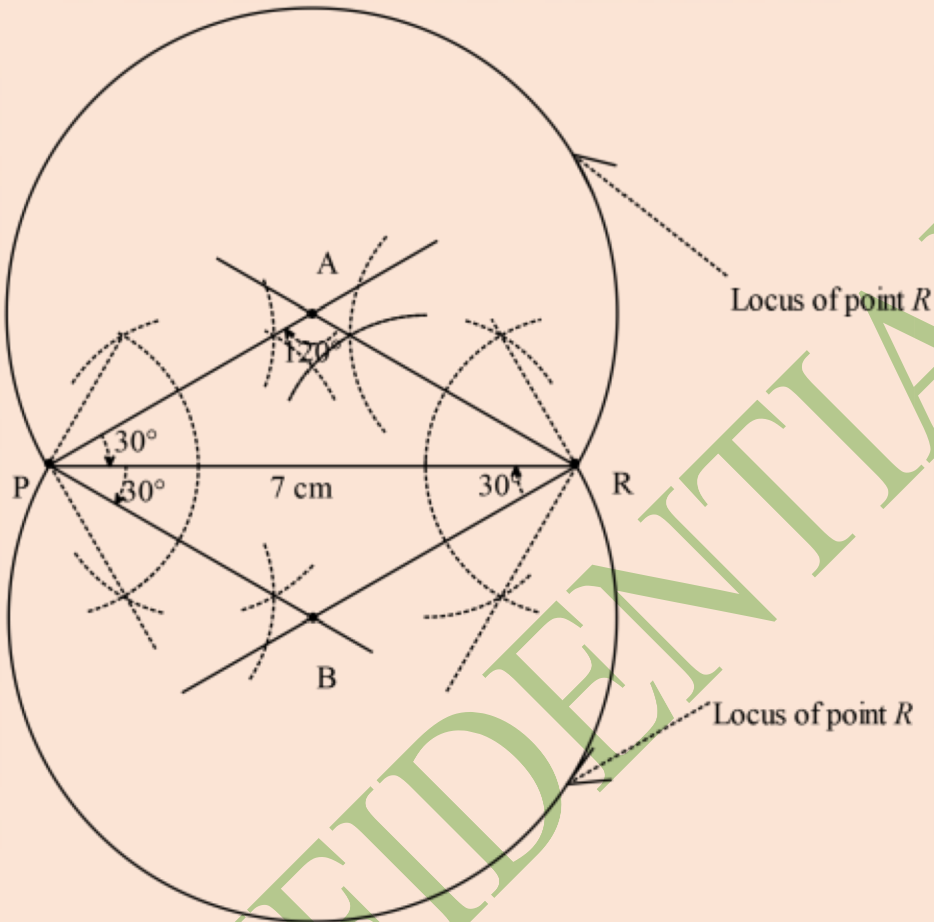
FORM FOUR END TERM 2 2024

PAPER 2 MARKING SCHEME

No	WORKING	MARKS
1 (a)	$(2x-y)^5 = 32x^5 - 80x^4y + 80x^3y^2 - 40x^2y^3 + 10xy^4 - y^5$ ($2x+y)^5 = 32x^5 + 80x^4y + 80x^3y^2 + 40x^2y^3 + 10xy^4 + y^5$ $(2x-y)^5 + (2x+y)^5 = 64x^5 + 160x^3y^2 + 20xy^4$	M1 A1
(b)	$3.75 = 2(2) - 0.25$ $x = 2$, $y = 0.25$ $3.75^5 + 4.25^5 = 64(2^5) + 160(2^3)(0.25^2) + 20(2)(0.25^4)$ $= 2048 + 80 + 0.15625$ $= 2128.15625$	M1 A1
2	3 -75) + 1 $(-11) = (-35.5)$ (4 -11 4 4 -8 $N = (5, -3.5, -8)$	M1 A1 B1
3	$x^2 - x - 6 = 0$ $x^2 - 3x + 2x - 6 = 0$ $(x-3)(x+2) = 0$ $x = 3$ or $x = -2$	M1 M1 A1
4	$x = \sqrt[3]{c - h^3 b}$ $x^3 = c - h^3 b$ $= \frac{c - x^3}{b}$ h^3 $\overline{\underline{c - x^3}}$ $h = \sqrt[3]{}$ b	M1 M1 A1

5	$S_n = \frac{n}{2}(2a + (n-1)d)$ $253 = \frac{11}{2}((2 \times 3) + (11-1)d)$ $46 = 6 + 10d$ $d = 4$	M1 M1 A1
6	$\log\left(\frac{100}{50^2}\right)$ $\log\left(\frac{1}{25}\right)$	B1 B1
7	$W = 10 \pm (0.05 \times 10) \Rightarrow 10 \pm 0.5$	M1
	$L = 15 \pm (0.05 \times 15) \Rightarrow 15 \pm 0.75$ Max area = $15.75 \times 10.5 = 165.375\ cm^2$ Min area = $14.25 \times 9.5 = 135.375\ cm^2$ A.E in area = $\frac{165.375-135.375}{2} = 15$ % error = $\frac{15}{150} \times 100\% = 10\ \%$	M1 A1
8	$AB = \sqrt{(6-2)^2 + (2-4)^2}$ $= \sqrt{16+4} = \sqrt{20}$ $= 2\sqrt{5}$ $r = \frac{1}{2}(2\sqrt{5}) = \sqrt{5}$ $Centre\ \left(\frac{2+6}{2}, \frac{2+4}{2}\right) = (4,3)$ $(x-4)^2 + (y-3)^2 = (\sqrt{5})^2$ $x^2 - 8x + 16 + y^2 - 6y + 9 = 5$ $x^2 + y^2 - 8x - 6y + 20 = 0$	M1 M1 A1
9	(a) Possible outcomes: HTH, HTT, HHH, THT, THH, TTT, TTH, HHT (b) $P(HHH) = \frac{1}{8}$	B1 B1

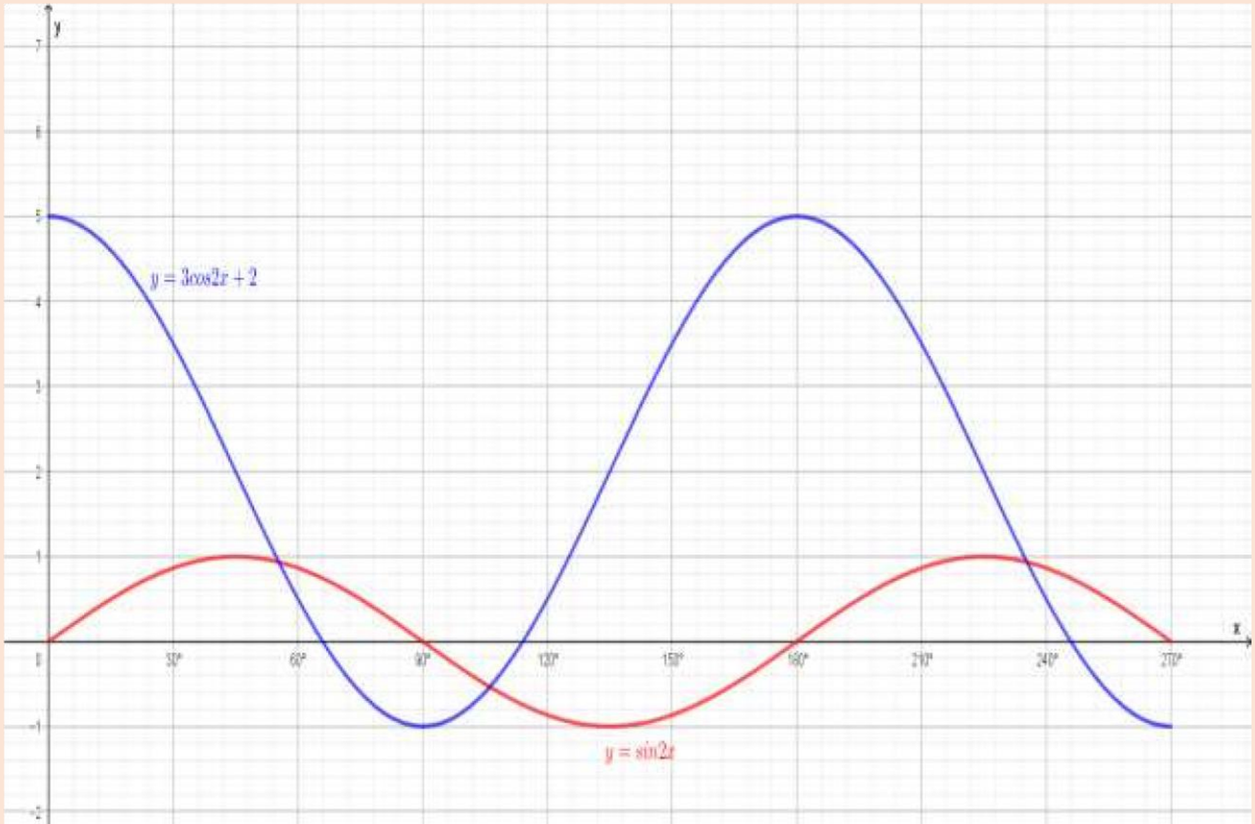
10	Cost $= \frac{100}{120} \times 324 = Sh.54\ per\ Kg$ $\frac{50x + 60y}{x + y} = 54$ $54x + 54y = 50x + 60y$ $x : y = 3 : 2$	M1 M1 A1
11	$A = 18200 + (\frac{18200 \times 22 \times 2}{100})$ $= Sh. 26\ 208$ Monthly instalment $= \frac{26\ 208}{24} = Sh. 1\ 092$	
12	$-3sin^2x + 8cos\ x = 0$ $-3(1 - cos^2x) + 8\cos x = 0$ $-3 + 3\ cos^2x + 8\cos x = 0$ Let $\cos x = k$ $3k^2 + 8k - 3 = 0$ $3k^2 - k + 9k - 3 = 0$ $(k + 3)(3k - 1) = 0$	M1
	$k = -3\ or\ k = \frac{1}{3}$ $\cos x = \frac{1}{3}$ $x = \cos^{-1}(\frac{1}{3}) = 70.52°, 289.47°$	M1 A1
13	$AP.PB = PT^2$ $2(2 + x) = 6^2$ $x = \frac{36 - 4}{2} = 16\ cm$ Radius $= 16 \div 2 = 8\ cm$	M1 M1 A1

14		B1- for angle APR = 30° B1 – for both centres A & B B1 – for both loci
15	(a) Angle PQS = 76 ÷ 2 = 38° Angle subtended at the centre is twice angle subtended at the circumference by the same arc. (b) Angle PQR = 90° Angle subtended on the circumference by the diameter is a right angle.	B1 B1 B1
16	i. Distance = $500 \times \frac{9}{4} = 1125\ nm$ ii. $1125 = 60(x - 40)\cos 53.4°$	M1 M1

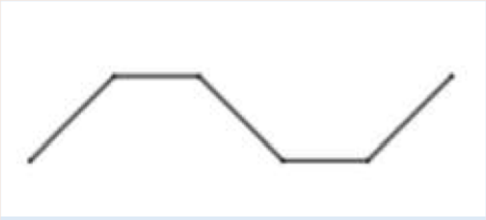
	$x = 40 + \dfrac{1125}{60 \times \cos 53.4°}$ $= 71.45°E$	A1
17	(a)	

$x°$	0	30	60	90	120	150	180	210	240	270
$3\cos 2x + 2$	**5**	3.5	**0.5**	-1	0.5	**3.5**	5	**3.5**	**0.5**	-1
$\sin(2x)°$	0	0.87	**0.87**	**0**	-0.87	**-0.87**	0	**0.87**	0.87	**0**

(c) At the points of intersection, values of x are; $55°, 106°$ *and* $235°$

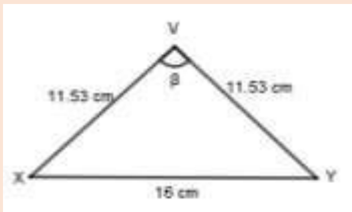


18	(a) $(i)\ \frac{dy}{dx} = 3x^2 + 2x - 1$ $(ii)\ At\ stationary\ points, \frac{dy}{dx} = 0$ $3x^2 + 2x - 1 = 0$ $3x^2 + 3x - x - 1 = 0$ $(3x - 1)(x + 1) = 0$ $x = \frac{1}{3}, x = -1$ (iii) At $(-1,0\ )$ is a maximum turning point and $(\frac{1}{3}, -1\frac{5}{27}\ )$ is a minimum turning point	

	(b) 	B2
	a) $Q = \frac{KP^2}{\sqrt[3]{R}}$ $15 = \frac{36\ K}{\sqrt[3]{27}}$ $K = \frac{15 \times 3}{36} = 1.25$ $Q = \frac{1.25P^2}{\sqrt[3]{27}}$ When Q = 81 and R = 125, $81 = \frac{1.25P^2}{\sqrt[3]{125}}$ $P^2 = \frac{81 \times 5}{1.25} = 324$ $P = \sqrt{324} = \pm 18$	M1 M1 A1
19	b)	

	(i) $m^2 = Kt^2 + hr^3$ $27^2 = K(3)^2 + h(5)^3$ $729 = 9K + 125h$ ...... (i) $Also,$ $78^2 = K(\sqrt{114})^2 + h(10)^3$ $6084 = 114K + 1000h$ ..... (ii) solving eqn (i) and (ii) simultaneously; $6084 = 114K + 1000h$ $\underline{-5832 = 72K + 1000h}$ $252 = 42K$ $K = 6$ $9(6) + 125h = 729$ $h = \frac{729 - 54}{125} = 5.4$ Thus; $m^2 = 6t^2 + 5.4r^3$	M1 both eqns A1 both h and K
	$when\ \ t = 8\ and\ r = 15$ $m^2 = 6(8)^2 + 5.4(15)^3$ $= 384 + 18225$ $m^2 = 18609$ $m = \sqrt{18\,609} = \pm 136.4$ (ii) $hr^3 = m^2 - Kt^2$ $r = \sqrt[3]{\frac{m^2 - Kt^2}{h}}$ New value of r = $\sqrt[3]{\frac{(0.9m)^2 - K(0.9t)^2}{h}} = \sqrt[3]{0.81} \times \sqrt[3]{\frac{m^2 - Kt^2}{h}}$ $= 0.93217\left(\sqrt[3]{\frac{m^2 - Kt^2}{h}}\right)$ Percentage change in r = $(1 - 0.93217) \times 100\% = 6.783\%$	M1 A1 M1 M1 A1

20	(a) $600 = 60 \times \alpha \Longrightarrow \alpha = 10°$ $C\,(70°N, 17°E)$ (b) $d = 60 \times \alpha \times \cos\theta$ $d = 60 \times 12 \times \cos 60 = 360\ nm$ (c) Time taken = $\left(\frac{360}{300}\right) + \left(\frac{600}{300}\right) = 3h\ 12min$ (d) Arrival time at C = $9.20\ a.m + 3h\ 12\ min = 1232\ p.m.$ (e) $d = \frac{40}{360} \times 2 \times \frac{22}{7} \times 6370 = 4448.89\ km$	B1 B1 M1 A1 M1 A1 M1 A1 M1 A1
21	(a) $QS = \sqrt{16^2 + 12^2} = 20\ cm$ (b) $h^2 + 10^2 = 13^2$ $h = \sqrt{13^2 - 10^2}$ $h = 8.3\ cm$ (c) $13^2 = 13^2 + 20^2 - 2 \times 20 \times 13 \times \cos\theta$ $169 = 169 + 400 - 520\cos\theta$ $\cos\theta = 0.7692$ $\theta = \cos^{-1}(0.7692) = 39.72°$ (d) Height of $\Delta\, VQR$ $h^2 + 6^2 = 13^2$	M1 A1 M1 A1 M1 A1

	$h = \sqrt{13^2 - 6^2} = 11.53\ cm$ $\cos\alpha = \frac{8}{11.53}$ $\alpha = \cos^{-1}(0.6938) = 46.07°$ (e)  $16^2 = 11.53^2 + 11.53^2 - 2 \times 11.53^2 \times \cos\beta$ $256 = 265.8818 - 265.8818 \cos\beta$ $\cos\beta = 0.0385$ $\beta = 87.79°$	M1 A1 M1 A1
22	a) i. $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} -3 & 4 \\ 2 & 3 \end{pmatrix} = \begin{pmatrix} -8 & 5 \\ 6 & 9 \end{pmatrix}$ $\begin{pmatrix} -3a + 2b & 4a + 3b \\ -3c + 2d & 4c + 3d \end{pmatrix} = \begin{pmatrix} -8 & 5 \\ 6 & 9 \end{pmatrix}$ Solving the equations simultaneously; $4a + 3b = 5$	

	$-3a + 2b = -8$ $\boldsymbol{a = 2}$ *and* $\boldsymbol{b = -2}$ $4c + 3d = 9$ $-3c + 2d = 6$ $\boldsymbol{c = 0}$ *and* $\boldsymbol{d = 3}$ **Thus matrix M =** $\begin{pmatrix} \mathbf{2} & \mathbf{-1} \\ \mathbf{0} & \mathbf{3} \end{pmatrix}$ ii. $\begin{pmatrix} \mathbf{2} & \mathbf{-1} \\ \mathbf{0} & \mathbf{3} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 6 \\ -12 \end{pmatrix}$ $2x - y = 6$ $3y = -12 \Longrightarrow y = -4$ $2x - (-4) = 6$	M1 M1 A1
	$2x = 2 \Longrightarrow x = 1$ $R(1, -4)$	B1

	b)	
	i. $\begin{pmatrix}1 & 0\\ k & 1\end{pmatrix}\begin{pmatrix}-8\\ 6\end{pmatrix}=\begin{pmatrix}-8\\ 30\end{pmatrix}$	
	$\begin{pmatrix}-8\\ -8k+6\end{pmatrix}=\begin{pmatrix}-8\\ 30\end{pmatrix}$	M1
	$-8k+6=30 \Longrightarrow k=-3$	
	$shear\ matrix=\begin{pmatrix}1 & 0\\ -3 & 1\end{pmatrix}$	A1
	ii. $\begin{pmatrix}1 & 0\\ -3 & 1\end{pmatrix}\begin{pmatrix}5 & 6\\ 9 & -12\end{pmatrix}=\begin{pmatrix}5 & 6\\ -6 & -30\end{pmatrix}$	M1
	$Q''(5,-6)$ and $R''(6,-30)$	A1
	iii. $\begin{pmatrix}1 & 0\\ -3 & 1\end{pmatrix}\begin{pmatrix}2 & -1\\ 0 & 3\end{pmatrix}=\begin{pmatrix}2 & -1\\ -6 & 6\end{pmatrix}$	M1
	Determinant = $(2\times 6)-(-1\times -6)=12-6=6$	
	Inverse = $\frac{1}{6}\begin{pmatrix}6 & 1\\ 6 & 2\end{pmatrix}=\begin{pmatrix}1 & \frac{1}{6}\\ 1 & \frac{1}{3}\end{pmatrix}$	A1

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(a) 10 — B1

(b) $Q_1 = 2.95 + \left(\frac{10-6}{5}\right) \times 1 = 3.75$ — M1

$Q_3 = 5.95 + \left(\frac{30-28}{6}\right) \times 1 = 6.283$ — M1

$Q.D = \frac{6.283-3.75}{2} = 1.27$ — M1 A1

(c) (i)

Class	x	f	$t = x - A$	ft	t^2	ft^2
1.0 − 9. 1	1.45	2	−3	−6	9	18
2.0 − 9. 2	2.45	4	−2	−8	4	16
3.0 − 9. 3	3.45	5	−1	−5	1	5
4.0 − .9 4	4.45	7	0	0	0	0
5.0 − .9 5	5.45	10	1	10	1	10
6.0 − .9 6	6.45	6	2	12	4	24
7.0 − .9 7	7.45	3	3	9	9	27
8.0 − .9 8	8.45	2	4	8	16	32
9.0 − .9 9	9.45	1	5	5	25	25
		40		25		157

B1 – $\sum ft$ B1 -$\sum ft^2$

$variance = \sqrt{\frac{157}{40} - \left(\frac{25}{40}\right)^2}$ — M1

$= \sqrt{3.534375}$ — A1

$\cong 1.9$ — B1

(ii) Standard deviation = $\sqrt{1.9} = 1.4$

24	(a) (i) Angle ADB = $\frac{1}{2} of\ (180-48)=66°$ Angle at the center is twice angle at the circumference. (ii) Angle CBA = $90°$ Angle subtended by the diameter on the circumference is a right angle. (iii) Angle BDE = $\frac{48}{2}+36=60°$ Angles in alternate segment. (iv) Angle CED = $180-(36+66+60)=18°$ Angle sum of triangle (b) Let DX be y cm, $12\times 4=y(14-y)$ $48=$ $14y-y^2$ $(y-6)(y-8)=0$ $y=6\ cm\ or\ 8\ cm$	B1 B1 B1 B1 B1 B1B1 B1 M1 A1