

1	(a)	$\sqrt{15^2 - 8^2}$	M1
		12.7 m	A1
	(b)	$15^2 + 11^2 \pm 2 \times 15 \times 11 \cos 55^\circ$ soi	M1
		Correct formula, simplification and square root taken soi	M1
		156(.7...) or 535(.2...) soi	A1
		12.5 m	A1
			(dep on first M1)
			further
	(c)	$\cos \hat{ADB} = \frac{8}{15}$ oe	M1
		$\hat{ADB} = 57.8^\circ$ soi	A1
2	(a)	$p = 17 \quad q = 36 \quad r = 125$ (B1 each)	B3
		$s = 178$ or their $(p + q + r)$ v	B1
	(b)	$x = 3n + 2$ oe $y = (n + 1)^2$ oe $z = n^3$ oe (B1 each)	B3
		$t = n^3 + n^2 + 5n + 3$ oe or their $(x + y + z)$ v	B18
	(a)	20°	B1
	(b)	105°	B1
3	(c)	55° or $180 - \text{their (a)} - \text{their (b)}$ v	B1
	(d)	55°	B2
		(allow B1 for any indication $\hat{ECB} = 75^\circ$)	
	(e)	30° or $85 - \text{their (d)}$ v or $50 - \text{their (a)}$ v	B2
		(allow B1 for indication $\hat{BAC} = \hat{BEC}$ or $\hat{ABE} = \hat{ACE}$)	

4	(a)	Final answer $t = \frac{mv - mu}{F}$ oe (allow M1 for reaching $m(v - u)$ or $mv - mu = Ft$ oe)	B2
	(b)(i)	$43 = c + 50d$ and $49 = c + 80d$ oe	B1
	(ii)	$c = 33$ and $d = 0.2$ or $\frac{1}{5}$ (allow B2 for one correct www or M1 for correct elimination of one variable)	B3
	(iii)	$40 = \text{their } c + m \times \text{their } d$ soi 35 cao	M1 A1
	(iv)	Statement such as “Length of unloaded string”	B1
5	(a)(i)	Fig $(\pi \times 24^2 \times 125)$ soi 226 litres cao (allow A1 for $226\,000$ seen)	M1 A2
	(ii)	Fig $\{2\pi \times 24 \times 125 + (2 \times) \pi \times 24^2\}$ soi Division by 100^2 soi or works in metres 2.07 m^2 cao	M1 M1 A1
	(b)	fig $\frac{48\,000}{150 \times 20}$ soi 16 cm	M1 A1
	(c)	(Drop =) fig $\frac{20\,000}{\pi \times 24^2}$ or fig $\frac{20\,000}{20 \times 150}$ Divides their drop by 2.5 or $\frac{20\,000}{2.5}$ soi 4.42 cm/h cao	M1 indep M1 A1

6	(a)	Triangle A correctly plotted	B1
	(b)	Triangle B with vertices at (10, 1), (12, 1) and (10, -2)	B1
	(c)	Triangle C with vertices at (-3, 1), (-3, -1) and (-6, 1) (allow B1 for 2 vertices correct or vertices at (9, 7), (12, 7) and (9, 9))	B2
	(d)	Triangle D with vertices at (1, 4), (1, 2) and (-2, 4) (allow B1 for 2 vertices correct or vertices at (0, -3), (0, -5), (-3, -3))	B2
	(e)	Shear Factor 2 or with matrix $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ [In (b), (c), (d) allow $\surd$ from earlier mistakes]	M1 A1
7	(a)	$\frac{200(x+4) - 200x}{x(x+4)}$ oe Final answer $\frac{800}{x(x+4)}$ oe	M1 A1
	(b)(i)	$\frac{200}{x}$	B1
	(ii)	$\frac{200}{x+4}$ or (their (i) - 5) seen their $\left(\frac{200}{x}\right)$ - their $\frac{200}{x+4} = \pm 5$ or $(x+4)$ [their (i) - 5] = 200 oe Correct derivation of $x^2 + 4x - 160 = 0$ AG	B1 M1 A1
	(c)	$\frac{-4 \pm \sqrt{656}}{2}$ (allow B1 for -4 and 2 and B1 for $\sqrt{656}$ or 25.6...) 10.81 and -14.81 (B1 each) (allow B1 for both 10.8(...) and -14.8(...) seen)	B2 B2
	(d)	$\frac{40}{\text{their } 10.81} + \frac{120}{4 + \text{their } 10.81}$ (dep on (their 10.81) > 0) 11.8 litres cao (but accept 11 800 cm ³)	M1 A1

8 (a)	Vertical lines at $t = 60, 80, 90, 95, 100, 110$ and 130 Rectangles completed, with heights in ratio $1 : 5 : 14 : 20 : 12 : 2$ (allow B1 for 4 or 5 correct heights)	B1 B2
(b)	Interval $95 < t \leq 100$ indicated	B1
(c)	$98\frac{3}{16}$ oe or 98.2 or better (allow B2 for 98 or $\frac{7855}{80}$ seen or allow M1 for $\frac{4t_1 + 10t_2 + \dots}{4 + 10 + \dots}$ where $60 \leq t_1 \leq 80$ etc and dep M1 for $t_1 = 70, t_2 = 85, t_3 = 92.5, t_4 = 97.5, t_5 = 105, t_6 = 120$)	B3
(d)	$\frac{7}{40}$ oe	B1
(e) (i)	$\frac{7}{790}$ cao (allow B1 for equivalents or for $\frac{8 \times 7}{80 \times 79}$ or for $\frac{7}{800}$)	B2
(ii)	$\frac{4}{395}$ oe (allow B1 for $\frac{2 \times 4 \times 8}{80 \times 79}$ or for answer $\frac{2}{395}$ oe)	B2

9	(a)	$p = 29(.0)$	B1
	(b)	All 8 points plotted v (allow P1 for at least 6 correct plots v) Smooth curve through all plots of which at least 6 v	P2 C1
	(c) (i)	1.28 to 1.33	B1
	(ii)	13.7 to 13.99	B1
	(d)	Tangent drawn at $x = 1.5$ and using $\frac{\text{change in } y}{\text{change in } x}$ $-9(.0)$ to $-12(.0)$	M1 A1
	(e)	Ruled straight line through (0, 25) and (4, 13) (allow B1 for short ruled line or good freehand line)	B2
	(f) (i)	1.2(0) to 1.25 and 3.2(0) to 3.28	B1
	(ii)	$7x^3 - 25x^2 + 25 = 0$ oe (accept $a = 7$, $b = -25$, $c = 0$, $d = 25$)	B1
10	(a)	Reasonable explanation, such as $\frac{1}{5}$ of whole angle at O	B1
	(b)	$\frac{1}{2} 1.5^2 \sin 72^\circ$ or other complete method for area of triangle $5 \times \text{their (area of triangle)}$ 5.35 cm^2	M1 M1 A1
	(c) (i)	Reference to angle at centre of circle property, (or other method)	B1 M1
	(ii)	$2 \times 1.5 \cos 18^\circ$ or other complete method 2.85 cm convincingly obtained AG	A1 M1
	(iii)	$\frac{1}{2} (\text{their } 2.85)^2 \sin 36^\circ$ or other complete method 2.39 cm^2	A1 M1
	(iv)	$\frac{36}{360} \pi (\text{their } 2.85)^2$ 0.162 to 0.166 cm^2	A1 B1
	(v)	6.15 to 6.19 cm^2 or $[\text{their (b)} + 5 \times \text{their (c)(iv)}] \text{ v}$	

11	(a)(i)	$\mathbf{b} - \mathbf{a}$	B1
	(ii)	$\frac{2}{3}(\mathbf{b} - \mathbf{a})$ oe or $\frac{2}{3}(\text{their (i)})$ v	B1
	(iii)	$\frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$ oe or $\mathbf{a} + \text{their(ii)}$ v	B1
	(iv)	$\frac{5}{3}\mathbf{b}$ oe cao	B1
	(b)	$\vec{CD} = \vec{CO} + \vec{OD}$ or $\vec{CD} = \vec{CB} + \vec{BD}$ or better seen	M1
		$\mathbf{b} - \frac{1}{3}\mathbf{a}$ convincingly obtained AG	A1
	(c)	$\frac{5}{3}\mathbf{b} - \frac{5}{9}\mathbf{a}$	B1
	(d)(i)	Shows $\vec{ED} = \frac{5}{3}\vec{CD}$ (accept $k = \frac{5}{3}$)	B1
	(ii)	Length of ED = $\frac{5}{3}$ length of CD oe E, C and D lie on a straight line	B1 B1
	(e)	$\frac{AE}{OE}$ or a correct method seen	M1
		$\frac{4}{5}$ oe	A1