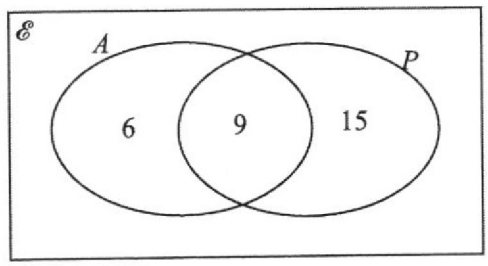
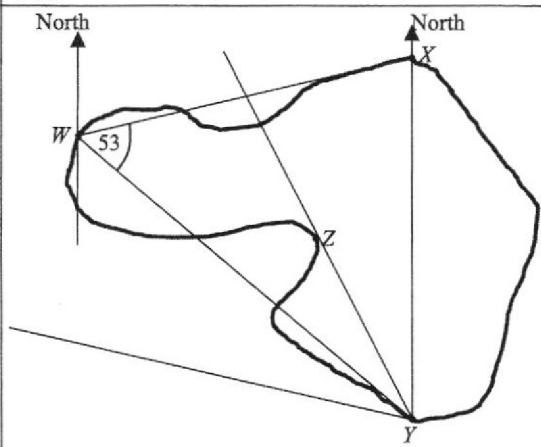
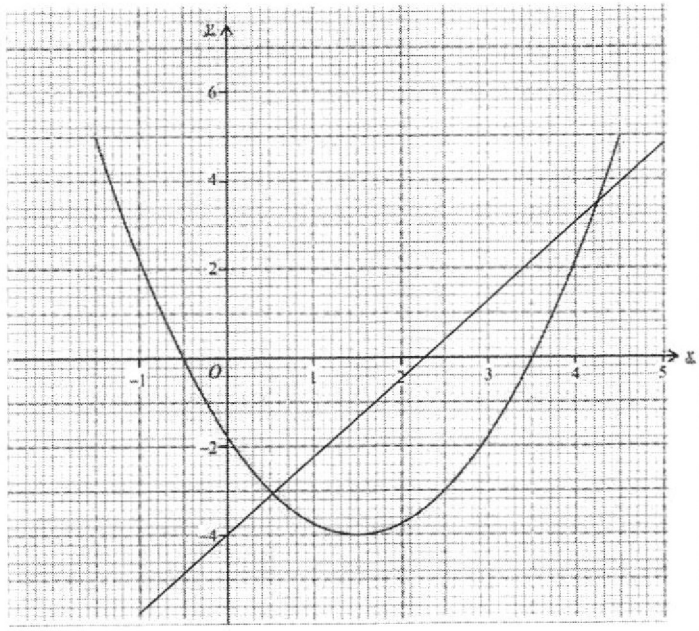
		Key Steps	Mark allocation / Remarks	
1		1.5π $\quad \sqrt{12.1}$	B1 Both correct,	1
2		$\sqrt[3]{\left(\frac{a^{15}}{b^6}\right)^{-2}} = \left(\frac{a^{15}}{b^6}\right)^{-2 \times \frac{1}{3}}$ $= \left(\frac{b^6}{a^{15}}\right)^{2 \times \frac{1}{3}}$ $= \frac{b^4}{a^{10}}$	B1 Either root/reciprocal rule seen B1 cao	2
3	(i)	$\frac{1}{2(-2)^2 + k(-2)} = \frac{1}{2}$ $k = 3$	B1	
	(ii)	$2x^2 + 3x = 2$ $2x^2 + 3x - 2 = 0$ $(2x - 1)(x + 2) = 0$ Another solution is $x = \frac{1}{2}$	B1	2
4		$\angle ACB = \frac{180 - p}{2} = 90° - \frac{p}{2}$ $\therefore \angle ACD = 90° - \frac{p}{2} + \frac{p}{2} = 90°$ John is correct (angle in semicircle)	B1 90° seen B1 with reason	2
5		$(2n + 3)^2 = (\text{even} + \text{odd})^2$ $= (\text{odd})^2$ $= \text{odd}$ $\therefore 2m = \text{odd} + 1$ $= \text{even}$ $m = \text{even} \div 2 = \text{integer}$	B1 Showing $(2n + 3)^2$ is odd, any method Zero mark for qn. if use specific nos. B1 Conclusion with clear reasons	2
6		The scale on vertical axis is not uniform, hence the graph cannot be linear.	B1 o.e.	1
7			B2, B1, B0 −1 m for each error	2
8		$a = \frac{2.5}{100} \times \frac{1}{12} \times 48206.47 = \$\ 100.43$ $b = 48206.47 + 100.43 - 1000 = \$\ 47\ 306.90$ ✓	B1 Must be 2 d.p. B1 Must be 2 d.p.	2

		Key Steps	Mark allocation / Remarks		
9	(i)	$\angle CED = 90°$	B1		
	(ii)	$\angle ABC = 60° + 45° = 105°$	B1		
	(iii)	Area of $\Delta CDE = (12 \times 12) \div 4 = 36\ cm^2$	B1		**3**
10		19:15 + 6:30 = 25:45 20 Aug 01 45 Accept 01:45 Reject 1:45	B1 B1 B1	25:45 soi Correct Date Correct Time	**3**
11		$\left(\frac{180}{15}\right)^3 \times 20$ g = 34.6 kg	B1 B1 B1	(ratio)^3 seen accept $\left(\frac{1.8}{15}\right)^3$ × 20 seen Ans (one d.p.)	**3**
12	(a)	$P = k h^2$ $3 = k(20)^2$ $k = \frac{3}{400}$ $\therefore P = \frac{3}{400} \times 30^2 = \$6.75$	M1 A1		
	(b)	$R = k\left(\frac{1}{T}\right)^2$ or $k\frac{1}{T^2}$ $T \to 2T$; $R \to k\left(\frac{1}{2T}\right)^2$ $\to \frac{1}{4} \times k\left(\frac{1}{T}\right)^2$ Hence, percentage change = –75%	B1 B1 B1	reciprocal square seen or implied $\frac{1}{4}$ seen accept "decrease by 25%"	**5**
13	(a)	$4(x-y)^2 - 9(x+y)^2$ $= [2(x-y)]^2 - [3(x+y)]^2$ $= [2x-2y]^2 - [3x+3y]^2$ $= [2x-2y+3x+3y][2x-2y-3x-3y]$ $= [5x+y][-x-5y]$ $= -[5x+y][x+5y]$	B1 B1	Use of diff of 2 sq seen –ve also factorised	
	(b)	$10ax + 15ay - 8bx - 12by$ $= 5a(2x+3y) - 4b(2x+3y)$ $= (5a-4b)(2x+3y)$	B1 B1	Use of grouping seen	**4**
14		One angle in icosagon $= \frac{18 \times 180°}{20} = 162°$ One angle in polygon B $= 360° - 162° - 90° = 108°$ Let $(n-2)180° = 108n$ $n = 5$ B is a pentagon	 M1 M1 A1 A1	Finding angle in icosagon Finding angle in polygon B Sides in polygon B, soi	**4**

		Key Steps	Mark allocation / Remarks		
15	(i)	$x_1 + x_2 + x_3 + \ldots + x_{10} = 11.8 \times 10$ $= 118$	B1		
	(ii)	$\sqrt{\frac{x_1^2 + \ldots + x_{10}^2}{10} - 11.8^2} = 4.729$	B1	Correct subs into formula	
		$\rightarrow x_1^2 + \ldots + x_{10}^2 = 1616$	B1		
	(iii)	Each value would differ more from the mean. Hence, the standard deviation will increase.	B1 B1	Correct reasoning only if reason is correct	5
16	(i)	arc $AB = 30 \times \frac{\pi}{6}$ $= 5\pi$ or 15.71	B1	accept either (min 3 s.f.)	
	(ii)	Perimeter $= (4 \times 5\pi) + \left(4 \times 5 \times \frac{\pi}{3}\right) + 8 \times 25$ $= 283.76$ cm	B1 B1 B1	$\frac{\pi}{3}$ seen Expression for perimeter min 3 s.f. (rej if in terms of π)	4
17	(i)	$(x+3)^2 + 1$	B1		
	(ii)	$y = x^2 + 6x + c$ $x^2 + 6x = y - c$ $x^2 + 6x + 3^2 = y - c + 3^2$ $(x+3)^2 = y - c + 9$ $x + 3 = \pm\sqrt{y - c + 9}$ $x = \pm\sqrt{y - c + 9} - 3$	B1 B1 B1	Use of completing square method seen $\pm$ seen	4
18	(i)	median = 33.5	B1		
	(ii)	LQ = 22, UQ = 42 Interquartile range = 20	B1 B1	At least LQ or UQ seen or implied	
	(iii)	Expand Branch A because Branch A has a more consistent flow of customers. or Expand Branch A because Branch A has more customers. or Expand Branch A because Branch A has consistently more customers.	B1	Branch A, with any logical supporting reason based on the central measure or dispersion measure.	4
19	(i)	$AB + BC = \sqrt{7^2 + 3^2} + \sqrt{5^2 + 2^2}$ $= 13.0009$ $= 13.0$	B1 B1 AG	Use of PT or distance formula Min of 4 sf **must** be seen	
	(ii)	$AC = \sqrt{12^2 + 5^2} = 13$ Sum angle of $ABCD = 360°$ because $ABCD$ is a 4-sided figure. OR Sum angle of $ABCD = 360°$ because ABC is not a straight line.	B1 B1 B1 Accept $AC \neq AB + BC$ Accept A, B and C are not collinear.	Use of PT or distance formula correct angle correct reason	
20	(i)	$3^4 \times 11^2$	B1		
	(ii)	All powers are even.	B1	o.e.	
	(iii)	$a = 11, b = 3$	B2		4

		Key Steps	Mark allocation / Remarks		
21	(i)	$y = \frac{3}{4}x + 12$	B1	equation s.o.i.	
		$3x - 4y + 48 = 0$	B1	General form	
	(ii)	$= \dfrac{3\times 8 + (-4)2 + 48}{\sqrt{3^2 + (-4)^2}}$	B1	Subs into given formula seen	
		radius $= 12.8$	B1		4
22	(i)	$\dfrac{XY}{\sin 53°} = \dfrac{60}{\sin 77°}$	B1	Sine Rule with subs	
		$XY = 49.18$ m	B1		
	(ii)	332°	B1	Any method	
	(iii)				
		Minimum bearing = 281° to 283°	B1	Bearing stated.	4
23	(i)	(7, 6)	B1		
	(ii)	Gradient $PM = \dfrac{5}{6}$	B1	reject 0.833 or $0.8\dot{3}$	
	(iii)	$\tan QPR = \dfrac{10}{4} = \dfrac{5}{2}$, $\angle QPR = 68.2°$	B1	Finding $\angle QPR$ or $\angle MPR$	
		$\tan MPR = \dfrac{5}{6}$, $\angle MPR = 39.8°$			
		$\angle QPR \neq 2 \times \angle MPR$	B1	Conclusion	
		Hence statement is wrong.			4
		Other possible approaches:			
		Showing that $PQ \neq PR$ and stating that ΔPQR is not isosceles.	B1		
		Hence statement is wrong.	B1		
		Showing that PM and QM are not perpendicular and stating that ΔPQR is not isosceles.	B1		
		Hence statement is wrong.	B1		

		Key Steps	Mark allocation / Remarks		
24	(a)	$x = 1.5$	B1		
	(b)	Correct line seen within the domain $-1 \le x \le 5$  	B1 B1		
	(c)	$x^2 - 3x - \frac{7}{4} = \frac{7}{4}x - 4$ $4x^2 - 12x - 7 = 7x - 16$ $4x^2 - 19x + 9 = 0$ $x = 0.5$ to 0.55, 4.2 to 4.25	B1 B2	Form equation	**6**
		or $4x^2 - 19x + 9 = 0$ $4x^2 - 12x - 7 = 7x - 16$ $x^2 - 3x - \frac{7}{4} = \frac{7}{4}x - 4$ $x = 0.5$ to 0.55, 4.2 to 4.25	B1 B2	Rearrange to the equations of the two graphs	