121/1 MS
MATHEMATICS (Alt. A)
Paper 1
November 2023
MARKING SCHEME

THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)

PAPER 1

MARKING SCHEME
(CONFIDENTIAL)

THIS MARKING SCHEME IS THE PROPERTY OF THE KENYA NATIONAL EXAMINATIONS COUNCIL AND MUST BE RETURNED TO THE KENYA NATIONAL EXAMINATIONS COUNCIL AT THE END OF MARKING.

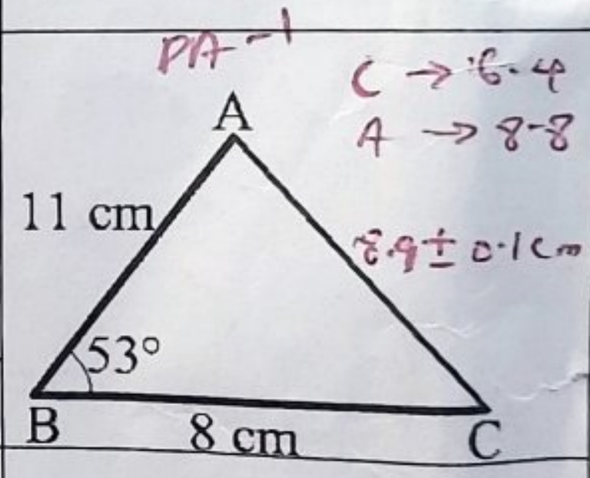
This marking scheme consists of 16 printed pages

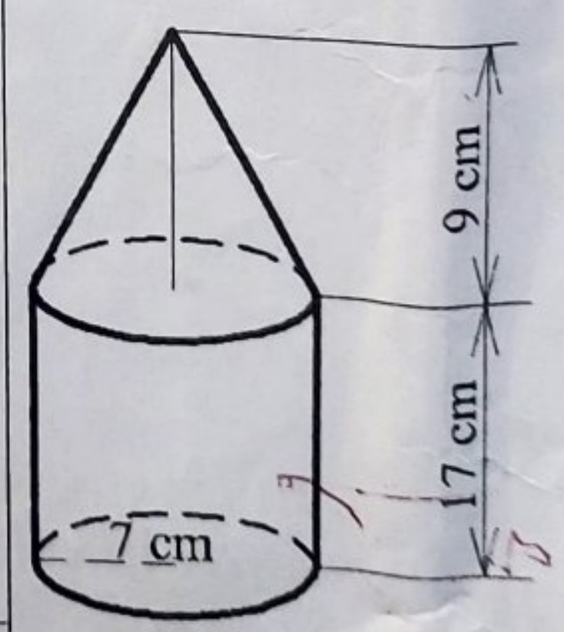
© 2023 The Kenya National Examinations Council.

CamScanner

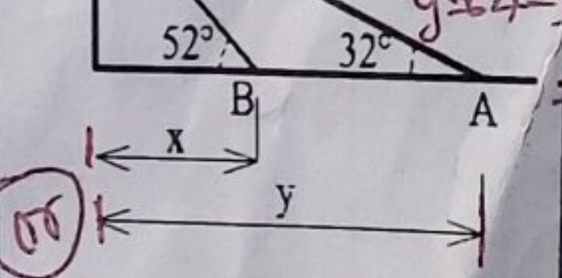
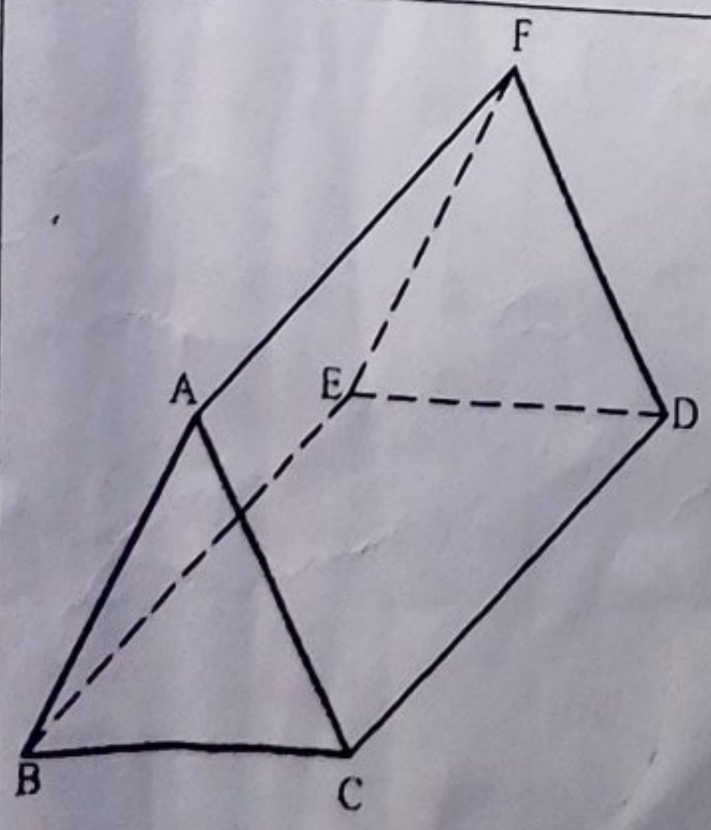
MATHEMATICS ALT. A 121/1 PAPER 1 MARKING SCHEME

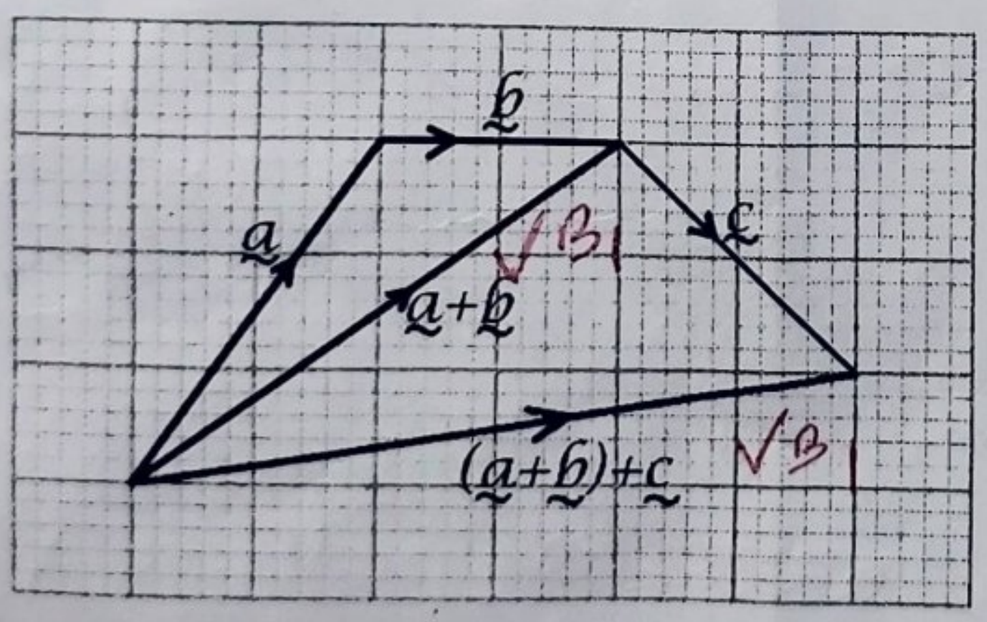
No.	Marking Scheme	Marks	Comments
1.	Num = $-13+5-70 \div 5$ Accept $-13-9$ or $-8-14$ ✓	M1	One operation remaining
	$= -22$	B1	
	Den = $9-14x-3\div 21$ Accept $9-(-2)$ or $9+2$ ✓	M1	One operation remaining
	$= 11$	B1	
	$\frac{\text{Num}}{\text{Den}} = \frac{-22}{11} = -2$ ✓	B1	
		3	
2.	$\frac{3a^2b^{-3}}{2^{-1}a^{-2}b^2} = 3\times 2\times a^{2--2}\times b^{-3-2}$ ✓ (for correct use of laws of indices in both numerator & denominator)	M1	
	$= 6a^4b^{-5}$ ✓ or $\frac{6a^4}{b^5}$	A1	Denied $6\times a^4\times b^{-5}$
		2	
3.	Area of triangle ABC $= \frac{1}{2}\times 8\times 11\times \sin 53°$ ✓	M1	
	$= 35.14\ \text{cm}^2$ ✓ when Area is formulated $S=\frac{11+8.8+8}{2}=$ Follow through	A1	Area = 35.16
		2	
4.	Volume $= \underbrace{\frac{22}{7}\times 7^2\times 17}_{M1} + \underbrace{\frac{1}{3}\times\frac{22}{7}\times 7^2\times 9}_{M1}$	M1M1	
	$= 2618+462$		
	$= 3080\ \text{cm}^2$ ✓ Accept $V=3079.16$ or $V=3079.20$ when pie $=3.142$, $V=3079.16\ \text{cm}^3$ when pie $=\pi$, $V=3078.76$ Accept 3079	A1	
		3	
5.	(a) LCM 40 sec and 60 sec		
	$= 2^3\times 3\times 5$ sec ✓ M1 (or M1 when 120 seen when the table is there)	M1	
	$= 120$ sec		
	$= 2$ min ✓	A1	
	(b) No. of times $= \frac{30}{2}$		
	$= 15$ ✓	B1	
		3	



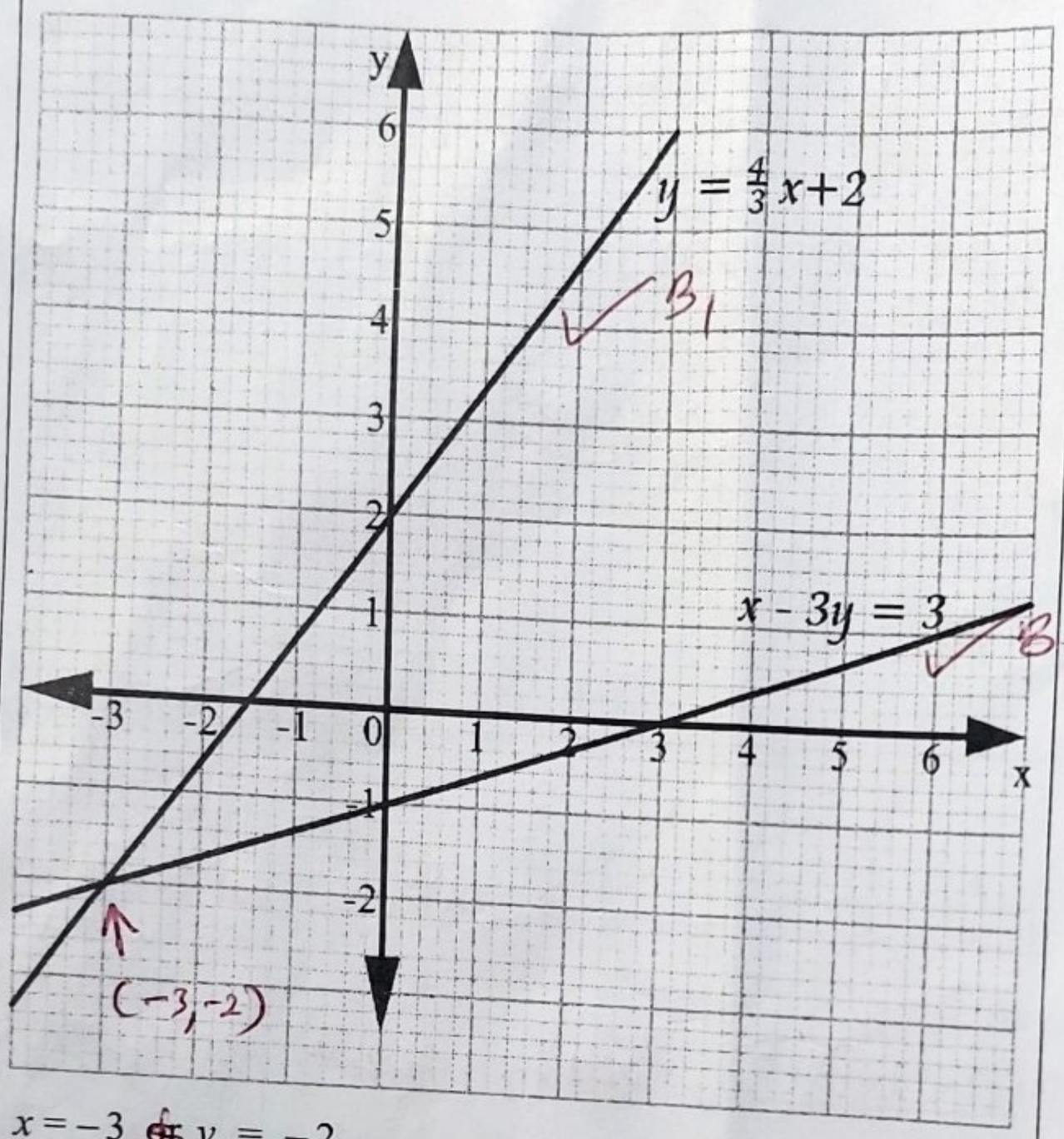


2	40	60	
2	20	30	
2	10	15	
3	5	15	
5	5	5	
	1	1	

No.	Marking Scheme	Marks	Comments
6.	$2\theta + \theta = 90$ ✓m1 $3\theta = 90$ $\theta = 30°$ ✓A1 $30° = \frac{1}{12} \times 2\pi^c$ $= \frac{\pi^c}{6}$ ✓B1 Accept $0.16\pi^c$ or $0.1667\pi^c$ ✓B1 Accept $2\theta + \theta = \frac{\pi}{2}$ ✓m1 $3\theta = \frac{\pi^c}{2}$ $6\theta = \pi^c$ $\theta = \frac{\pi^c}{6}$ ✓A1B1	M1 A1 B1 3	$2\pi^c = 360°$ $? = 30°$ $\cos 2\theta = 1 - 2\sin^2\theta$ Let $x = \sin\theta$ $1 - 2\sin^2\theta = x$ $1 - 2x^2 = x$ $2x^2 + x - 1 = 0$
7.	$(5x-4y)(4x+5y)$ $= 20x^2 + 25xy - 16xy - 20y^2$ ✓m1 (correct expansion only) $= 20x^2 + 9xy - 20y^2$ $(5x-4y)(4x+5y) - 9xy$ $= 20x^2 + 9xy - 20y^2 - 9xy$ $= 20(x^2 - y^2)$ ✓m1 Accept $20x^2 - 20y^2$ $= 20(x+y)(x-y)$ ✓A1 ~~Accept $20x^2 - 20y^2$~~	M1 2M1 A1 3	
8.	$\text{Tan } 52 = \frac{40}{x}$ ✓m1 Accept $\tan 38° = \frac{x}{40}$ ✓m1 $x = \frac{40}{\tan 52}$ $= 31.25$ m $\text{Tan } 32 = \frac{40}{y}$ ✓m1 Accept $\tan 58 = \frac{y}{40}$ ✓m1 $y = \frac{40}{\tan 32}$ $= 64.01$ $y - x = 64.01 - 31.25$ ✓m1 (Difference) $= 32.76$ m ✓A1	~~M1~~ M1 A1 4	Or Accept $\tan 52 = \frac{40}{x}$ ✓m1, $x = 31.25$ $\tan(x+38) = \tan(x+38)$ $= 31.25 + y$ ✓m1 $\frac{40}{40}$ $y = 64 - 31.25 = 32.75$ ✓A1 $\tan 32° = \frac{40}{y} + 31.25$ ✓m1m1 $y = 32.76$ A1 
9.	 	B1 B1 B1 3	Parallel edges of √(correct) length ± 0.1cm Broken and continuous lines correctly identified C.A.O FED correctly labelled. This last B mark can only be scored if the 1st two are scored.

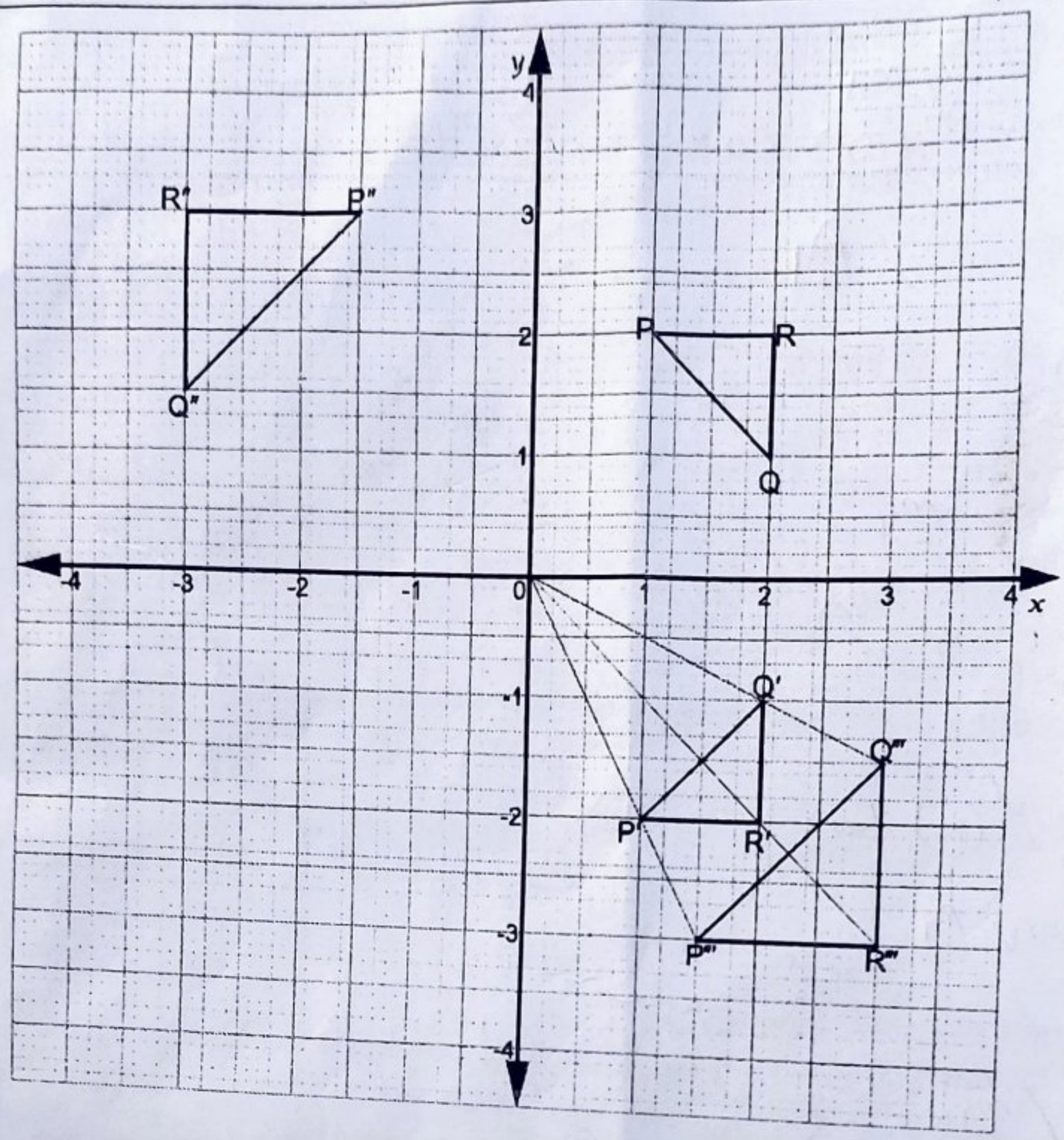
No.	Marking Scheme	Marks	Comments
10.	Commission on storybook = sh.60 .....(i) Commission on textbook = sh.90 .....(ii) Let no. of story books sold = x $x \times 60 + \frac{x}{2} \times 90 = 8400$ $105x = 8400$ $x = 80$	B1 M1 A1 3	
11.	$\begin{array}{c\|c\|c\|c\|c\|c} x & 1 & 2 & 3 & 4 & 5 \\ \hline y & 1 & 4 & 9 & 16 & 25 \end{array}$ Area $= \frac{1}{2} \times 1 \times \{1 + 25 + 2(4 + 9 + 16)\}$ $= \frac{1}{2} \times \{26 + 2 \times 29\}$ $= \frac{1}{2} \times 84$ $= 42$ sq units	B2 M1 A1 4	All √ Allow B1 for 3√ correct
12.	 (a) √ representation of $\mathbf{a}+\mathbf{b}$ √ Resultant vector $\mathbf{a}+\mathbf{b}$ drawn (b) √ representation of $(\mathbf{a}+\mathbf{b})+\mathbf{c}$ √ Resultant vector $(\mathbf{a}+\mathbf{b})+\mathbf{c}$ drawn	B1 B1 B1 B1 4	$\begin{pmatrix}2\\3\end{pmatrix}+\begin{pmatrix}2\\0\end{pmatrix}=\begin{pmatrix}4\\3\end{pmatrix}$ √ $\begin{pmatrix}4\\3\end{pmatrix}+\begin{pmatrix}2\\-2\end{pmatrix}=\begin{pmatrix}6\\1\end{pmatrix}$ √ Increase of calculation in terms of column vectors. $\begin{pmatrix}2\\3\end{pmatrix}+\begin{pmatrix}2\\0\end{pmatrix}=\begin{pmatrix}4\\3\end{pmatrix}=\begin{pmatrix}4\\3\end{pmatrix}$ $\begin{pmatrix}4\\3\end{pmatrix}+\begin{pmatrix}2\\-2\end{pmatrix}=\begin{pmatrix}6\\1\end{pmatrix}$ No evidence must be shown on the diagram otherwise OW -1

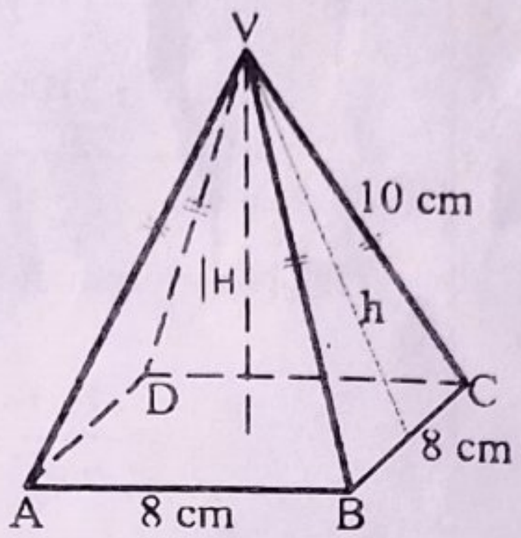
No.	Marking Scheme	Marks	Comments
13.	Det P $= 4\times -1 - 2\times -7$	B1	If B_0 then $M_0 A_0$
	$P^{-1} = \frac{1}{10}\begin{pmatrix} -1 & -2 \\ 7 & 4 \end{pmatrix}$ ✓B1 for inverse		
	$R = 20\times\frac{1}{10}\begin{pmatrix} -1 & -2 \\ 7 & 4 \end{pmatrix} + \begin{pmatrix} -1 & 5 \\ 6 & -3 \end{pmatrix}$ ✓M1	M1	
	$= \begin{pmatrix} -2 & -4 \\ 14 & 8 \end{pmatrix} + \begin{pmatrix} -1 & 5 \\ 6 & -3 \end{pmatrix}$ (3)		
	$= \begin{pmatrix} -3 & 1 \\ 20 & 5 \end{pmatrix}$ ✓A1	A1	
		3	
14.	(a)		
	x: 0 1 2 3 4 5 6 7 / f: 1 3 8 10 3 2 2 1 ✓	B1	B1 for all correct values of x and f
	(b) $\bar{x} = \frac{0+3+16+30+12+10+12+7}{30}$ ✓M1 Accept $\frac{90}{30}$ ✓M1 (3)	M1	
	$= \frac{90}{30}$ A1	A1	
	$= 3$ ✓A1		
		3	
15.	$y = 3x^2 - 2x$		
	$\frac{dy}{dx} = 6x - 2$ (4)		
	at $x = 2$,		
	$\frac{dy}{dx} = 6\times 2 - 2$ ✓M1	M1	
	$= 10$		
	$m_2 \times 10 = -1$		
	$m_2 = -\frac{1}{10}$ ✓A1	A1	
	At $x = 2$, $y = 3\times 2^2 - 2\times 2 = 12 - 4 = 8$		
	$\frac{y-8}{x-2} = -\frac{1}{10}$ ✓M1	M1	
	$10y - 80 = -x + 2$		
	$y = -\frac{1}{10}x + \frac{82}{10}$ ✓A1 Accept $10y = -x + 82$ ✓A1 or equivalent		
		4	

No.	Marking Scheme	Marks	Comments
16.			
	$x = -3$ & $y = -2$	B1	line $y = \frac{4}{3}x + 2$ √ drawn correctly
	$x = -3$ and $y = -2$ √B_1	B1	line $3y = x - 3$ √ drawn correctly.
	If lines do not intersect B0. Accept allowance of one small square.	3	

CamScanner

No.	Marking Scheme	Marks	Comments
17. (a)	(i) Distance covered by motor cyclist in 40 min $= 60 \times \frac{2}{3}$ ✓m1 (or) 60 x 40/60 ✓m1 = 40 km ✓A1	M1 A1	
	(ii) R.S = 80 − 60 = 20 km /h Time to catch up $= \frac{40}{20}$ = 2 hours ✓m1	M1	
	Distance of meeting point from A = 80 x 2 ✓m1 (or) 60 x 2 + 40 ✓m1 = 160 km ✓A1	M1 A1	
	(iii) Time Matatu overtook motorcycle 2.00 + 2.00 } ✓m1 → addition may be implied in the answer (4.00 pm) 4.00pm ✓A1 (or) 1600hrs	M1 A1	
(b)	R.S = 40 + 80 = 120 km/h Time to meet = $\frac{400}{120}$ ✓m1 = 3 hr 20 min Time lorry & matatu met 2.00 + 3.20 } ✓m1 → addition may be implied 5.20 p.m ✓A1 or 1720h	M1 A1	(b) Let mat take y km Lorry = (400 − y) km $\frac{y}{80} = \frac{400-y}{40}$ $y = \frac{32000}{120}$; $\frac{32000}{120} \times \frac{1}{80}$ ✓m1 $= 3\frac{1}{3}$ hr 2pm + 3.20 ✓m = 5.20pm ✓A (or) Ratio of speeds = 1:2 Lorry dist = $\frac{1}{3} \times 400$ Time = $\frac{400}{3} \times \frac{1}{40}$ ✓m $= \frac{10}{3}$ = 3h 20min 2pm + 3.20 = 5.20pm ✓m ✓A (or) $400 \times \frac{2}{3} \times \frac{1}{80}$ ✓m1 2pm + 3.20 ✓m1 = 5.20pm ✓A
		10	

No.	Marking Scheme	Marks	Comments
18.			
(a)	(i) √ location of any of the vertices of Δ P′Q′R′	B1	for atleast one co-ordinate (x,y)
	Δ P′Q′R′ √ drawn and labelled	B1	
	(ii) Centre of enlargement √ located (or) implied.	B1	
	√ location of any of the vertices of Δ P″Q″R″	B1	(alt) using matrix method
	Δ P″Q″R″ √ drawn and labelled	B1	for atleast one co-ordinate correctly evaluated
	(iii) √ location of any of the vertices of Δ P‴Q‴R‴	B1	
	Δ P‴Q‴R‴ √ drawn and labelled	B1	
(b)	Enlargement	B1	
	Centre (0, 0)	B1	
	S.F = + 1.5	B1	
		10	

No.	Marking Scheme	Marks	Comments
19. (a)	$AC^2 = 8^2 + 8^2$		
	$AC = \sqrt{128}$	M1	
	$= 11.31$ cm	A1	
	$\frac{1}{2}AC = 5.657$		
	Let H = height of pyramid		
	$H^2 + 5.657^2 = 10^2$		
	$H = \sqrt{100 - 32.029}$	M1	
	$= \sqrt{68.021}$		
	$= 8.246$ cm	A1	
(b)	Let h = height of a Δ face		
	$h^2 = 4^2 + 68.021$		
	$h = \sqrt{84.021}$ or $\sqrt{10^2 - 4^2}$	M1	
	$= 9.165$	A1	
	$S.A = 8 \times 8 + 4 \times \frac{1}{2} \times 8 \times 9.165$	M1	
	$= 64 + 146.64$		
	$= 210.64$	A1	
(c)	$Vol. = \frac{1}{3} \times (8 \times 8) \times 8.246$	M1	
	$= 175.94$	A1	
		10	

19(a) $AC = \sqrt{8^2+8^2}$ ✓ m_1 Accept $\sqrt{8^2+8^2}$ ✓ m_1

19(a) (or) $h = \sqrt{10^2 - 4^2} = 9.165$

$h = \sqrt{9.165^2 - 4^2}$ ✓ m, m

$= 8.25$ Ans ✓

19(a) $h = \sqrt{10^2 - 4^2} = \sqrt{84}$ ✓ m

$h^2 = (\sqrt{84})^2 - 4^2$

$= \sqrt{84 - 16}$ ✓ m, m_1

$= \sqrt{68}$

$= 8.25$ ✓ A1

Follow through

45 sf. unless otherwise stated. Answers to 3 sf. unless stated otherwise. Follow through

19(b) $s = \frac{10+10+8}{2} = \sqrt{m_1}$

$= 14$

$A = \sqrt{14(14-10)(14-10)(14-8)} = 210.64$

$\angle BVC = 47.16$ ✓ m_1

$A = \frac{1}{2} \times 10^2 \times \sin 47.16 = 36.67$

$4 \text{ triangles} = 4 \times 36.67 = 146.68 + 8^2$ ✓ m_1 ✓ m_1

$= 210.68$ ✓ A1

Accept 8.25

Hero's formula used

$s = \frac{1}{2}(10+10+8)$ - - - ✓ m_1

$S.A = 4 \times \sqrt{14(14-10)(14-10)(14-8)} + 8^2$ ✓ m_1

$= 146.64 + 64$ ✓ m

$= 210.64 \text{ cm}^2$ ✓ A1

Accept 210.6 cm² ✓ A1

(or)

$\sin\theta = \frac{4}{10}$; $\theta = 23.58°$

$2\theta = 23.58 \times 2 = 47.16$

Area of $1\Delta = \frac{1}{2} \times 10^2 \sin 47.16$ ✓ m_1

$= (50 \sin 47.16) \times 4$ ✓ m_1

$= 146.64$

$SA = 146.64 + 8^2$ ✓ m_1

$= 210.64$ ✓ A1

Accept $V = \frac{1}{3} \times 8 \times 8 \times 8.25$ ✓ m_1

$= 176$ ✓ A1

Book only one for PA-1

No.	Marking Scheme	Marks	Comments
20.	(a)(i) No of bananas Neema would have bought $= \frac{2100}{x}$ ✓B1	B1	
	(ii) No of bananas bought by Neema after discount $= \frac{2100}{x-3}$ ✓B1	B1	Accept $\frac{2100}{x}+35$
	(b) $\frac{2100}{x-3} - \frac{2100}{x} = 35$ ✓M1	M1	
	$2100x - 2100(x-3) = 35x(x-3)$		
	$35x^2 - 105x - 6300 = 0$ ✓M1	M1	Correct quadratic equation or equivalent
	$x^2 - 3x - 180 = 0$		
	$(x-15)(x+12) = 0$ ✓M1	M1	Accept $\frac{3 \pm 27}{2}$ ✓M1
	$x = 15$ or $x = -12$		
	$x = 15$ ✓A1	A1	
	No of banana bought		
	$= \frac{2100}{15-3}$ ✓M1 (or) $\frac{2100}{12}$ ✓M1 (or) ~~M1~~ $\frac{2100}{15}+35$ ✓M1	M1	
	$= 175$ ✓A1	A1	
	(c) Let the no of students $= x$		
	$\frac{2}{5}x \times 2 + \frac{3}{5}x \times 1 = 175$ ✓M1	M1	
	$x = 125$ ✓A1	A1	
		10	

No.	Marking Scheme	Marks	Comments
21.	(a) Modal class = 60 – 69 ✓B1	B1	
	(b)		

U.C.B	39.5	49.5	59.5	69.5
C.F	8	18	46	78

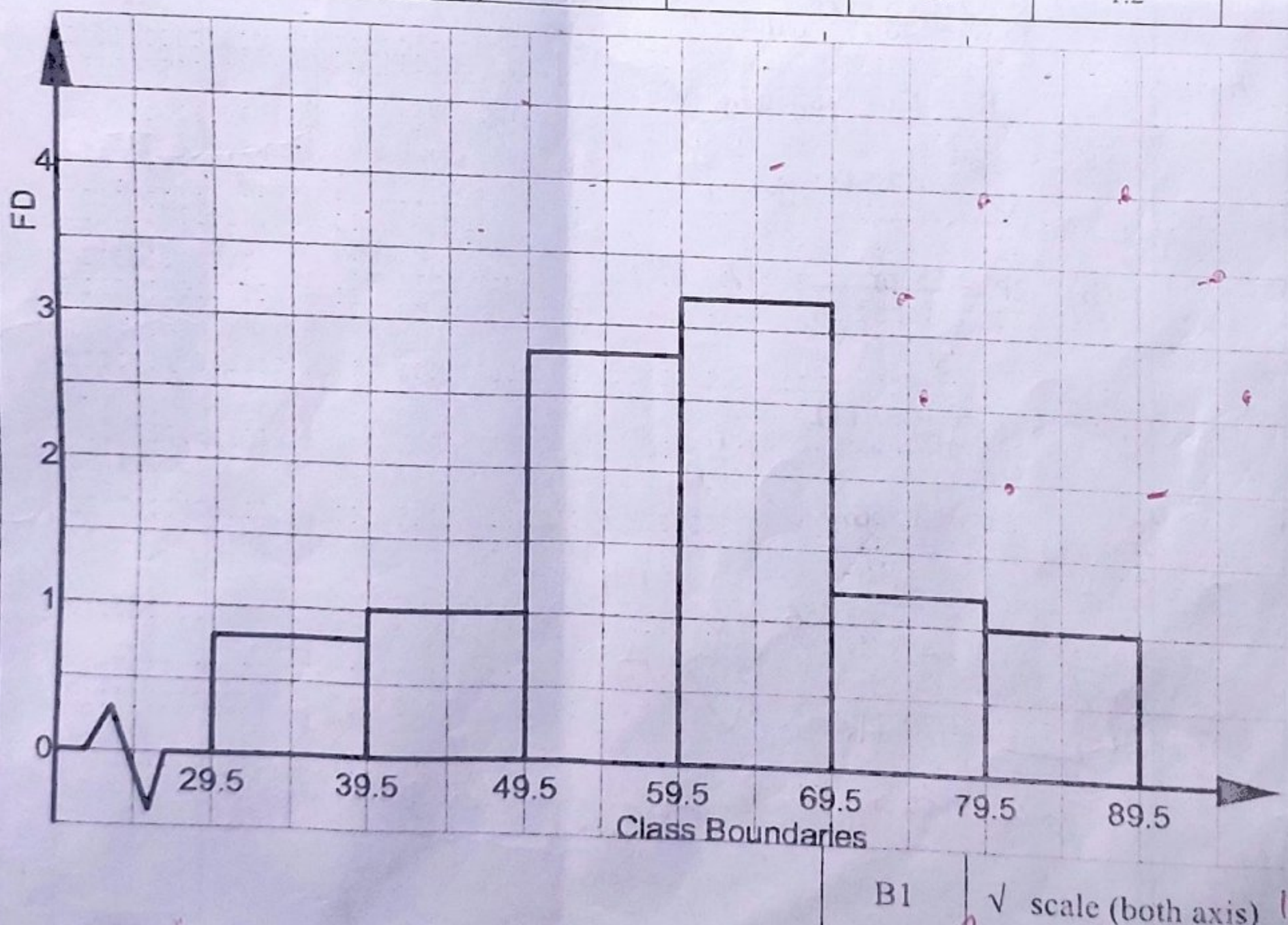
✓B1 ✓B1

Median score = $59.5 + \frac{4}{32} \times 10$ ✓M1	M1	
= 60.75 ✓A1	A1	
(c)	B1	implied CB

Class boundaries & FD

Class boundaries	29.5 – 39.5	39.5 – 49.5	49.5 – 59.5	59.5 – 69.5	69.5 – 79.5	79.5 – 89.5
Freq	8	10	28	32	12	10
Freq Density	0.8	1	2.8	3.2	1.2	1

B2



	B1	√ scale (both axis) linear scale
	B2 ✓B2	All 6 bars √ correctly drawn. (Not necessarily shaded) Allow B1 for 3 bars √
(d) No. of students who scored from 71.5 to 76.5	M1	*Follow thro*
= (76.5 – 71.5) × 1.2 ✓M1 → scored only if the 5th Bar is correct		
= 5 × 1.2		
= 6 ✓A1 depends on M1 above	A1	
	10	

Follow thro

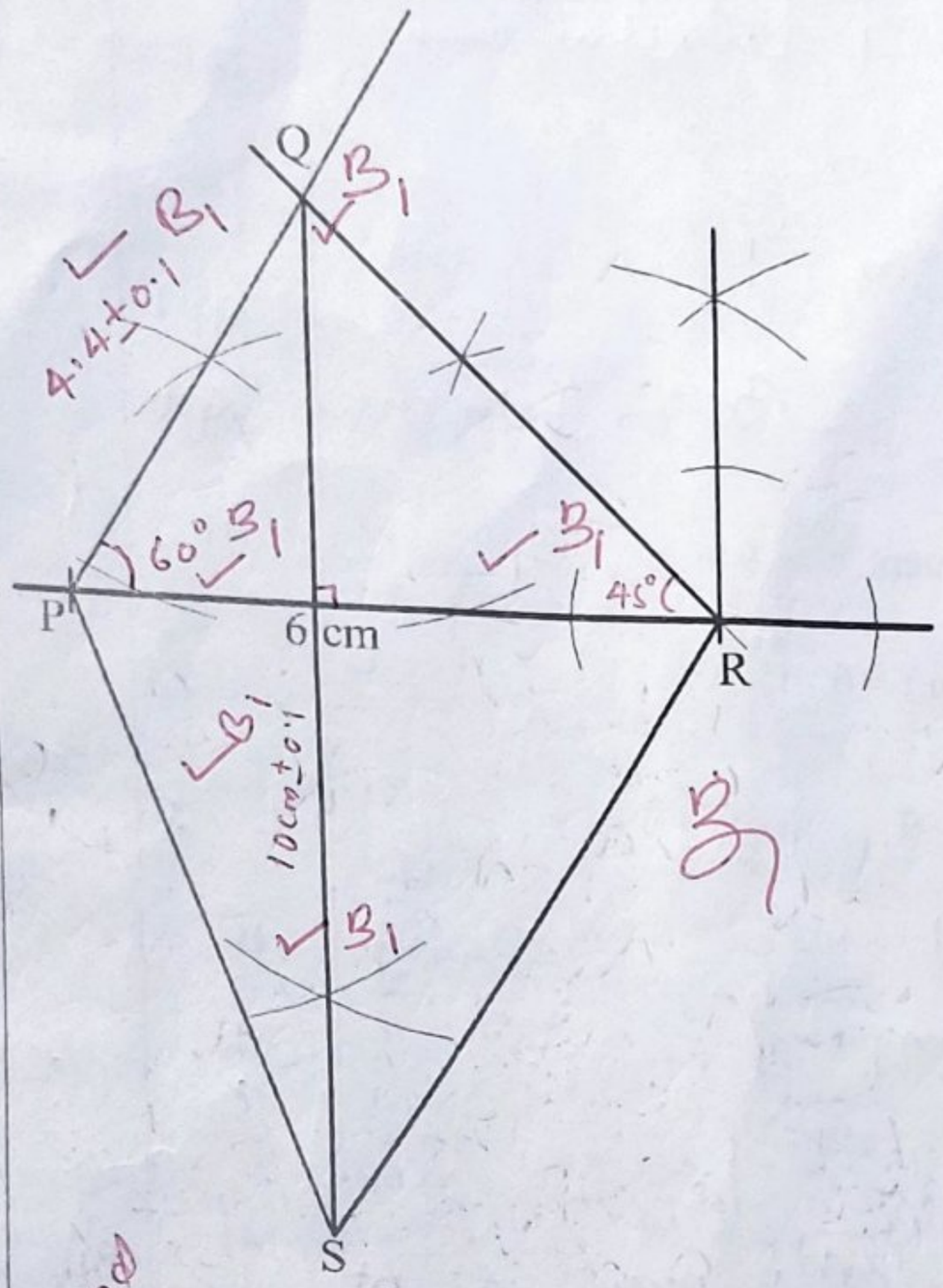
No.	Marking Scheme	Marks	Comments
22.	(a)(i) $\angle QPR = 180 - 65\times2$ ✓ m_1 (or) 50° seen on the diagram.	M1	
	$= 50°$		
	$\frac{QR}{\text{Sin } 50°} = \frac{2.7}{\text{Sin } 65°}$ ✓ m_1	M1	$\cos 65° = \frac{x}{2.7}$ ✓ m_1 $QM = 2.7\cos 65°$ $QR = 2\times 2.7\cos 65°$ ✓ m_1
	$QR = \frac{2.7 \text{ Sin } 50}{\text{Sin } 65}$		$= 2.282$ ✓ A1
	$= 2.282$ cm ✓ A1 CAO (4 s.f.)	A1	
	(ii) $\text{Cos } R = \frac{7^2 + 2.7^2 - 6^2}{2\times7\times2.7}$ ✓ m_1 (or) equivalent	M1	$6^2 = 2.7^2 - 7^2 - 2\times7\times2.7\cos R$
	$= 0.5368$	~~A1~~	
	$R = \text{Cos}^{-1} 0.5365$ ✓ m_1		
	$= 57.54°$ ✓ A1 Accept 57.53° when calculator is used	~~B1~~	
	(b) $2r = \frac{6}{\text{Sin } 57.54}$ ✓ m_1	M1	
	$r = \frac{1}{2}\times7.111$		
	$r = 3.556$ ✓ A1	A1	
	$\text{Area} = \frac{22}{7}\times3.556^2$ ✓ m_1	M1	
	$= 39.73 \text{ cm}^2$ ✓ A1	A1	
	Follow through dependency on the pie used.		
		10	

Follow through

CamScanner

No.	Marking Scheme	Marks	Comments
23.	(a)(i) $\frac{dx}{dt} = t^2 - 6t$ ✓ m_1 derivative seen	M1	
	$t^2 - 6t = 0$		
	$t(t - 6) = 0$ ✓ m_1	M1	
	$t = 0$ and $t = 6$ ✓ A_1 for both values of t	A1	
	(ii) When t = 0, displacement x = 9 m ✓ B_1	B1	
	Displacement, x, when t = 6		
	$x = \frac{216}{3} - 3\times 36 + 9$		
	$= -27$ ✓ B_1	B1	
	(b) $t^2 - 6t = -5$ ✓ m_1	M1	
	$t^2 - 6t + 5 = 0$		$\frac{6+4}{2}$
	$(t - 1)(t - 5) = 0$ ✓ A_1 Accept $t = \frac{6\pm 4}{2}$ ✓ m_1	M1	
	$t = 1$ or $t = 5$ ✓ A_1	A1	
	(c) $a = \frac{d^2x}{(dt)^2} = 2t - 6$		
	At t = 2		
	$a = 2\times 2 - 6$ ✓ M_1 correct substitution of 2 in the 2nd derivative.	M1	
	$= -2\ m/s^2$ ✓ A_1	A1	
		10	

CamScanner

No.	Marking Scheme	Marks	Comments
24.			
	(a) √ Construction of 60 °at P arcs seen	B1	
	√ Construction of 45 °at R line PR must be extended beyond R, arcs seen	B1	
	√ Point Q located and ΔPQR complete	B1	
	PQ = (4.4 ± 0.1) cm	B1	
	(b) ⊥ dropped from Q to PR arcs seen on PR line	B1	
	√ length of QS = 10 cm ± 0.1cm	B1	
	Quadrilateral PQRS complete	B1	
	(c) Area of quadrilateral PQRS = $\frac{1}{2}\times 6\times 3.8 + \frac{1}{2}\times 6\times 6.2$	M1M1	For each √m1m1
	= 30.0 cm² √A1	A1	Must be A ½×10×6 = 30.0 cm² √A1 (for 4.4)
		10	

If no construction and the quadrilateral is correct 7 mks scored

(c) follow thro'

Page | 14