KOTHARI INTERNATIONAL SCHOOL, NOIDA

ANNUAL EXAMINATION, SESSION: 2025-26

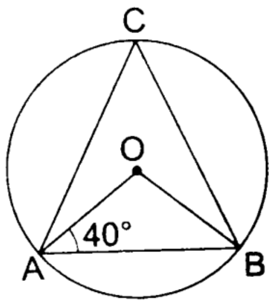
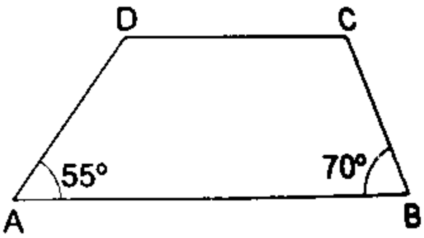
GRADE: 9, SUBJECT: MATHEMATICS (041)

SET B- ANSWER KEY

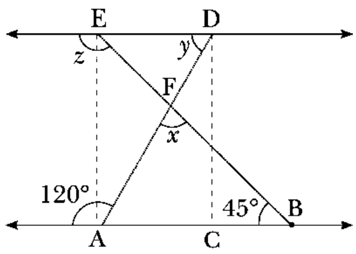
DATE & DAY: 9th Feb 26, Monday

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

	SECTION – A (20*1 = 20)	Marks
Q1.	(c) $6\sqrt{5}$	(1)
Q2.	$(a)(i)$ and (iii)	(1)
Q3.	(a) 384 cm^2	(1)
Q4.	(a) 20°	(1)
Q5.	(b) 3.5 cm	(1)
Q6.	(a) $x-2y-5=0$	(1)
Q7.	(c) 2, -2	(1)
Q8.	(c) 60^0	(1)
Q9.	(a) $m+n$	(1)
Q10.	(c) 2	(1)
Q11.	(b) 12 cm	(1)
Q12.	(d)-6xy	(1)
Q13.	(c) 60 cm^2	(1)
Q14.	(c) 80	(1)
Q15.	(d) a = -2, b=1	(1)
Q16.	(b) 105°	(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.	Since $BQ \parallel OP$, the angle that OPmakes with the straight line $BA$is equal to the corresponding angle at B. $B=105°$ So, the corresponding angle at Obetween $OP$and $BA$is also: $angle\ POA=105°$ **Use the triangle at point O** At point O, the straight line BAmakes a linear angle of 180°. So, the interior angle between $OP$and OAon the triangle side is: $x=105°+25°=130°$	(1) (1)

Q22.	**Given:** In the figure, $\angle 1 = \angle 2$ and $\angle 2 = \angle 3$ **To Prove:** $\angle 1 = \angle 3$ **Proof:** Euclid's axiom *Things which are equal to the same thing are equal to one another.* Here, • $\angle 1 = \angle 2$ (Given) • $\angle 2 = \angle 3$ (Given) Since both $\angle 1$ and $\angle 3$ are equal to $\angle 2$, $\angle 1 = \angle 3$	(1) (1)
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 $\angle OAB=40^0$, then find ∠ACB.  Solution: $\angle OAB=\angle OBA=40^0$ $\angle AOB=180\text{-}40\text{-}40=100^0$ $\angle ACB=50^0$ 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: $\angle ADC=180\text{-}55=125^0$ Co-interior angles $\angle ACD=180\text{-}70=110^0$	(1) (1)

Q25.	Find volume of a cone of radius 7 cm and slant height 13cm? Volume of a cone of base radius 'r', and height 'h' = $1/3\pi r^2 h$ Radius of the cone, 'r' =7cm Slant Height of the cone, 'l' = 13cm Height= 12cm $1/3\pi r^2 h = (1/3 \times 22 \times 7^2 \times 12)/7\ cm^3$ Volume=616 cm^3 **OR** Given that the Side is 7 cm, diagonal of a cube with side length a is given by $a\sqrt{3}$. **Calculation** Substitute $a = 7$: $\sqrt{3} \times 7$ The exact value is $7\sqrt{3}$ cm.	(1/2) (1/2) (1/2) (1/2) (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: $a = 7 + 4\sqrt{3}$ $\frac{1}{a} = \frac{1}{7+4\sqrt{3}}$ Rationalize: $\frac{1}{a} = \frac{(7-4\sqrt{3})}{(7+4\sqrt{3})(7-4\sqrt{3})} = \frac{(7-4\sqrt{3})}{49-48} = \frac{(7-4\sqrt{3})}{1}$ $a + \frac{1}{a} = 7 + 4\sqrt{3} + 7 - 4\sqrt{3} = 14$	 (1) (1) (1) (1) (1)

	$a^2 + \frac{1}{a^2} = (a + \frac{1}{a})^2 - 2$ $a^2 + \frac{1}{a^2} = 196 - 2 = 194$	(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 cubic polynomial $x^3 - 5x^2 - 2x + 24$ factors completely into linear terms. Expanding $(x-3)(x-4)(x+2)$ Apply the Rational Root Theorem: possible rational roots are factors of 24 over factors of 1, such as ±1, ±2, ±3, ±4, ±6, ±8, ±12, ±24. $p(-2) = (-8) - 5(4) - 2(-2) + 24 = -8 - 20 + 4 + 24 = 0$, so $x + 2$ is a factor. Using long division with root x+2: quotient $x^2 - 7x + 12$ and remainder 0. **Quadratic Factoring** Factor $x^2 - 7x + 12$: $x^2 - 3x - 4x + 12 = x(x-3) - 4(x-3) = (x-4)(x-3)$ $2x^3 - 3x^2 - 17x + 30$= $(x-3)(x-4)(x+2)$ **OR** *Given polynomial* $p(x) = x^3 + mx^2 - x + 6$ ***Find m using the Factor Theorem***	(1) (1) (1)

	Since $(x-2)$ *is a factor,* $p(2)=0$ $2^3+m(2)^2-2+6=0$ $8+4m-2+6=0$ $12+4m=0$ $m=-3$ ***using the Remainder Theorem*** *Remainder when divided by* $(x-3)$ *is:* $n=p(3)$ *Substitute* $m=-3$*:* $p(3)=3^3-3(3^2)-3+6$ $=27-27-3+6$ $=3$ $\boxed{m=-3, n=3}$	 (1/2) (1) (1/2) (1)
Q29.	Two vertices of an equilateral triangle are (0, 2) and $(0,-2)$. Plot these points and find the possible coordinates of the third vertex. Two vertices of an equilateral triangle are $Q(0,2)$ and $R(0,-2)$ Let the third vertex be $P(x,y)$. $QR=\sqrt{(0-0)^2+(2-(-2))^2}=\sqrt{16}=4$ Since the triangle is equilateral: $PQ=QR=PR=4$ $x^2+(0-2)^2=16$ $x^2+4=16$ $x^2=12$ $x=\pm\sqrt{12}=\pm 2\sqrt{3}$ The possible coordinates of the third vertex are: $\boxed{(2\sqrt{3},0) \text{ and } (-2\sqrt{3},0)}$	 (1) (1) (1)
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** **Form the linear equation**	(1/2) (1/2) (1/2) (1/2) (1)

	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, $$\boxed{a = 4, b = -1, c = -20}$$	
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 longest altitude corresponds to the smallest side, i.e. 35 cm. Using: $$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$ $$420 = \frac{1}{2} \times 35 \times h$$ $$h = \frac{840}{35}$$ $$\boxed{h = \frac{840}{35} \text{ cm=24 cm}}$$ • **Area of the triangle:** $\boxed{\mathbf{420\ cm^2}}$ • **longest altitude:** $\boxed{\mathbf{24\ cm}}$	(1/2) (1/2) (1/2) (1/2) (1)
	SECTION – D (4 * 5 = 20)	

Q32. **Solution:**

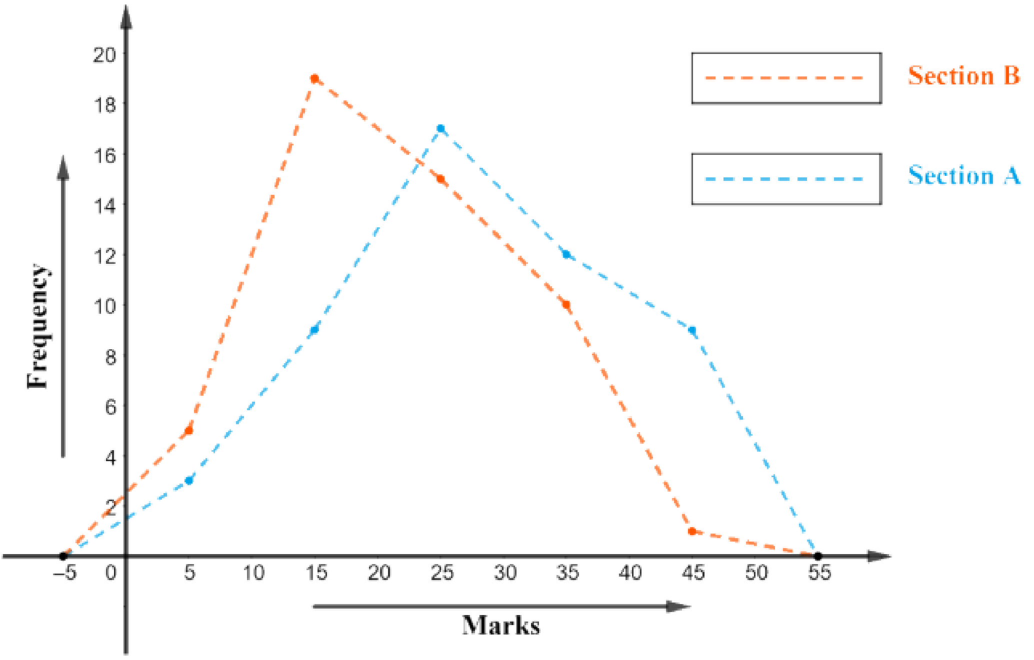
Class Mark = (Upper Limit + Lower Limit)/2 (1.5)

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

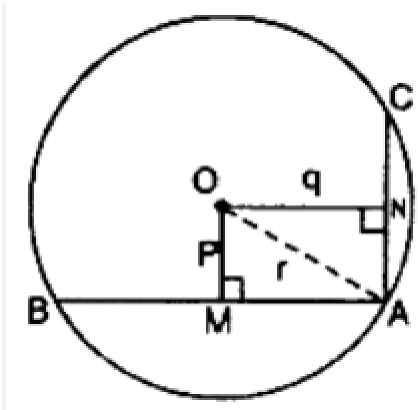
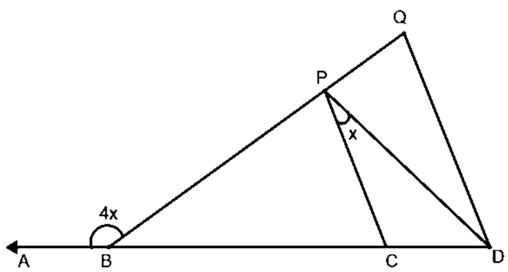


(3)

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 $=\frac{2}{3}\pi r^3$ $=\frac{2}{3}\times\frac{22}{7}\times(2.1)^3$ $=\frac{2}{3}\times\frac{22}{7}\times 9.261$ $=19.404\ \mathrm{m}^3$ $\boxed{\text{Volume of air} = 19.4\ \mathrm{m}^3}$	(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 (1/2)

Outer diameter $= 2 \times 2.8 = \boxed{5.6 \text{ m}}$ (1/2)

(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 m^3 of air.

$$\text{Number of persons} = \frac{19.4}{4.62} \approx 4.2$$ (1.5)

Only whole persons can be accommodated.

$\boxed{4 \text{ persons}}$ (0.5)

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 $= 2\pi R^2$ (1/2)

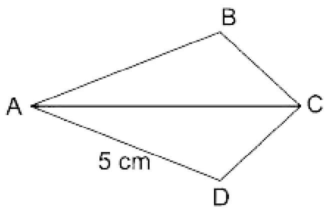
$= 2 \times \frac{22}{7} \times (2.8)^2$ (1)

$= 49.28 \text{ m}^2$

Subtract area of door:

$$= 49.28 - 6.28 = \boxed{43 \text{ m}^2}$$ (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

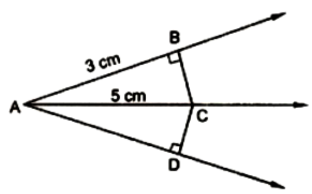
∠BCA = ∠DCA

AC=AC

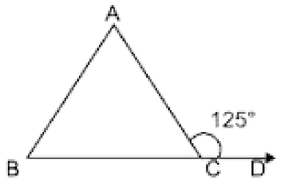
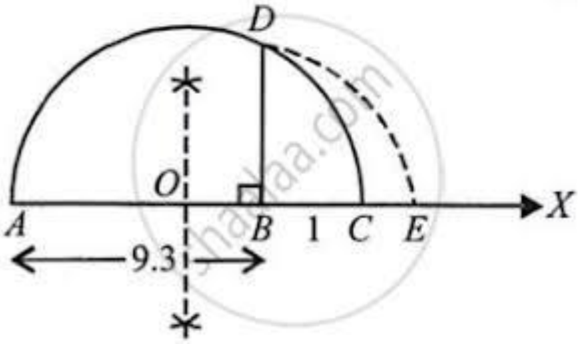
ΔABC ≅ ΔADC? (1/2)

AB=AD=5 cm (1/2)

(ii) In given figure, ∠BAC = ∠DAC, then by which congruence rule ΔABC ≅ ΔADC?



(1)

	By congruency AAS rule (iii) In given figure, AB=AC and ∠ACD =125^0. Find ∠A.  Solution: ∠ABC=∠ACB=180-125=55^0 ∠A=180-110=70^0	(1) (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**