h.	**1.5 Marks**

Question 33 (a): State and Prove Basic Proportionality Theorem (Thales Theorem). [5 Marks]

Step-by-Step Solution & Working Details	Marks
Statement: If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.	**1.0 Mark**
Given, To Prove, Construction and clear Diagram.	**1.0 Mark**
Proof using area of triangles: area(ΔADE) = (1/2)×AD×EN and area(ΔBDE) = (1/2)×DB×EN	**1.0 Mark**
area(ΔADE)/area(ΔBDE) = AD/DB. Similarly, area(ΔADE)/area(ΔDEC) = AE/EC	**1.0 Mark**
Since ΔBDE and ΔDEC lie on same base DE and between same parallels DE || BC, area(ΔBDE) = area(ΔDEC). Hence AD/DB = AE/EC. (Proved)	**1.0 Mark**

Question 33 (b) [OR]: Given ΔABC ~ ΔPQR with medians AD and PM, prove AB/PQ = AD/PM. [5 Marks]

Step-by-Step Solution & Working Details	Marks
Given ΔABC ~ ΔPQR => AB/PQ = BC/QR = AC/PR and ∠B = ∠Q.	**1.0 Mark**
Since AD is median, BD = BC/2. Since PM is median, QM = QR/2.	**1.0 Mark**
AB/PQ = (2 BD)/(2 QM) => AB/PQ = BD/QM.	**1.0 Mark**
In ΔABD and ΔPQM: AB/PQ = BD/QM and ∠B = ∠Q. By SAS similarity criterion, ΔABD ~ ΔPQM.	**1.0 Mark**
Therefore, corresponding sides ratio: AB/PQ = AD/PM. (Proved)	**1.0 Mark**

Question 34: Prove: (cos A - sin A + 1) / (cos A + sin A - 1) = cosec A + cot A [5 Marks]

Step-by-Step Solution & Working Details	Marks
Dividing numerator and denominator by sin A:	**0.5 Mark**
LHS = (cot A - 1 + cosec A) / (cot A + 1 - cosec A) = [(cot A + cosec A) - 1] / (cot A - cosec A + 1)	**1.0 Mark**
Substituting 1 = $\text{cosec}^2 A - \cot^2 A$ = (cosec A - cot A)(cosec A + cot A) in numerator:	**1.0 Mark**

LHS = [(cot A + cosec A) - (cosec A - cot A)(cosec A + cot A)] / (cot A - cosec A + 1)	**1.0 Mark**
Taking (cosec A + cot A) common: = (cosec A + cot A)[1 - cosec A + cot A] / (cot A - cosec A + 1)	**1.0 Mark**
Cancelling common factor [1 - cosec A + cot A]: = cosec A + cot A = RHS. (Proved)	**0.5 Mark**

Question 35: Solid toy = hemisphere + cone (h=2cm, r=2cm). Circumscribed by cylinder. Find difference in volumes. [5 Marks]

Step-by-Step Solution & Working Details	Marks
Radius of cone & hemisphere r = 4/2 = 2 cm. Height of cone h = 2 cm.	**0.5 Mark**
Volume of Cone $V_{cone} = (1/3)\pi r^2 h = (1/3) \times 3.14 \times (2)^2 \times 2 = (1/3) \times 3.14 \times 8 = 8.373\ cm^3$	**1.0 Mark**
Volume of Hemisphere $V_{hemi} = (2/3)\pi r^3 = (2/3) \times 3.14 \times (2)^3 = (2/3) \times 3.14 \times 8 = 16.747\ cm^3$	**1.0 Mark**
Total Volume of Toy $V_{toy} = V_{cone} + V_{hemi} = 8.373 + 16.747 = 25.12\ cm^3$.	**0.5 Mark**
Cylinder parameters: Radius R = 2 cm, Height H = h + r = 2 + 2 = 4 cm.	**0.5 Mark**
Volume of Cylinder $V_{cyl} = \pi R^2 H = 3.14 \times (2)^2 \times 4 = 3.14 \times 16 = 50.24\ cm^3$.	**1.0 Mark**
Difference in Volumes = $V_{cyl} - V_{toy} = 50.24 - 25.12 = 25.12\ cm^3$.	**0.5 Mark**

SECTION E: Case-Based Integrated Questions (12 Marks)

Question 36: Case Study 1: Seating Arrangement & Coordinate Geometry [4 Marks]

Step-by-Step Solution & Working Details	Marks
(a) Distance between Neena and Karan: Using distance formula $d = \sqrt{[(x2 - x1)^2 + (y2 - y1)^2]}$. Correct calculation giving numerical distance.	**1.0 Mark**
(b) Coordinates of seat of Akash: Reading grid coordinates accurately from diagram.	**1.0 Mark**
(b) [OR] Distance between Binu and Karan: Distance formula calculation.	**1.0 Mark**
(c) Coordinates of point exactly between Akash and Binu: Using midpoint formula ((x1+x2)/2, (y1+y2)/2).	**2.0 Marks**

Question 37: Case Study 2: Athletics Training & Arithmetic Progression [4 Marks]

Step-by-Step Solution & Working Details	Marks
Initial time a = 51 sec, d = -2 sec/day, target a_n = 31 sec. Formula: a_n = a + (n-1)d	—
(a) 31 = 51 + (n-1)(-2) => -20 = -2(n-1) => n-1 = 10 => n = 11 days.	1.0 Mark
(b) Time on 5th day a_5 = 51 + 4(-2) = 43s. Time on 7th day a_7 = 51 + 6(-2) = 39s. Difference = 4 seconds.	1.0 Mark
(b) [OR] Term 120 more than 21st term: a_21 = 3 + 20(12) = 243. Required term = 243 + 120 = 363. 3 + (n-1)12 = 363 => n = 31st term.	1.0 Mark
(c) If a = 52, d = -3, a_n = 31: 31 = 52 + (n-1)(-3) => -21 = -3(n-1) => n-1 = 7 => n = 8 days.	2.0 Marks

Question 38: Case Study 3: Flagstaff on Tower & Heights and Distances [4 Marks]

Step-by-Step Solution & Working Details	Marks
Tower height BC = 5 m. Flagstaff AB = h meters. Angle of elevation of top of tower = 45°, top of flagstaff = 60°.	—
(a) Distance of point from foot of tower: In ΔBCD, tan 45° = BC/CD => 1 = 5/CD => CD = 5 meters.	1.0 Mark
(b) Height of flagstaff h: In ΔACD, tan 60° = AC/CD => √3 = (5 + h)/5 => 5√3 = 5 + h => h = 5(√3 - 1) ≈ 3.66 meters.	1.0 Mark
(c) If angle of elevation is 30° at point E: In ΔBCE, tan 30° = BC/CE => 1/√3 = 5/CE => CE = 5√3 ≈ 8.66 meters.	2.0 Marks
(c) [OR] Distance between top of tower B and point E: In ΔBCE, sin 30° = BC/BE => 1/2 = 5/BE => BE = 10 meters.	2.0 Marks