KOTHARI INTERNATIONAL SCHOOL, NOIDA

ANNUAL EXAMINATION, SESSION: 2025-26

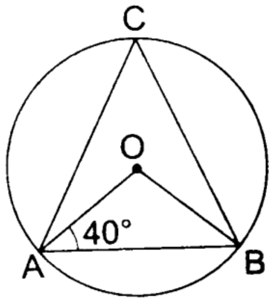
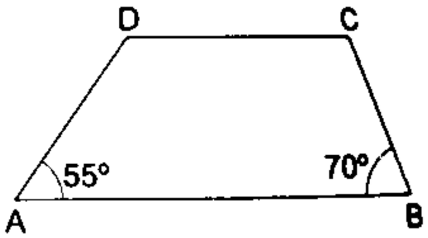
GRADE: 9, SUBJECT: MATHEMATICS (041)

SET A- ANSWER KEY

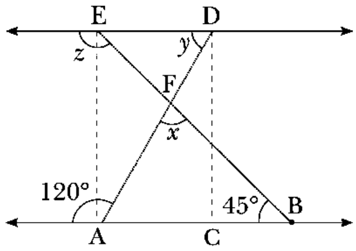
DATE & DAY: 9^{th} Feb 26, Monday

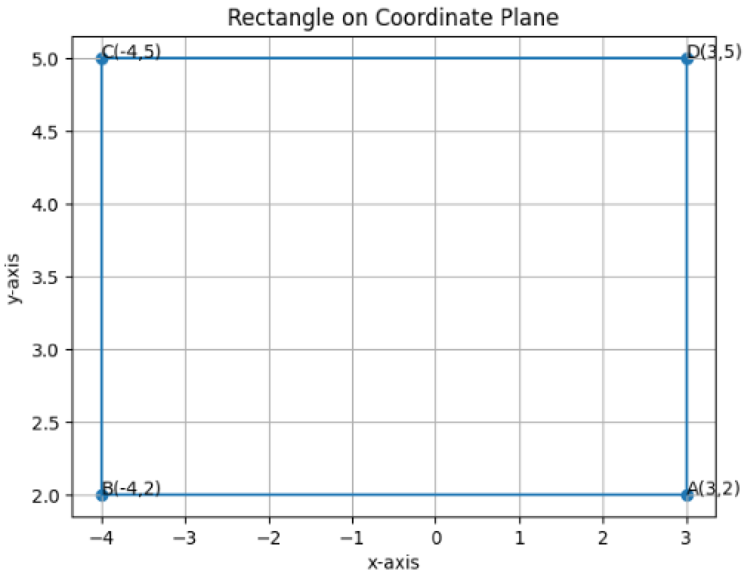
MAXIMUM MARKS: 80 **TIME ALLOTTED: 3 HOURS**

	SECTION – A (20*1 = 20)	Marks
Q1.	(c) $6\sqrt{3}$	(1)
Q2.	(a) $m + n$	(1)
Q3.	(c) 216 cm^2	(1)
Q4.	(a) 115^0	(1)
Q5.	(a)30 cm^2	(1)
Q6.	(a) 1, -1	(1)
Q7.	(a) 7 cm	(1)
Q8.	(c) 60^0	(1)
Q9.	$(a)(i)\ and\ (iii)$	(1)
Q10.	(d) 12	(1)
Q11.	(d) none of these	(1)
Q12.	(c) 80	(1)
Q13.	(a) $x - 2y - 5 = 0$	(1)
Q14.	(c)6xy	(1)
Q15.	(a) 20°	(1)
Q16.	(b) (-4, 6)	(1)
Q17.	(b) ∠d+∠e	(1)
Q18.	(c) opposite angles are bisected by the diagonals	(1)
Q19.	(d) Assertion (A) is false, but Reason (R) is true.	(1)
Q20.	(c) Assertion (A) is true, but Reason (R) is false.	(1)
	SECTION – B (5 * 2= 10)	
Q21.	In △ABC, ∠A = 90° and AB = AC. ∠B + ∠C = 90° (angle sum property). ∠B = ∠C (base angles of isosceles △). Hence, ∠B = ∠C = 45°. • Correct identification of equal angles/reasoning: 1 mark. Final answer (∠B=45°, ∠C=45°): 1 mark.	
Q22.	AB + BC + CD = AD AD forms part of straight line AH. By Euclid's axiom, whole AH > part AD. Thus, AH > AB + BC + CD.	

	• Stating AB + BC + CD = AD: 1 mark. Applying axiom (whole > part), conclusion: 1 mark.	
Q23.	Given: Circle with centre O, chord AB, OM ⊥ AB at M. OA = OB (radii), OM common, ∠OMA = ∠OMB = 90°. Thus, △OMA ≅ △OMB (RHS congruence). ∴ AM = MB (CPCT). • Stating OA=OB, OM common, right angles: 1 mark. • RHS congruence and AM=MB: 1 mark. **OR** In ΔABC, In the below figure, if ∠OAB=40^0, then find ∠ACB.  Solution: ∠OAB=∠OBA=40^0 ∠AOB=180-40-40=100^0 ∠ACB=50^0 Angle subtended by an arc at the centre is double the angle subtended by the same arc on the circumference.	(1/2) (1/2) (1)
Q24.	In the adjoining figure, ABCD is a trapezium in which AB ‖ DC. IF ∠A = 55° and ∠B = 70°, then find ∠C and ∠D.  Solution: ∠ADC=180-55=125^0 Co-interior angles ∠ACD=180-70=110^0	(1) (1)
Q25.	Find volume of a cone of radius 7 cm and slant height 25cm? Volume of a cone of base radius 'r', and height 'h' = $1/3\pi r^2h$ Radius of the cone, 'r' =7cm Slant Height of the cone, 'l' = 25cm Height= 24cm $1/3\pi r^2h = (1/3 \times 22 \times 7^2 \times 24)/7$ cm^3 Volume=1232 cm^3 **OR**	(1/2) (1/2) (1/2) (1/2)

	Given that the diagonal is 9√3 cm, diagonal of a cube with side length a is given by $a\sqrt{3}$. **Calculation** Substitute $a = 9$: $\sqrt{3} \times 9 \approx 1.732 \times 9 = 15.59$ cm. The exact value is $9\sqrt{3}$ cm.	(1) (1)
	SECTION – C (6*3 = 18)	
26.	Prove that: $\frac{(x^{a+b})^2(x^{b+c})^2(x^{c+a})^2}{(x^a x^b x^c)^4} = 1$ $(x^{a+b})^2 = x^{2(a+b)} = x^{2a+2b}$ $(x^{b+c})^2 = x^{2b+2c}$ $(x^{c+a})^2 = x^{2c+2a}$ So, numerator becomes: $x^{(2a+2b)+(2b+2c)+(2c+2a)} = x^{4a+4b+4c}$ Simplify the denominator $(x^a x^b x^c)^4 = x^{4(a+b+c)} = x^{4a+4b+4c}$ Divide numerator by denominator $\frac{x^{4a+4b+4c}}{x^{4a+4b+4c}} = x^0 = 1$ **OR** Given: $a = \frac{3+\sqrt{5}}{2}$ $\frac{1}{a} = \frac{2}{3+\sqrt{5}}$ Rationalize: $\frac{1}{a} = \frac{2(3-\sqrt{5})}{(3+\sqrt{5})(3-\sqrt{5})} = \frac{2(3-\sqrt{5})}{9-5} = \frac{3-\sqrt{5}}{2}$ $a + \frac{1}{a} = \frac{3+\sqrt{5}}{2} + \frac{3-\sqrt{5}}{2} = \frac{6}{2} = 3$ $a^2 + \frac{1}{a^2} = (a + \frac{1}{a})^2 - 2$ $a^2 + \frac{1}{a^2} = 3^2 - 2 = 9 - 2 = 7$	(1) (1) (1) (1) (1) (1)

Q27.	If we draw two imaginary lines AE and CD and name the angles as shown below, then find the measure of x, y and z.  Solution: At point **A**, the given angle is **120°**. The interior angle on the same straight line is: $y = 180° - 120° = 60°$ Since **ED ∥ AB**, corresponding angles are equal. At point **B**, the given angle is **45°**. Co-interior angles $\boxed{z = 180 - 45 = 135°}$ Now consider triangle **AFB** formed by the two transversals and the bottom line. • Angle at **A** inside the triangle = **60°** • Angle at **B** inside the triangle = **45°** Using the triangle angle sum property: $x = 180° - (60° + 45°)$ $x = 180° - 105° = 75°$ $\boxed{x = 75°}$ $\boxed{x = 75°, y = 60°, z = 135°}$	(1) (1) (1)
Q28.	The polynomial $2x^3 - 3x^2 - 17x + 30$ factorizes as $(x-2)(2x-5)(x+3)$. Apply the Rational Root Theorem: possible rational roots are factors of 30 over factors of 2, such as $\pm1, \pm2, \pm3, \pm5, \pm6, \pm\frac{3}{2}, \pm\frac{5}{2}$. $p(2) = 2(8) - 3(4) - 17(2) + 30 = 16 - 12 - 34 + 30 = 0$, so $x - 2$ is a factor. Using long division with root x-2: quotient $2x^2 + x - 15$ and remainder 0. **Quadratic Factoring** Factor $2x^2 + x - 15$: $2x^2 + 6x - 5x - 15 = 2x(x+3) - 5(x+3) = (2x-5)(x+3)$ $2x^3 - 3x^2 - 17x + 30 = (x-2)(2x-5)(x+3)$. **OR** *Given polynomial* $p(x) = x^3 + mx^2 - x + 6$ ***Find m using the Factor Theorem*** *Since* $(x-2)$ *is a factor,* $p(2) = 0$ $2^3 + m(2)^2 - 2 + 6 = 0$	(1) (1) (1) (1/2)

	$8 + 4m - 2 + 6 = 0$ $12 + 4m = 0$ $m = -3$ ***using the Remainder Theorem*** *Remainder when divided by* $(x-3)$ *is:* $n = p(3)$ *Substitute* $m = -3$*:* $p(3) = 3^3 - 3(3^2) - 3 + 6$ $= 27 - 27 - 3 + 6$ $= 3$ $\boxed{m = -3, n = 3}$	(1) (1/2) (1)
Q29.	Three vertices of a rectangle are (3,2), (-4,2), and (-4,5). Plot these points and find the coordinates of the fourth vertex. AB is horizontal (same $y = 2$) BC is vertical (same $x = -4$) So, the rectangle's sides are parallel to the axes. **Fourth vertex:** To complete the rectangle, the fourth vertex must have: • the **x-coordinate of A** → 3 • the **y-coordinate of C** → 5 $\boxed{D(3,5)}$ **coordinates of the fourth vertex are** $\boxed{(3,5)}$**.** 	(1/2) (1/2) (1/2) (1.5)
Q30.	**Given:** • Marks for each correct answer = **+4** • Marks for each incorrect answer = **−1** • Number of correct answers = **x** • Number of incorrect answers = **y** • Total marks obtained = **20**	(1/2) (1/2) (1/2)

	Form the linear equation Marks from correct answers = $4x$ Marks lost from incorrect answers = $-1 \times y = -y$ Total marks: $$4x - y = 20$$ **Write in standard form $ax + by + c = 0$** $$4x - y - 20 = 0$$ • **Linear equation:** $\boxed{4x - y = 20}$ • **Standard form:** $\boxed{4x - y - 20 = 0}$ Hence, $$\boxed{a = 4, b = -1, c = -20}$$	(1/2) (1)
Q31.	Sides of the triangle are $$a = 35 \text{ cm}, b = 54 \text{ cm}, c = 61 \text{ cm}$$ **Semi-perimeter** $$s = \frac{35 + 54 + 61}{2} = \frac{150}{2} = 75$$ **Apply Heron's formula** $$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$ $$= \sqrt{75(75-35)(75-54)(75-61)}$$ $$= \sqrt{75 \times 40 \times 21 \times 14}$$ Factorising: $$= \sqrt{(25 \times 3)(8 \times 5)(3 \times 7)(2 \times 7)}$$ $$= \sqrt{25 \times 16 \times 9 \times 49}$$ $$= 5 \times 4 \times 3 \times 7$$ $$\boxed{\text{Area} = 420 \text{ cm}^2}$$ The **smallest altitude** corresponds to the **largest side**, i.e. **61 cm**. Using: $$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$ $$420 = \frac{1}{2} \times 61 \times h$$ $$h = \frac{840}{61}$$ $$\boxed{h = \frac{840}{61} \text{ cm} \approx 13.77 \text{ cm}}$$ • **Area of the triangle:** $\boxed{420 \text{ cm}^2}$ • **Smallest altitude:** $\boxed{\frac{840}{61} \text{ cm} \approx 13.77 \text{ cm}}$	(1/2) (1/2) (1/2) (1/2) (1)

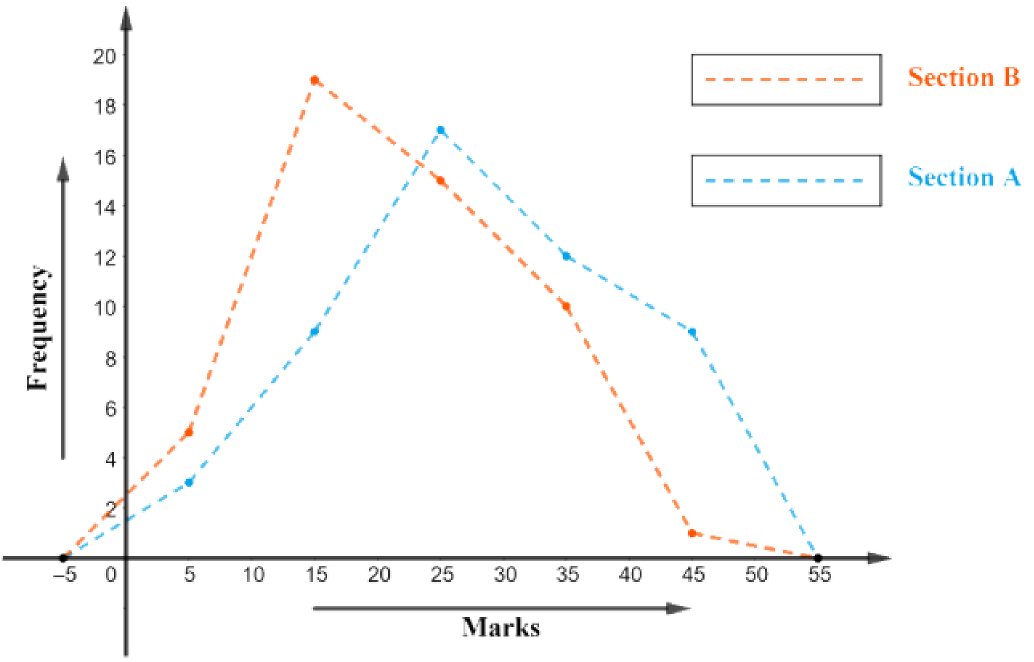
	SECTION – D (4 * 5 = 20)	
Q32.	**Solution:** Class Mark = (Upper Limit + Lower Limit)/2	(1.5)

Section - A

Marks	Class Mark	Frequency
0-10	5	3
10-20	15	9
20-30	25	17
30-40	35	12
40-50	45	9

Section - B

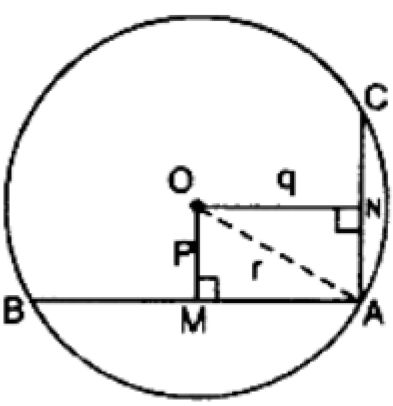
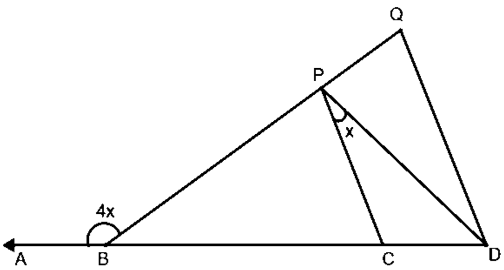
Marks	Class Mark	Frequency
0-10	5	5
10-20	15	19
20-30	25	15
30-40	35	10
40-50	45	1



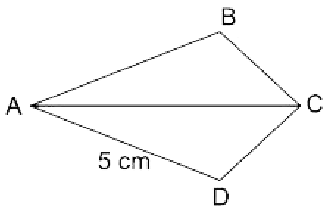
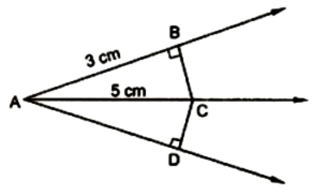
(3)

It can be observed that the performance of students of Section 'A' is better than the students of Section B as section 'A' shows more students securing marks between class intervals '40 – 50' and '30 – 40'. (0.5)

Q33.	AB and AC are two chords of a circle of radius r such that AB = 2AC. If p and q are the distances of AB and AC from the centre then prove that $4q^2 = p^2 + 3r^2$. Solution:	

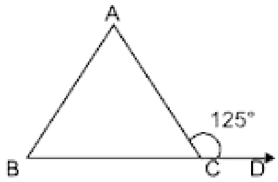
	 AB and AC are chords of a circle with centre O and radius r, where AB = 2AC. Let p be the distance from O to AB and q from O to AC. Draw perpendiculars from O to the chords: OM to AB (M midpoint of AB) and ON to AC (N midpoint of AC). Proof: In right triangle OMA, $AM = \frac{AB}{2} = AC$ (given AB = 2AC), so $p^2 + AC^2 = r^2$. In right triangle ONC, $NC = \frac{AC}{2}$, so $q^2 + \left(\frac{AC}{2}\right)^2 = r^2$. From first equation, $AC^2 = r^2 - p^2$. Substitute into second: $q^2 + \frac{(r^2 - p^2)}{4} = r^2$. Multiply by 4: $4q^2 + r^2 - p^2 = 4r^2$. Simplify: $4q^2 = 3r^2 + p^2$.	(1) (1/2) (1/2) (1) (1) (1) (1)
Q34.	In the given figure, AD and BQ are straight lines. BP = BC and DQ‖ CP. If ∠AEB=4x and that ∠CPD=x, prove that (i) CP=CD (ii) DP bisects that ∠CDQ  Solution: In triangle PCD, ∠BCP = 2x acts as the exterior angle to ∠CPD = x and ∠CDP, so by the exterior angle theorem, ∠BCP = ∠CPD + ∠CDP. Substituting values gives 2x = x + ∠CDP, hence ∠CDP = x. Now triangle CPD has ∠CPD = ∠CDP = x, making it isosceles with CP = CD (sides opposite equal angles). **Proof of (ii) DP Bisects ∠CDQ** Since DQ ∥ CP, corresponding angles yield ∠QDC = ∠BCP = 2x. In straight line BQ at D, ∠CDQ = ∠QDC = 2x, and ∠CDP + ∠PDQ = ∠CDQ, so x + ∠PDQ = 2x, hence ∠PDQ = x.	(1) (1) (1) (1)

	Thus ∠CDP = ∠PDQ = x, proving DP bisects ∠CDQ.	(1)
Q35.	Factorise: $$\left(\frac{x}{2}+y+\frac{z}{3}\right)^3+\left(\frac{x}{3}-\frac{2y}{3}+z\right)^3+\left(-\frac{5x}{6}-\frac{y}{3}-\frac{4z}{3}\right)^3$$ **Solution:** **Let** $a=\frac{x}{2}+y+\frac{z}{3}$ $b=\frac{x}{3}-\frac{2y}{3}+z$ $c=-\frac{5x}{6}-\frac{y}{3}-\frac{4z}{3}$ $a+b+c=\left(\frac{x}{2}+\frac{x}{3}-\frac{5x}{6}\right)+\left(y-\frac{2y}{3}-\frac{y}{3}\right)+\left(\frac{z}{3}+z-\frac{4z}{3}\right)$ $=\left(\frac{3x+2x-5x}{6}\right)+\left(\frac{3y-2y-y}{3}\right)+\left(\frac{z+3z-4z}{3}\right)=0+0+0=0$ So, $$a+b+c=0$$ **: Use identity** If $a+b+c=0$, then: $$a^3+b^3+c^3=3abc$$ $$\left(\frac{x}{2}+y+\frac{z}{3}\right)^3+\left(\frac{x}{3}-\frac{2y}{3}+z\right)^3+\left(-\frac{5x}{6}-\frac{y}{3}-\frac{4z}{3}\right)^3$$ $$=3\left(\frac{x}{2}+y+\frac{z}{3}\right)\left(\frac{x}{3}-\frac{2y}{3}+z\right)\left(-\frac{5x}{6}-\frac{y}{3}-\frac{4z}{3}\right)$$	(1) (1) (1) (2)
	SECTION-E (3 * 4 =12)	
Q36.	An Igloo is built in the shape of a hemisphere, with an inner diameter of 4.2m and walls of compacted snow that are 0.7m thick. **Based on the above information, answer the following questions:** (a) Find the volume of air in the Igloo. SOLUTION: The air inside the igloo occupies a **hemisphere of radius 2.1 m**. Volume of hemisphere $=\frac{2}{3}\pi r^3$ $=\frac{2}{3}\times\frac{22}{7}\times(2.1)^3$ $=\frac{2}{3}\times\frac{22}{7}\times 9.261$ $=19.404\ \text{m}^3$ $\boxed{\text{Volume of air} = 19.4\ \text{m}^3}$	(1/2) (1/2)

	(b) What is the outer diameter of the Igloo? Solution: Inner diameter = 4.2 m $\Longrightarrow$ Inner radius $r = 2.1$m Thickness of wall = **0.7 m** Outer radius $R = 2.1 + 0.7 = 2.8$m Outer diameter $= 2 \times 2.8 = \boxed{5.6 \text{ m}}$ (c) If each person needs 4.62 m^3 of air to breathe, find how many persons may be accommodated in the Igloo? Solution: Each person needs 4.62 m³ of air. $$\text{Number of persons} = \frac{19.4}{4.62} \approx 4.2$$ Only whole persons can be accommodated. $\boxed{4 \text{ persons}}$ Find the outer surface area of the hemispherical part of the Igloo, given that the area of the door is 6.28m². **OR** Outer radius $R = 2.8$m Curved surface area of hemisphere $= 2\pi R^2$ $= 2 \times \frac{22}{7} \times (2.8)^2$ $= 49.28 \text{ m}^2$ Subtract area of door: $= 49.28 - 6.28 = \boxed{43 \text{ m}^2}$	(1/2) (1/2) (1.5) (0.5) (1/2) (1) (1/2)
Q37.	(i) In the given figure, AC bisects ∠A and ∠C. if AD=5cm, then find AB.  Proof: In ΔABC and ΔADC ∠BAC = ∠DAC ∠BCA = ∠DCA AC=AC ΔABC ≅ ΔADC? AB=AD=5 cm (ii) In given figure, ∠BAC = ∠DAC, then by which congruence rule ΔABC ≅ ΔADC? 	(1/2) (1/2) (1)

By congruency AAS rule

(iii) In given figure, AB=AC and ∠ACD =125^0. Find ∠A.



Solution: ∠ABC=∠ACB=180-125=55^0 (1)
∠A=180-110=70^0 (1)

Q38.

(i) Find an Irrational number between $\sqrt{3}$ and $\sqrt{5}$.

(ii) Find a rational number between $\sqrt{3}$ and $\sqrt{5}$.

(iii) locate $\sqrt{9.3}$ on the number line.

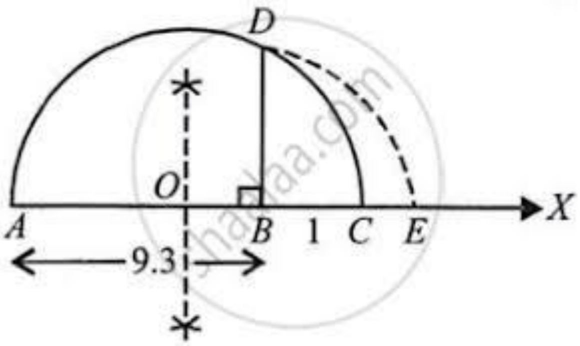
OR

Represent $\sqrt{5}$ on number line.

$(i)\sqrt{3}$ =1.732… and $\sqrt{5}$= 2.236….

$irrational\ number = (\sqrt{3} + \sqrt{5})/2$

(ii) rational number= 1.8, 1.9, 2



OR