BANGALORE SAHODAYA SCHOOLS COMPLEX ASSOCIATION

QUESTION PAPER (2023-24)MATHEMATICS (Code – 241)

MARKING SCHEME

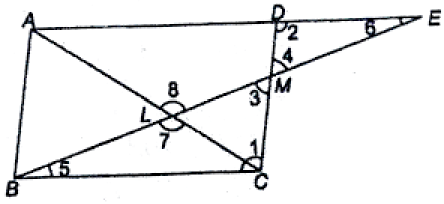
CLASS X –SET 1

Q.NO	SECTION - A	Marks
1	(d)	1
2	(b)	1
3	(a)	1
4	(b)	1
5	(c)	1
6	(d)	1
7	(a)	1
8	(b)	1
9	(b)	1
10	(d)	1
11	(d)	1
12	(b)	1
13	(c)	1
14	(d)	1
15	(b)	1
16	(a)	1
17	(c)	1
18	(b)	1
19	(c)	1
20	(d)	1
	SECTION - B	
21	$108 = 2\times 2\times3\times3\times3$ $72 = 2\times 2\times 2\times 3\times3$ HCF = $2\times 2\times3\times3$ $= 36$ $\frac{108}{36} = 3$, $\frac{72}{36} = 2$, 5 containers are required	 ½ ½ ½ ½
22	In ΔCDO, ΔABO $\angle DCO = \angle BAO$ (AIA) $\angle COD = \angle BOA$ (VOA)	

	$\therefore$ By AA, $\Delta CDO \sim \Delta ABO$	1
	$\therefore \frac{AO}{OC} = \frac{AB}{DC} = \frac{BO}{DO}$	½
	$\frac{2}{1} = \frac{AB}{DC}$	
	$\therefore AB = 2DC$	½
23	Join OR	
	$\angle ORS = 90^\circ$ (Radius $\perp$ tanent)	½
	$\angle OPR = \angle ORP = 30^\circ$ ($\angle$opp equal sides OP & OR in ΔOPR)	½
	$\therefore$ In ΔPRS	
	$\angle SPR + \angle PRS + \angle RSP = 180^\circ$ (By ASP)	
	$30^\circ + 30^\circ + 90^\circ + \angle RSP = 180^\circ$	½
	$\angle RSP = 180^\circ - 150^\circ = 30^\circ$	½
24	$2\sec^2 60^\circ + x\cos^2 30^\circ - \frac{3}{4}\cot^2 60^\circ = 10$	
	$\Rightarrow 2\times(2)^2 + x\left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{4}\left(\frac{1}{\sqrt{3}}\right)^2 = 10$	1
	$\Rightarrow 2\times 4 + x\left(\frac{3}{4}\right) - \frac{3}{4}\left(\frac{1}{3}\right) = 10$	
	$\Rightarrow \frac{8}{1} + \frac{3x}{4} - \frac{1}{4} = 10$	
	$32 + 3x - 1 = 40$	½
	$3x = 40 - 31$	
	$3x = 9$	
	$x = 3$	½
	OR	
	$9\cos^2\theta + 5\sin^2\theta = 6$	
	$5(\cos^2\theta + \sin^2\theta) + 4\cos^2\theta = 6$	
	$5 + 4\cos^2\theta = 6$	
	$4\cos^2\theta = 1$	½
	$\cos^2\theta = \frac{1}{4}$	
	$\cos\theta = \sqrt{\frac{1}{4}} = \frac{1}{2}$	
	$\cos\theta = \cos 60$	½
	$\theta = 60^\circ$	½
	$\tan\theta = \tan 60^\circ = \sqrt{3}$	½

25	The minute hand sweeps 6° in 1minute $\therefore$ 11 : 20 – 11 : 55 = 35 mins $\therefore$ Angle swept in 35mins = $35\times 6 = 210^\circ$ Length of arc = $\frac{\theta}{360}\times 2\pi r$ $= \frac{210}{360}\times 2\times\frac{22}{7}\times 6$ = 22cm **OR** Perimeter of shaded region = 4 (circumference of semi circle) + 2 circumference of bigger semicircle) $= 4\,(\pi r) + 2(\pi R)$ $= 4\times\frac{22}{7}\times 21 + 2\times\frac{22}{7}\times 42$ = 528cm	½ ½ 1 1 ½ ½
	SECTION - C	
26	If possible let $3-\sqrt{2}$ be a rational number $\therefore 3-\sqrt{2} = \frac{a}{b}$ a and b are co primes integers b $\neq 0$ $\sqrt{2} = 3-\frac{a}{b}$ $\sqrt{2} = \frac{3b-a}{b} \longrightarrow$ (1) RHS is an rational number of numerator and denominator are both integers. If possible Let $\sqrt{2}$ be a rational number $\Rightarrow \sqrt{2} = \frac{p}{q}$ (squaring both sides) $\Rightarrow p^2 = 2q^2$ 2 | p^2 hence 2 | p $\longrightarrow$ (3) $p = 2m$ $\Rightarrow p^2 = 4m^2$ $\Rightarrow 2q^2 = 4m^2$ $\Rightarrow q^2 = 2m^2$ $\Rightarrow$ 2 | q^2 hence 2 | q $\rightarrow$ (4) From (3) and (4)	1

	2 divides both p and q Which contradicts (2) Hence our assumption is wrong $\therefore\ \sqrt{2}$ is irrational Hence our assumption that 3 - $\sqrt{2}$ is rational is wrong. $\therefore 3 - \sqrt{2}$ irrational	2
27	$\alpha + \beta = \frac{-b}{a}$ $1 = \frac{-(-3k)}{k^2 - 10}$ $k^2 - 10 = 3k$ $k^2 - 3k - 10 = 0$ (k +2) (k-5) = 0 k = 5 or k = -2	½ ½ ½ 1 ½
28	No.of questions answered correctly be x No.of questions answered incorrectly be y $2x - \frac{y}{2} = 90$ $\Rightarrow 4x - y = 180^\circ$ $x + y = 120^\circ$ $5x = 300$ $x = \frac{300}{5} = 60$ $y = 120 - 60$ $= 60$ No. of questions answered wrong = 60 **OR** For infinite solutions $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ $\frac{3}{a+b} = \frac{4}{2(a-b)} = \frac{12}{5a-1}$ consider $\frac{3}{a+b} = \frac{4}{2(a-b)}$	½ ½ ½ ½ ½ ½ ½ ½

	$3a-3b=2a+2b$	
	$a-5b=0$ (1)	
	Consider	½
	$\frac{4}{2(a-b)}=\frac{12}{5a-1}$	
	$10a-2=12a-12b$	
	$2a-12b=-2$	½
	$a-6b=-1$ (2)	
	$a-5b=0$	
	Solving for a and b a = 5 , b=1	1
29	$\Delta ABC \sim \Delta AXY$	
	$X\hat{Y}B = B\hat{Y}C \rightarrow$ (1) Given	
	$X\hat{Y}B = Y\hat{B}C \rightarrow$ (2) AIA	½
	$B\hat{Y}C = Y\hat{B}C$ From (1) and (2)	½
	In ΔYBC, BC = YC sides opposite to equal angles	
	$\frac{AB}{AX}=\frac{BC}{XY}=\frac{AC}{AY}$ CPST	½
	$\frac{5}{3}=\frac{BC}{4}$	
	$BC=\frac{20}{3}$	½
	$YC=\frac{20}{3}$	½
	$\frac{AX}{BX}=\frac{3}{2}=\frac{AY}{YC}$	½
	$AY=\frac{3}{2}\times\frac{20}{3}$ = 10cm	
	OR	
	In Δles BCM and EDM	
		
	$\hat{1}=\hat{2}$ AIA	½
	CM = DM given	
	$\hat{3}=\hat{4}$ VOA	
	$\therefore \Delta BCM \cong \Delta EDM$, (ASA)	
	$BC = ED \rightarrow$ (1)CPCT	
	$BC = AD \rightarrow$(2) opposite sides of a parallelogram	
	$\Rightarrow AD = DE$ From (1) and (2)	
	In Δ^{les} AEL and CBL	

$\hat{7} = \hat{8}$ VOA — 1

$\hat{5} = \hat{6}$ AIA — ½

$\therefore \Delta AEL \sim \Delta CBL$ AA ~

$\frac{AE}{BC} = \frac{EL}{BL}$ CPST

$\frac{AE}{AD} = \frac{EL}{BL}$ $BC = AD$

$\frac{2AD}{AD} = \frac{EL}{BL}$ — 1

$EL = 2BL$

30

$LHS = \frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$ — ½

Dividing Numerator and Denominator by $\cos\theta$

$= \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$ — 1

$= \frac{(\tan\theta + \sec\theta) - (\sec^2\theta - \tan^2\theta)}{\tan\theta + 1 - \sec\theta}$ — ½

$= \frac{(\tan\theta + \sec\theta) - (\sec\theta + \tan\theta)(\sec\theta - \tan\theta)}{(\tan\theta + 1 - \sec\theta)}$ — ½

$= (\tan\theta + \sec\theta)\left[\frac{\tan\theta + 1 - \sec\theta}{\tan\theta + 1 - \sec\theta}\right]$ — ½ ½

$= (\tan\theta + \sec\theta)$ = RHS — ½

31

Weight (in kg)	No.of students	Less than CF
38-40	3	3
40-42	2	5
42-44	4	9
44-46	5	14
46-48	14	28
48-50	4	32
50-52	3	35

Table 1½

$\frac{N}{2} = \frac{35}{2} = 17.5$

Median = $l + \left(\frac{\frac{n}{2} - c}{f}\right)h$ — ½

$= 46 + \left(\frac{17.5 - 14}{14}\right)2$ — ½

$= 46 + \frac{3.5}{14} \times 2$ — ½

= 46+0.5

= 46.5kg

	SECTION - D	
32	Let the numerator of the fraction be x	½
	$\therefore$ the denominator is $x+3$	
	Fraction = $\frac{x}{x+3}$	½
	$\frac{x+1}{(x+3)+1} - \frac{x}{x+3} = \frac{1}{24}$	½
	$\frac{x+1}{x+4} - \frac{x}{x+3} = \frac{1}{24}$	½
	$\frac{(x+1)(x+3) - x(x+4)}{(x+4)(x+3)} = \frac{1}{24}$	½
	$\frac{x^2+4x+3-x^2-4x}{x^2+7x+12} = \frac{1}{24}$	1
	$x^2+7x+12 = 72$	
	$x^2+7x-60 = 0$	
	$x^2+12x-5x-60 = 0$	½
	$x(x+12) - 5(x+12) = 0$	
	$(x+12)(x-5) = 0$	½
	$x = -12$ or $x = 5$	
	Rejecting x = -12 as fraction cannot be negative	½
	$x = 5$	
	The new fraction is $\frac{6}{9} = \frac{2}{3}$	1
	OR	
	Let the number of students be x	
	$\frac{500}{x} - \frac{500}{x+25} = 1$	½
		1
	$500(x+25) - 500x = x(x+25)$	
	$x^2+25x-12500 = 0$	1
	$(x+125)(x-100) = 0$	1
	Rejecting x = -125 , x = 100	1
	$\therefore$ the number of students are 100	½
33	(a) Given to prove, figure, construction	1½
	proof	1½
	(b) PL =7cm, Let x = RN = RM	½ + ½
	QL = 3cm $\Rightarrow$	½
	PN = 7cm, QM = 3cm	½

	$2x + 14 + 6 = 28$ $2x = 8$ $x = 4$ QR = 7cm, PR = 11cm	
34	(a) $\frac{3}{4}$ volume of cone = 75 volume of one lead shot $\frac{3}{4}\times\frac{1}{3}\pi r^2h = 75\times\frac{4}{3}\pi R^3$ $\frac{5\times5\times16}{4} = 25\times4\times R^3$ $R^3 = 1,\ R = 1cm$ (b) Height of the cone = h = 31- 7= 24cm $l = \sqrt{r^2 + h^2}$ $l = \sqrt{7^2 + 24^2} = 25cm$ TSA (toy) = CSA(cone+hemisphere) $= \pi rl + 2\pi r^2$ $= \pi r(l + 2r)$ $= \frac{22}{7}\times7(25 + 2\times7)$ $= 22\times39 = 858cm^2$ **OR** Height of cone = 30 – (13+5) = 30 – 18 = 12cm $l = \sqrt{r^2 + h^2}$ $l = 13cm$ (i) TSA of the toy = CSA (cone + cylinder+hemisphere) $= \pi rl + 2\pi rh + 2\pi r^2$ $= \pi r(l + 2h + 2r)$ $= \frac{22}{7}\times5(13 + 26 + 10)$	½ ½ ½ ½ ½ ½ ½ 1 ½ 1 ½ ½ ½ ½ ½ ½ ½

	$= \frac{22}{7} \times 5 \times 49$ $= 770\ cm^2$ (ii) Volume of toy = Volume (cone + cylinder+hemisphere) $= \frac{1}{3}\pi r^2 h + \pi r^2 h_1 + \frac{2}{3}\pi r^3$ $= \pi r^2 \left(\frac{h}{3} + h_1 + \frac{2}{3} r\right)$ $= \frac{22}{7} \times 5 \times 5 \times \left(\frac{12}{3} + 13 + \frac{2}{3} \times 5\right)$ $= \frac{22}{7} \times 25 \times \frac{61}{3}$ $= \frac{33550}{21} = 1597.619 cm^3$	½ ½ 1 ½ ½ ½ ½ ½ ½
35	(table below)	½

Marks	No.of students	x_i	$f_i\ x_i$
45-55	4	50	200
55-65	X	60	60x
65-75	Y	70	70y
75-85	9	80	720
85-95	4	90	360
	17+x+y=40		$\Sigma fx = 1280 + 60x + 70y$

$17 + x + y = 40$

$x + y = 23 \longrightarrow (1)$ — 1

$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

$69.5 = \frac{1280 + 60x + 70y}{40}$ — 1

$2780 - 1280 = 60x + 70y$

$6x + 7y = 150 \longrightarrow (2)$

Solving (1) and (2) $x = 11$, $y = 12$ — 1 ½

Mode = $l + \frac{(f_1 - f_0)}{(2f_1 - f_0 - f_2)} .h$

$= 65 + \frac{12 - 11}{(24 - 11 - 9)} \times 10$ — 1

$= 65 + 2.5 = 67.5$

	SECTION E	
36	(i) E (-10, 0)	1
	(ii) A (-1, 0) B (7, 6)	
	$\text{AB} = \sqrt{(7+1)^2 + (6)^2}$	
	$= \sqrt{8^2 + 6^2}$	
	$= \sqrt{100}$	
	AB = 10 units	1
	A (-1 , 0)	
	C (-10, y)	½
	$\text{AB} = \sqrt{(-10+1)^2 + y^2}$	
	$10 = \sqrt{9^2 + y^2}$	
	$100 = 81 + y^2$	
	$y^2 = 19$	
	$y = 19$	
	$\therefore C(-10, \sqrt{19})$	½
	OR	
	A(-1, 0) b (7,6)	
	$AB = \sqrt{(7+1)^2 + (6)^2}$	1
	$= \sqrt{8^2 + 6^2}$	
	$= \sqrt{100}$	
	AB = 10 units	
	(-2 , 0) , (-10, y)	½
	$10 = \sqrt{(-10+2)^2 + (y)^2}$	
	$10 = \sqrt{8^2 + y^2}$	
	$100 = 64 + y^2$	½
	$y^2 = 36$	
	y = 6	
	$\therefore$The coordinates of the point where the other end of the ladder touches is (-10, 6)	
	(iii) $0 = \frac{7m_1 - m_2}{m_1 + m_2}$	½

	$7m_1 = m_2$ $\frac{m_1}{m_2} = \frac{1}{7}$ The ratio is 1:7	½
37	(a) $\tan 30^\circ = \frac{\text{Height of the Vidhana soudha}}{\frac{107\sqrt{3}}{2}}$ $\therefore$ Height of the Vidhana Soudha $= \frac{107\sqrt{3}}{2} \times \frac{1}{\sqrt{3}}$ $= 53.5$ m (b) $\tan 45^\circ = \frac{BC}{24}$ BC = 24m $\tan 60^\circ = \frac{AC}{24}$ $AC = 24\sqrt{3}$ $\therefore AB = 24\sqrt{3} - 24$ $= 24\left(\sqrt{3}-1\right)m$ **OR** $\cos 60^\circ = \frac{24}{AD} = \frac{1}{2}$ $\therefore AD = 48m$ $\cos 45^\circ = \frac{24}{BD} = \frac{1}{\sqrt{2}}$ $\therefore BD = 24\sqrt{2}$m (c) $\tan\theta = \frac{24}{8\sqrt{3}}$ $= \frac{3}{\sqrt{3}}$ $\tan\theta = \sqrt{3}$ $\Rightarrow \theta = 60^\circ$	½ ½ ½ ½ ½ ½ ½ ½ ½ ½ ½ ½
38	1. 3, 5, 7………. 2. There are 49 gaps of 2cm between the first and the 50th string.	1

	∴ Distance between them = 49 x 2 = 98cm 3. The wooden beads used in the strings form an AP 1, 2, 3, …..50 ∴ Number of wooden beads required = $\frac{50\times 51}{2}$ = 1275 **OR** Out of 50 strings, only 25 strings contains blue beads. The blue beads used in the strings form an AP 2, 4, 6 ……. Total blue beads = n(n+1) = 25 x 26 = 650 Required number of blue beads = 650 – 250 = 400	1 ½ 1 ½