L-Università ta' Malta

MATSEC
Examinations Board

Marking Scheme

SEC Mathematics

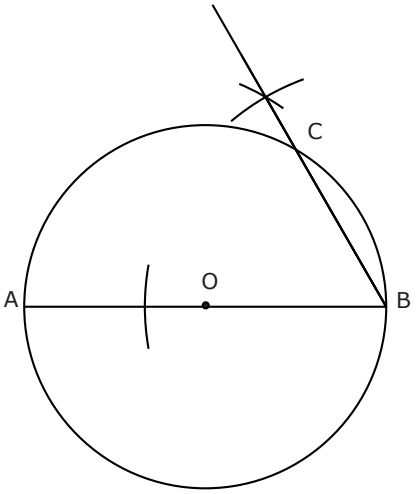
Main Session 2025

Marking schemes published by the MATSEC Examination Board are not intended to be standalone documents. They are an essential resource for markers who are subsequently monitored through a verification process to ensure consistent and accurate application of the marking scheme.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board when in doubt.

PAPER I

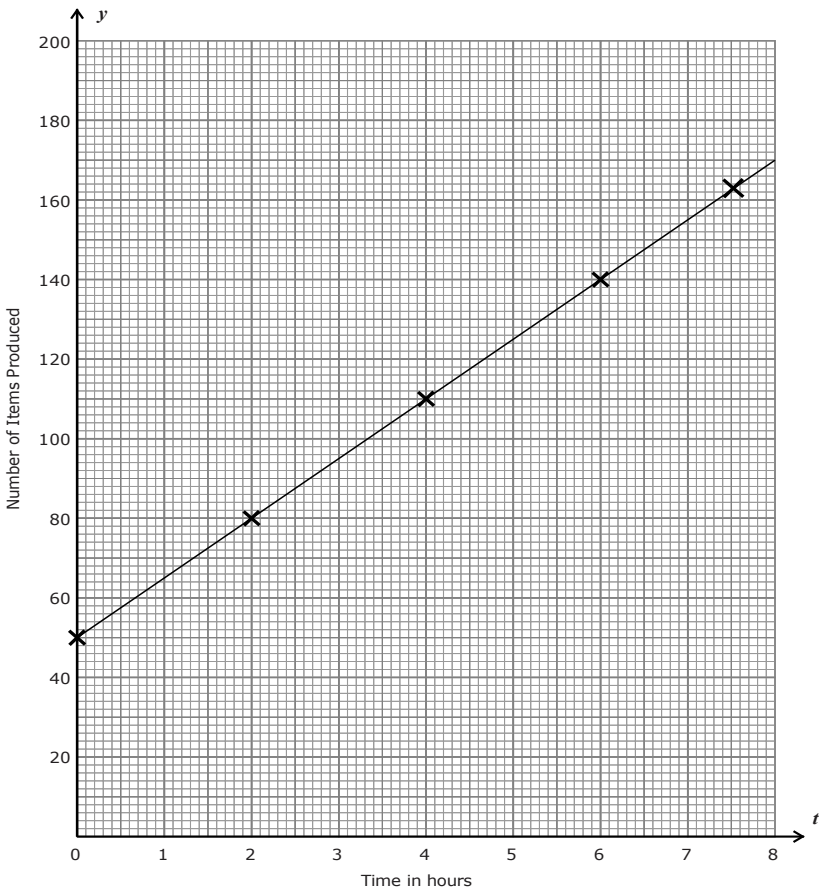
[Level 1-2-3]

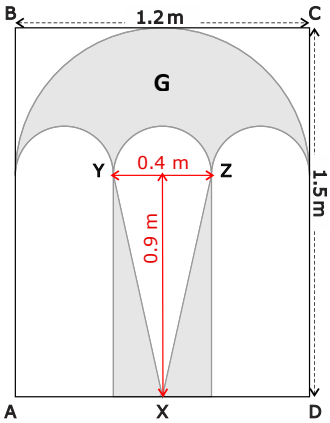
Question			Solution	Further Criteria	Marks	
1	a		(i) $\frac{5}{2} = 2\frac{1}{2}$ (ii) $3\frac{1}{4} < 3.40$ (iii) $\frac{3}{4} > \frac{1}{2}$		B1 B1 B1	6
	b		Any number between 5.67 and 5.68		B1	
	c		275% = $\frac{275}{100} = \frac{11}{4}$ OR $\frac{275}{25}$ = 11, so 275% = $\frac{11}{4}$	275% = $\frac{275}{100}$ OR $\frac{275}{25}$ = 11 Accept 11 and 11 quarters and $\frac{11}{4}$ Do not accept 2.75 Accept trial and error	M1 A1 fm nw	
Total:						
2	a	i		draws circle radius 3 cm± 0.1 ignore labelling Draws diameter… ignore labelling	M1 M1	11
		ii	Labels diameter AB Draws an angle of 60°± 1 at B Used construction arcs appropriately		M1 M1 M1	
	b		Line OB in the circle is called a …radius… Line AB is …double… the length of line OB.		B1 B1	

	c		<table><tr><th>Statement</th><th>Always True</th><th>Always False</th><th>Sometimes true/ sometimes false</th></tr><tr><td>An isosceles triangle has 2 equal sides and 2 equal angles.</td><td>✓</td><td></td><td></td></tr><tr><td>A right-angled triangle is an equilateral triangle.</td><td></td><td>✓</td><td></td></tr><tr><td>An isosceles triangle is scalene.</td><td></td><td>✓</td><td></td></tr><tr><td>A right-angled triangle is isosceles.</td><td></td><td></td><td>✓</td></tr></table> One mark for each tick in the correct position		B4	
Total:						
3	a		$-3.13, \quad -0.00313, \quad 0.313, \quad 3.13\,, \quad 31.3$ Award A1 if ans is given in descending order and otherwise correct Award A1 for 3 values in the correct order.		A2	4
	b		−10°C + 22°C = 12°C fmnw		M1 A1	
Total:						**4**
4	a		$1\,^{3}/_{4} + 2\,^{4}/_{5} = {}^{91}/_{20} = 4\,^{11}/_{20}$	converts fractions properly or converts fractions to decimals Adds fractions properly / decimals… $4\,^{11}/_{20}$	M1 M1 A1	6
	b			4.55	M1	
	c		$4\,^{11}/_{20} - 3\,^{1}/_{5} = 1\,^{7}/_{20}$ m OR 4.55 – 3.2 = 1.35 m	Subtracts fractions appropriately $1\,^{7}/_{20}$ Ft not awarded when ans a) <3.2 OR $3\,^{1}/_{5} = 3.2$ 1.35	M1 A1ft OR M1 A1ft fmnw	
Total:						**6**
5	a		Angle PQR = (180 – 40) / 2 = 140/2 = 70° (angles in an isosceles	70° explanation	B1 M1	6
	b		Angle QTR = 40° (angles in the same segment)	40° explanation	B1 M1	
	c		Angle TQR = 70 / 2 = 35° (angle PQR bisected) Angle QRT = 180 – (40 + 35) = 180 – 75 = 105° (angles in a triangle)	105° Explains that angle QRT = 35°	B1 M1	
Total:						**6**

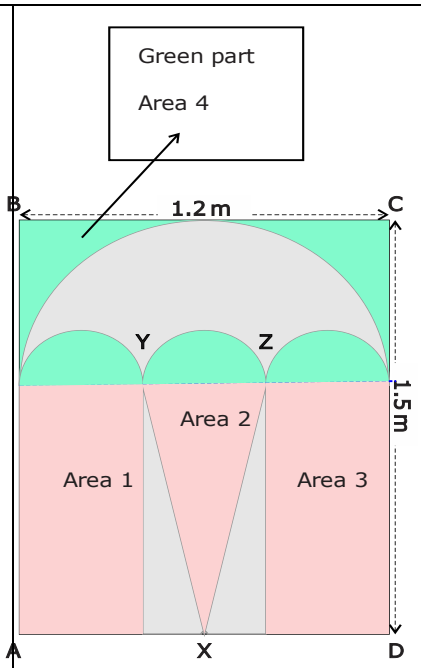
6	a		An enlargement with scale factor 2, centre of enlargement (0, 2)	Enlargement Scale factor 2 or by 2 Centre (0, 2) Accept if construction lines shown but centre point described inaccurately	A1 M1 A1	
	b		A translation by a vector of $\begin{pmatrix}-4\\-2\end{pmatrix}$	Translation Vector of $\begin{pmatrix}-4\\-2\end{pmatrix}$. Accept also $(-4,-2)$	A1 A1	
	c			(i) right-angled (ii) similar	B1 B1	
	d		Area of Area of ΔABC = $\frac{1\times 4}{2}$ = 2cm^2 Area of ΔA'B'C' = $\frac{2\times 8}{2}$ = 8cm^2 the area of ΔA'B'C' is four times that of ΔABC since 2cm^2 x 4 = 8cm^2 OR Since ΔA'B'C' is an enlargement of ΔABC by 2 its area is enlarged by 2^2, i.e. by 4.	Works out the area of ΔABC or Δ A'B'C' correctly Explains why the area of ΔA'B'C' is four times that of ΔABC. Accept area in small squares, large square or measuring from graph Candidates who worked out area of the triangles as L x B and arrived at the factor 4 times get M1 overall. Candidates who measured the sides of the triangle, obtaining a factor close to 4, get M2, A0	A1 M2	10
Total:						
7	a		24 volunteers involved in ticket sales No of volunteers: 80 + 24 + 38 +10 = 152 P (vol is involved in ticket sales) = $\frac{24}{152}$ or $\frac{3}{19}$	152 24 $\frac{24}{152}$ or $\frac{3}{19}$	B1 B1 B1	
	b		% involved in event promotion = $\frac{38}{152}\times 100 = 25\%$	Fraction involved =$\frac{38}{152}$ 25%	M1 A1ft	

	c		Volunteers in event organization = 80 Fraction of these aged 15- 30 = $\frac{135}{360}$ $\frac{135}{360} \times 80 = 30$ 30 vol in event organisation 15-30 yr old	80 $\frac{135}{360}$ 30	M1 M1 A1	
	d		Total age = 41 x 10 = 410 Age of twins = 410 – (28+39+41+65+48+55+29+53) = 52 Age of one twin = 52 / 2 = 26 OR $\frac{28+39+41+65+48+55+29+53+2x}{10}$ = 41 28+39+41+65+48+55+29+53 +2*x* = 410 2*x* = 410 – (28+39+41+65+48+55+29+53) = 52 *x* = 26	Total age of group = 410 total of the other volunteers is 358 Subtracts age of eight other volunteers OR rearranges equation26	M1 M1 M1 A1	
Total:						
8	a		1500/80 = 18.75 days	18.75 days, accept also 18 18 only (fmnw)	M1, A1	5
	b		90 x 80 = 7200 7200/1500 = 4.8 boxes She needs 5 boxes	90 x 80 7200/1500 5 boxes Award 2 marks only (M2) for 90/18 = 5	M1 M1 A1	
Total:						
9	a			$30xy^3 - 12x^2y^2 = 6xy^2(5y - 2x)$ Award one mark for correct partial factorisation, e.g. $xy^2(30y - 12x)$	A2	12
	b		$5x(2x-4) + 3x(x-3) =$ $10x^2 - 20x + 3x^2 - 9x =$ $13x^2 - 29x$	Opens a pair of brackets correctly Opens both pairs correctly $13x^2 - 29x$	M1 M1 A1	

	c			$b = \sqrt{\frac{a+2}{3}}$, So $b^2 = \frac{a+2}{3}$ $a + 2 = 3b^2$ $a = 3b^2 - 2$	M1 M1 A1	
	d		$3y - 5x = -4 \cdots (1)$ $2y + x = 2 \cdots (2)$ $(1) + (2) \times 5 \Rightarrow 13y = 6 \Rightarrow y = \frac{6}{13}$ $\therefore x = 2 - 2y = 2 - 2\left(\frac{6}{13}\right) = \frac{14}{13}$	Eliminates one unknown Derives that $x = \frac{14}{13}$ or $y = \frac{6}{13}$ Correct method to find other unknown Correct values for both x and y Accept ans in decimals to 2 dp or more accurate (y =0.4615, x=1.0769)	M1 A1 M1 A1	
Total:						
10	a		Area of rectangle 42 Area of triangle 6 For area by counting: Award M2 A1 if area is 48m^2, award M1M1A0 if area is 46-50 Area of field is 48 m^2… do not award mark if unit of area is not included		M1 M1 A1	5
	b		Perimeter of wall is 6+6+7+6 Perimeter is 25m…do not award mark if unit of length is not included		M1 A1 fmnw	
Total:						**5**
11						10

	a		$y = 15t + 50$ Award M1 for $y = 15t$ Award M1, A1 for fully correct answer	M1 A1	
	b		<table><tr><td>t</td><td>0</td><td>2</td><td>4</td><td>6</td><td>8</td></tr><tr><td>y</td><td>50</td><td>**80**</td><td>110</td><td>**140**</td><td>170</td></tr></table> Values 80 and 140 correct Correct plotting of 2 points or more Fully correct graph…do not accept freehand drawn graph	A2 M1 A1	
	c		(i) 125 ± 1 figolli (ii) 7 hours	A1 A1	
	d		This bakery starts with fewer tarts (30 compared to 50) So, its graph begins lower. Or intercept for 2nd bakery is 30 as compared to 50 Its production rate is faster (20 tarts per hour versus 15), So, its graph is steeper…. Or gradient for 2nd bakery is 20 as compared to 15. Accept $y = 20t + 30$… award M2 in this case	M1 M1	
Total:					
12	a		Volume = length x breadth x height = 1.2m x 1.5m x 0.08m = 0.144m^3	Uses V = length x breadth x height Uses the same units of length for the height, breadth and length 0.144	M1 M1 A1	13
	b			Triangle base is 0.2 m OR Triangle height is 0.9 m Area of Δ = $bh/2$ = 0.2 x 0.9/2 = 0.09m^2 Area of two triangles = 0.18 or Volume of one triangular prism = 0.09 x 0.08 = 0.0072m^3 V of two triangular prisms = 0.0144m^3	M1 M1 M1 A1	

12c Method 1	c		Area grey part marked **G** in diagram above: Area of large semicircle – 3 x Area of small semicircles $= \frac{\pi \times 0.6^2}{2} - \frac{3 \times \pi \times 0.2^2}{2}$ Area of large semicircle = $\frac{\pi \times 0.6^2}{2}$ = 0.5655m^2 Area Small semicircle = $\frac{\pi \times 0.2^2}{2}$ = 0.06283m^2 Area of 3 small semicircles = 0.06284 x 3 = 0.18852m^2 Tot area of G = 0.5655- 0.18852 = 0.37698m^2 Vol of grey part marked **G** is 0.37698 x 0.08 = 0.0301m^3 Vol of white concrete = Vol found in part (a) – vol found in part (b) – vol part **G** = 0.144 – 0.0144- 0.0301 = 0.0995 m^3	LARGE SEMICIRCLE: Volume = $\frac{\pi \times 0.6^2}{2} \times 0.08$ or Area = $\frac{\pi \times 0.6^2}{2}$	M1	
				SMALL SEMICIRCLE: Vol = $\frac{\pi \times 0.2^2}{2} \times 0.08$ or Area = $\frac{\pi \times 0.2^2}{2}$	M1	
				VOL/AREA OF G: Vol/Area large semicircle MINUS 3 x vol/area small semicircles	M1	
				VOL OF G: 0.03m^3 or more accurate	A1	
				VOL OF WHITE CONCRETE: Ans (a) – Ans(b) –vol **G** 0.1 m^3 or more accurate	M1 A1	

12c Method 2			Area of white concrete: Area 1+Area 2 + Area 3 + Area 4 Area 1 and Area 3: $0.4 \times 0.9 + 0.4 \times 0.9 = 0.72$ Vol = 0.0576 Area 2: $\frac{1}{2} \times 0.4 \times 0.9 = 0.18$ Vol = 0.0144 Area 4: $1.2 \times 0.6 - \frac{\pi(0.6)^2}{2} + 3\frac{\pi(0.2)^2}{2}$ $= 0.72 - 0.5655 + 3 \times 0.06283$ $= 0.72 - 0.5655 + 0.18849$ = 0.34302 Vol = 0.0274416 Area of white concrete: Area 1 + Area 2 + Area 3 + Area 4 = 1.243 Vol of white concrete = $1.243 \times 0.08 = 0.0994\ m^3$ Method marks – award for use of correct formulae with correct values… numerical answers have been written to help sort out working Award method marks for one rect, one small semicircle	 Area/vol of 1 or 2 rectangular parts: A/V of two: 0.72/0.0576 Area/ vol of large semicircle 0.5655/0.0453 Area/ vol of small semicircle 0.06283/0.0050264 Area/vol of white triangle 0.0144/0.001152 Area $= 1.2 \times 0.6 - \frac{\pi(0.6)^2}{2} + 3\frac{\pi(0.2)^2}{2}$ OR vol $= 0.08(1.2 \times 0.6 - \frac{\pi(0.6)^2}{2} + 3\frac{\pi(0.2)^2}{2})$ 0.34302/0.0274416 Vol of white concrete= 0.1 or more accurate	M1 M1 M1 M1 M1 A1	

12c Method 3			Area of large semicircle = $\frac{\pi \times 0.6^2}{2}$ = 0.5655m^2 Area Small semicircle = $\frac{\pi \times 0.2^2}{2}$ = 0.06283m^2 Area of 3 small semicircles = 0.06284 x 3 = 0.18852m^2 Vol of white concrete = 1.2 x 1.5 x 0.08 – vol of large semicircle + 3xvol of semicircle – vol of two grey Δ^s =0.144- 0.0453 + 0.01508-0.0144 = 0.09938 OR 0.08 x (1.8 – 0.566 + 3 x 0.063 -0.18) =0.0994	LARGE SEMICIRCLE: Volume =$\frac{\pi \times 0.6^2}{2} \times 0.08$ or Area = $\frac{\pi \times 0.6^2}{2}$	M1	
				SMALL SEMICIRCLE: Vol = $\frac{\pi \times 0.2^2}{2} \times 0.08$ or Area = $\frac{\pi \times 0.2^2}{2}$	M1	
				Vol of white concrete = 1.2 x 1.5 x 0.08 – vol of large semicircle + 3xvol of semicircle – vol of two grey Δ^s Award M2 for: vol of large semicircle - 3xvol of semicircle – vol of two grey Δ^s	M3	
				Vol of white concrete = 0.1 or more accurate	A1	
Total:						**13**

PAPER II

[Level 1-2]

<table>
<tr><th colspan="3">Question</th><th>Solution</th><th>Further Criteria</th><th>Marks</th><th></th></tr>
<tr><td rowspan="2">1</td><td>a</td><td></td><td>(i) Mean = $(6+1+4+3+12+4+3+3+2)/9$
= $38/9$ = 4.2222 Ans: Accept 4.2 or more accurate
Ignore extra working 4.2 =4… A1 still given here
Accept 38/9 as final ans… A1 still given here
Fmnw… accept 4.2 or more accurate without any working shown
Do not accept 4 as an answer without working shown

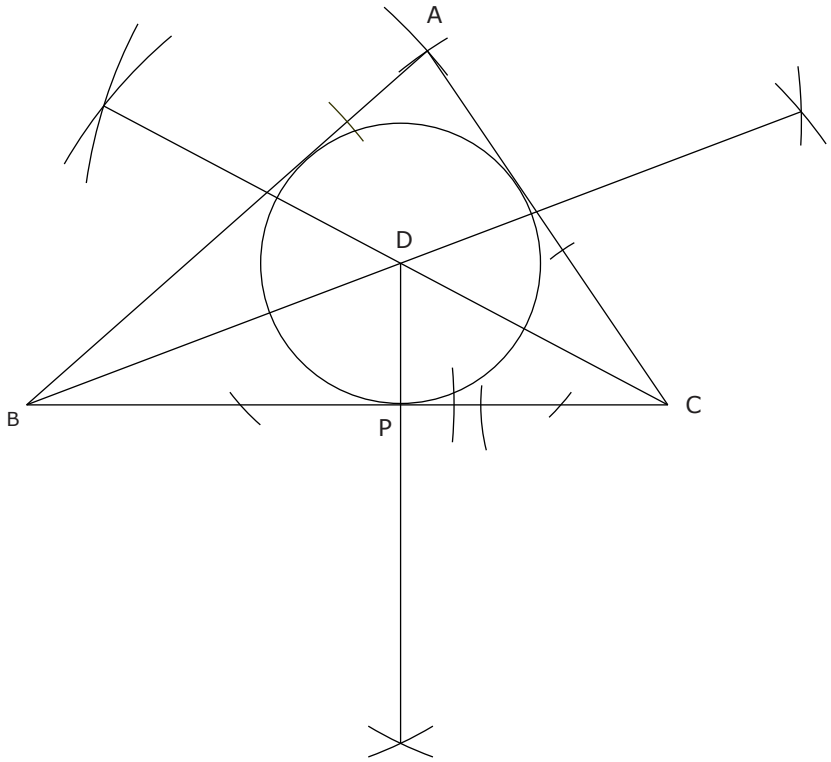
(ii) Median: 1, 2, 3, 3, 3, 4, 4, 6, 12
Middle no is 5th no… i.e 3 Ans3

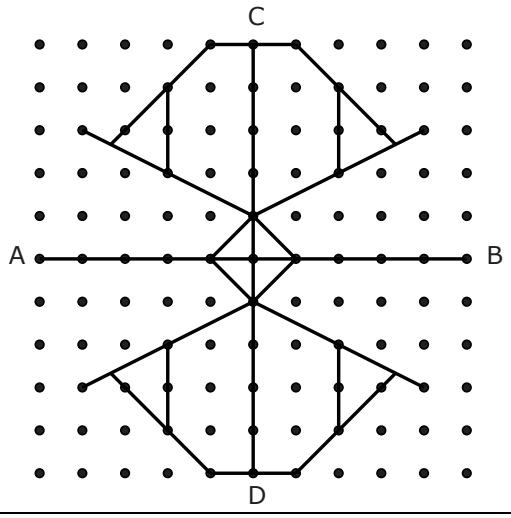
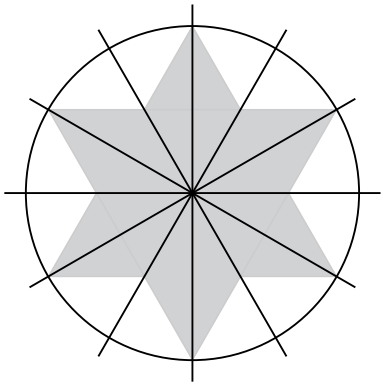
(iii) mode is 3 Ans 3</td><td></td><td>M1
A1

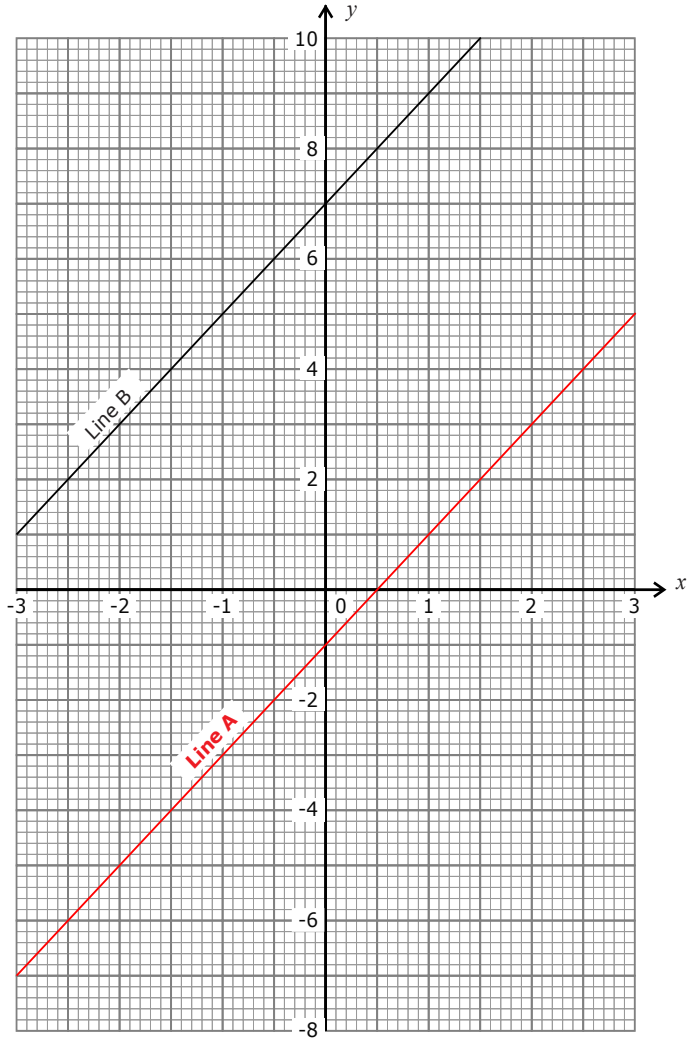
M1
A1

A1</td><td rowspan="2">7</td></tr>
<tr><td>b</td><td></td><td>Mode or median
Mode (or median) is not affected by the outlier</td><td>Either mode or median is correct</td><td>B1
M1</td></tr>
<tr><td colspan="5">Total:</td><td>7</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td colspan="3"><table><tr><th>Statement</th><th>TRUE</th><th>FALSE</th></tr><tr><td>18 is an odd number</td><td></td><td>✓</td></tr><tr><td>- 3 > - 10</td><td>✓</td><td></td></tr><tr><td>23 is a prime number</td><td>✓</td><td></td></tr><tr><td>51 is a multiple of 3</td><td>✓</td><td></td></tr><tr><td>8 is a factor of 72</td><td>✓</td><td></td></tr><tr><td>22 is a square number</td><td></td><td>✓</td></tr></table></td><td>A6</td><td>6</td></tr>
<tr><td colspan="5">Total:</td><td>6</td><td></td></tr>
<tr><td rowspan="3">3</td><td>a</td><td></td><td>$\frac{12}{28}$, $\frac{3}{7}$</td><td>2 marks for 2 correct values
1 mark for one correct value
No negative marking for incorrect values</td><td>B2</td><td rowspan="3">5</td></tr>
<tr><td>b</td><td></td><td>$\frac{3}{10}$</td><td></td><td>B1</td></tr>
<tr><td>c</td><td></td><td>4 triangles
Shades 4 triangles</td><td></td><td>B1
B1</td></tr>
<tr><td colspan="5">Total:</td><td>5</td><td></td></tr>
<tr><td rowspan="4">4</td><td rowspan="2">a</td><td rowspan="2"></td><td colspan="2">(i) a right
(ii) a radius
(iii) perpendicular</td><td>B1
B1
B1</td><td rowspan="3">7</td></tr>
<tr><td rowspan="2">b</td><td>i</td><td colspan="2">99°; angles at a point add up to 360° or shows working</td><td>M1A1</td></tr>
<tr><td>ii</td><td colspan="2">63° (angles in a triangle add up to 180°) or shows working</td><td>M1A1</td></tr>
<tr><td colspan="5">Total:</td><td>7</td><td></td></tr>
</table>

5	a			20% accept 20	B1	8
	b		20% ~ 40 bottles and 15% ~ 30 bottles. 200 – (40 + 30) = 130 bottles left	20% ~ 40 bottles 15% ~ 30 bottles 130 bottles left (fmnw)	M1 M1 A1	
	c			$20 \div 3.25 = 6.153$ 6 bottles can be bought	M1 A1	
	d		$\frac{1}{6}$ x 3000g = 500g	Uses $\frac{1}{6}$ of 3kg or 3000g 500 or 500g	M1 A1	
Total:						**8**
6			$\frac{7800\times2\times5}{100}$ = €780	Correct use of formula or uses suitable correct method 780 Award M1 for working out 2% interest on 7800 appropriately	M2 A1	3
Total:						**3**
7	a			(i) 2.55 (ii) any number between 2.5 and 2.6	B1 B1	5
	b		$0.315, \frac{1}{2}, \frac{3}{5}, \frac{3}{4}, 0.78$ Award 2 marks if answer given in descending order Award 2 marks if there is just one value displaced, e.g. $0.315, \frac{1}{2}, \frac{3}{4}, \frac{3}{5}, 0.78$ Award zero marks otherwise		B3	
Total:						**5**
8	a			$3 + 4 \times (8 - 2) = 27$	B1	3
	b		$\frac{3}{2} \times \frac{16}{3} = 8$	$\frac{3}{2} \times \frac{16}{3}$ 8	M1 A1	
Total:						**3**
9	a		9:30+ 1:40 0:55 12:05	12:05 Award 2 marks for 9:30+1:40 =11:10	3 fmnw	9
	b		12:05 + 1:25 13:30	13:30 Award 1 mark when candidate adds all the values (9:30, 1:40, 0:55, 1:25) but gets an incorrect answer	2 fmnw	

	c		6x2 = 12 cm^2, 10x2= 20 cm^2, 6x2 = 12 cm^2. Total area 44cm^2	Works out area by adding the areas of suitable rectangles Uses length x breadth to find areas of rectangles Uses the diagram appropriately to find unknown sides of rectangles 44	M1 M1 M1 A1	
Total:					**9**	
10						
	a		Triangle ABC constructed accurately with correct lengths allowing 2mm error All construction arcs clearly shown		M1 M1	11
	b		Bisector of angle ABC constructed accurately allowing 2° error Construction arcs for bisector of angle ABC clearly shown Bisector of angle ACB constructed accurately allowing 2° error Construction arcs for bisector of angle ABC clearly shown Point D accurately located		M1 M1 M1 M1 A1	
	c		(i) Construct perpendicular accurately allowing 2° error Construction arcs for perpendicular clearly shown (ii) Accurate circle allowing 1mm error at vertices.		M1 M2 A1	
Total:					**11**	

11	a		No, he is not right 6 is as likely to get as a 1 OR both events have a chance of $\frac{1}{6}$	B1 M1	
	b		(i) Dice Cards (A, 1) (A, 2) (A, 3) (A, 4) (A, 5) (A, 6) (B, 1) (B, 2) (B, 3) (B, 4) (B, 5) (B, 6) (C, 1) (C, 2) (C, 3) (C, 4) (C, 5) (C, 6) (D, 1) (D, 2) (D, 3) (D, 4) (D, 5) (D, 6) (ii) P (C, 5) = 1/24 (iii) P (A, odd) = 3/24 = 1/8___ M1 each for denominator & numerator	B3 B1 M2	8
Total:				**8**	
12	a		N → E → NW → SE One mark for each step	B3 fmnw	
	b		one mark for each quadrant completed correctly  	B3	8
	c		award 2 marks for 6 correct lines award 1 mark for 3 to 5 correct lines 	B2	
Total:				**8**	

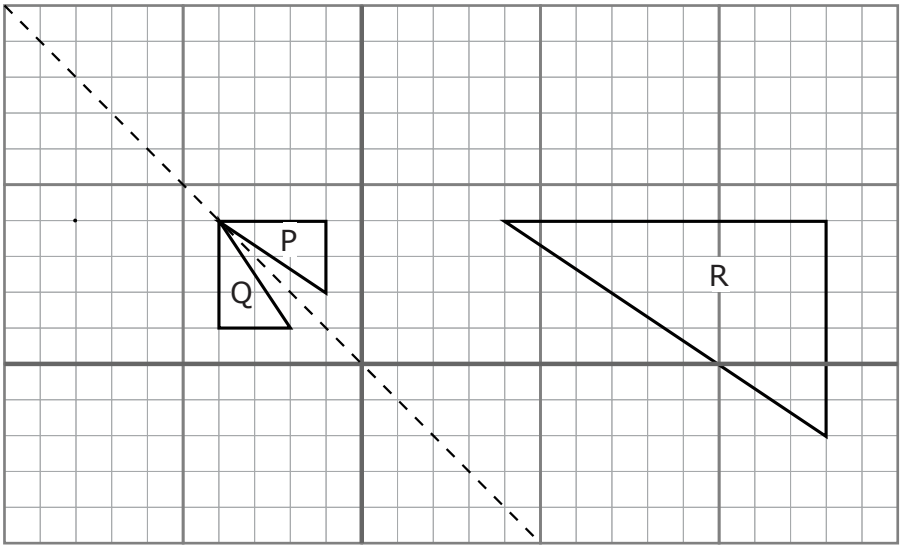
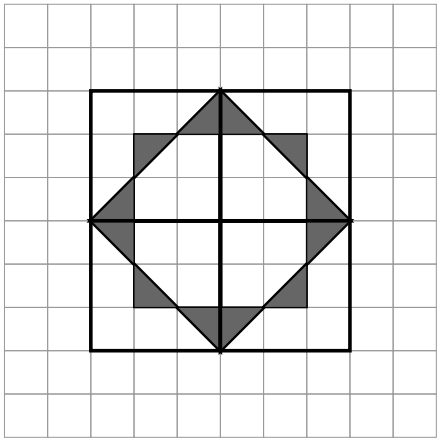
<table>
<tr><td rowspan="3">13</td><td>a</td><td></td><td>
<table>
<tr><td>x</td><td>−3</td><td>−2</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y</td><td>−7</td><td>−5</td><td>−3</td><td>−1</td><td>1</td><td>3</td><td>5</td></tr>
</table>
One mark for 2 or 3 correct values
Two marks for 4 correct values
</td><td>B2</td><td rowspan="5">10</td></tr>
<tr><td>b</td><td></td><td> 
</td><td>B2</td></tr>
<tr><td></td><td>Plot of line A,</td><td>Correct line
Award one mark if candidate:
plots a correct given point on line A
OR
Finds a correct intercept for line A</td></tr>
<tr><td>c</td><td></td><td></td><td>Intercept 7
Gradient 2
Line B has eqt $y = 2x + 7$</td><td>B1
B1
B1</td></tr>
<tr><td>d</td><td></td><td></td><td>line A: when x=26, y=2(26)-1=51
line B: when x=26, y=2(26)+7=59
∴ the point (26, 59) lies on Line B</td><td>B1
B1
B1</td></tr>
<tr><td colspan="5">Total:</td><td>10</td></tr>
</table>

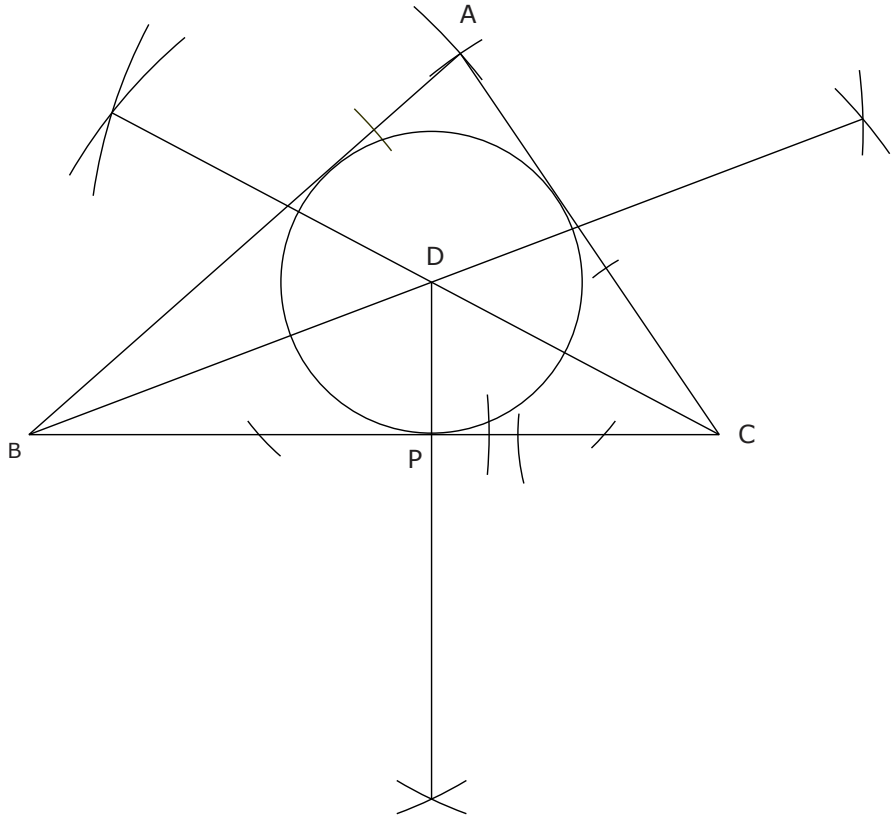
14	a			$4x$, accept $x + x + x + x$	B1	
	b		$(3x - 5 + 2x + 1)2$ $(5x - 4)2$ $10x - 8$	Considers perim as sum of four sides Adds algebraically four sides correctly $10x - 8$	M1 M1 A1	
	c			$2(4x) = 10x - 8$ $8x = 10x - 8$ $8 = 2x$ $x = 4$ Trial and error not allowed here	M1 M1 A1	10
	d			Length = $3(4) - 5$ Width = $2(4) + 1$ Area of B = 63 cm^2	M1 M1 A1ft	
Total:					**10**	

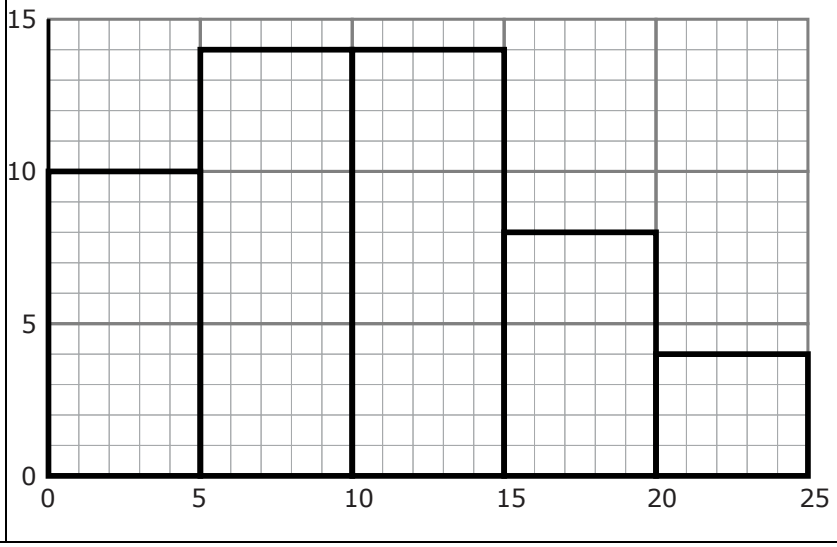
PAPER II

[Level 2-3]

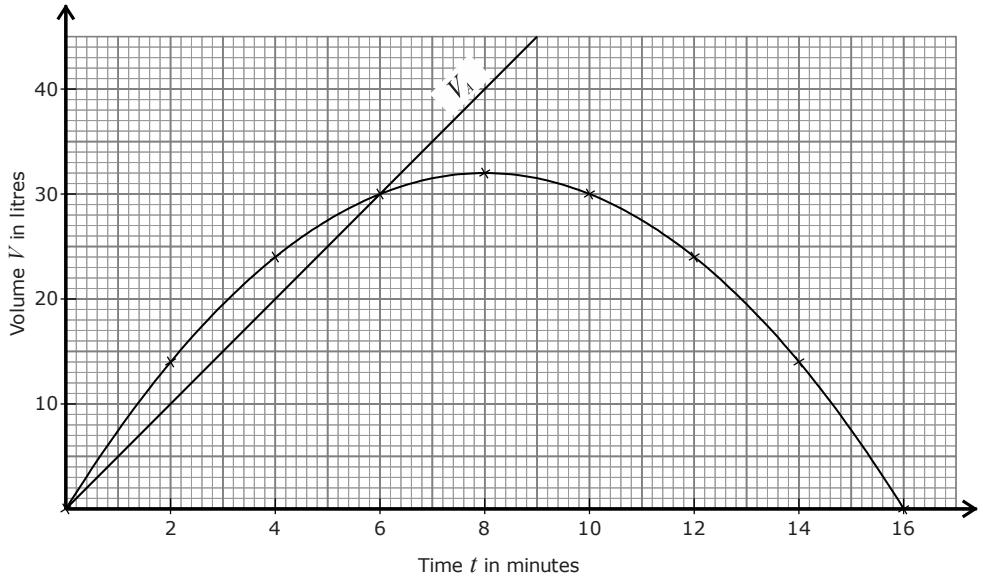
Question			Solution	Further Criteria	Marks	
1	a		(i) Mean = $(6+1+4+3+12+4+3+3+2)/9$ = $38/9$ = 4.2222 Ans: Accept 4.2 or more accurate Ignore extra working 4.2 = 4… A1 still given here Accept 38/9 as final ans… A1 still given here Fmnw… accept 4.2 or more accurate without any working shown Do not accept 4 as an answer without working shown (ii) Median: 1, 2, 3, 3, 3, 4, 4, 6, 12 Middle no is 5th no… i.e 3 Ans 3 (iii) mode is 3 Ans 3		M1 A1 M1 A1 A1	7
	b		Mode or median Mode (or median) is not affected by the outlier	Either mode or median is correct	M1 M1	
Total:						**7**
2	a			20%, accept 20	B1	8
	b		20% ~ 40 bottles and 15% ~ 30 bottles. 200 – (40 + 30) = 130 bottles left	20% ~ 40 bottles 15% ~ 30 bottles 130 bottles left	M1 M1 A1	
	c			$20 \div 3.25 = 6.153$ 6 bottles can be bought	M1 A1	
	d		$1/6$ x 3000g = 500g	Uses $1/6$ of 3kg or 3000g 500 or 500g	M1 A1	
Total:						**8**
3			<table><tr><th>Fractions</th><th>Decimals</th><th>Percentages</th></tr><tr><td>$3/5$</td><td>0.6</td><td>60%</td></tr><tr><td>$\mathbf{13/20}$</td><td>0.65</td><td>65%</td></tr></table>	One mark for each correct value	B4	4
Total:						**4**

4					
	a	**i**	Line $y = -x$ Correct reflection, possibly in the wrong line, usually y=x, y=0, x=0 Correct image Q	A1 M1 A1	7
		ii	Correct enlargement by 3, possibly about a wrong centre Correct image R	M1 A1	
	b		 Correct construction award B1 when middle cross is missing or partly missing Award zero for order 2. Award B1 when triangles correctly placed but not shaded Award B1 for shading the whole square Award B2 for a correct shape of order 4 … which includes the given ans	B2	
Total:				**7**	
5	a		0.039139 (accept 0.04 or more accurate) 4×10^{-2}	A1 A1	7
	b		(i) $3/2$ (ii) answer is always equal to 1	A1 A1	

	c		450 = $(12500 \times 5 \times R)/100$ R= 0.72%	Forms equation Solves eqt R=0.72 €90 in one yr $\frac{90}{12500} \times 100$ 0.72	M1 A1 A1 **OR** M1 M1 A1	
Total:					**7**	
6						11
	a		Triangle ABC constructed accurately with correct lengths allowing 2mm error All construction arcs clearly shown		M1 M1	
	b		Bisector of angle ABC constructed accurately allowing 2° error Construction arcs for bisector of angle ABC clearly shown Bisector of angle ACB constructed accurately allowing 2° error Construction arcs for bisector of angle ABC clearly shown Point D accurately located		M1 M1 M1 M1 A1	
	c		(i) Construct perpendicular accurately allowing 2° error Construction arcs for perpendicular clearly shown (ii) Accurate circle allowing 1mm error at vertices.		M1 M2 A1	
Total:					**11**	

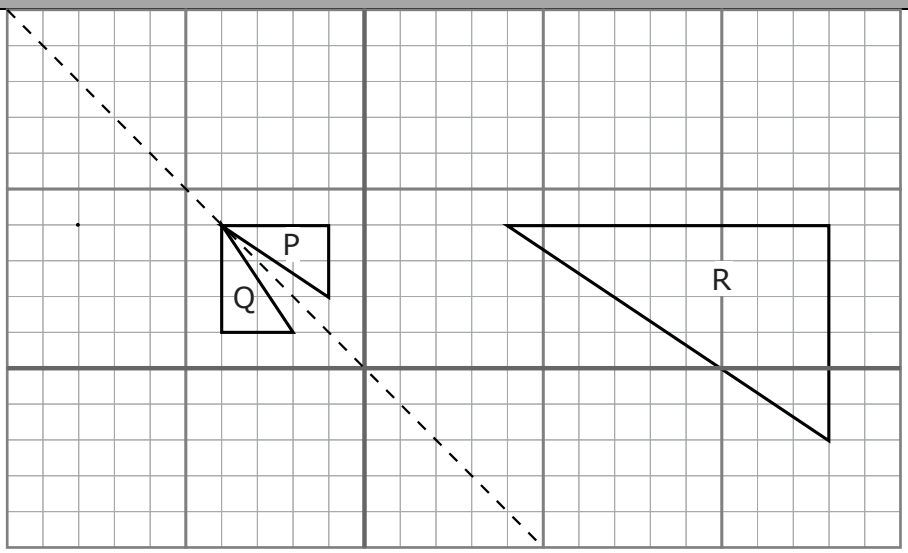
7	a	**i**	angle BOC = 34 x 2 = 68° (angle at centre = 2 x angle at circumference	Angle BOC =68° Valid explanation	B1 M1	9
		ii	angle OCA = 34° (base angles in isosceles triangle – equal radii) angle ACD = 90 – 34 = 56° (radius perpendicular to tangent)	angle ACD = 56° valid explanation	B1 M2	
	b		$C = 2\pi r \qquad 63.8 = 2\pi r$ $AB = 10.154\ldots \times 2 = 20.308$ $sin34 = BC/20.308$ $BC = 20.308\ldots \times sin34 =$ $= 11.4cm(1d.p.)$	$63.8 = 2\pi r$ Diameter = $2r$ $\sin 34 = \text{diameter}/20.308$ BC = 11.4 cm	M1 M1 M1 A1	
Total:					**9**	
8	a			$4x$, accept $x + x + x + x$	B1	10
	b		$(3x - 5 + 2x + 1)2$ $(5x - 4)2$ $10x - 8$	Considers perim as sum of four sides Adds algebraically four sides correctly $10x - 8$	M1 M1 A1	
	c			$2(4x) = 10x - 8$ $8x = 10x - 8$ $8 = 2x\ x = 4$ Trial and error not allowed here	M1 M1 A1	
	d			Length = $3(4) - 5$ Width = $2(4) + 1$ Area of B = 63cm^2	M1 M1 A1ft	
Total:					**10**	
9						9

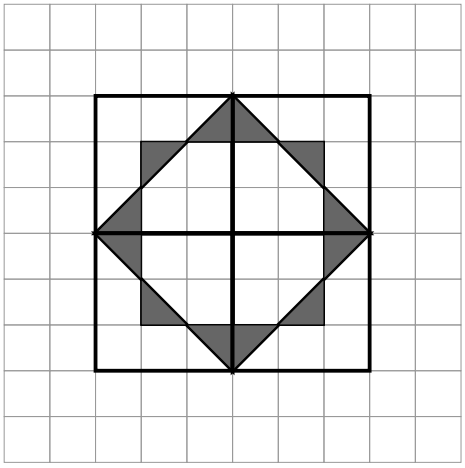
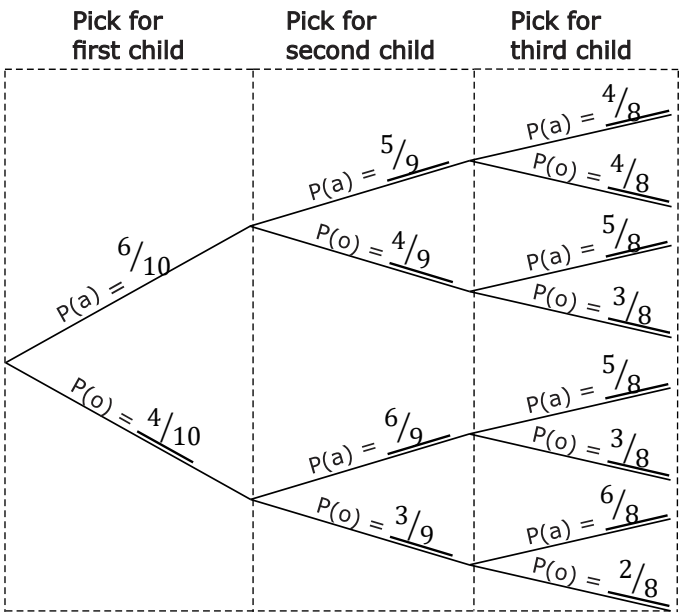
	a		8	B1	
	b		Correct labelling of frequency axis Correct labelling of study-hrs axis, treating it as a continuum Award 1 mark for 1 or 2 correct bars, 2 marks for 3 or 4 or 5 correct βαρσ	M1 M1 M2	
	c		$\frac{12}{50}$ Or $\frac{6}{25}$ Award one mark for correct numerator (12) and one for correct denominator (50)	M2	
	d		Modal group: $10 \leq t < 15$ Award one mark for time between 5 and 10	2	
Total:				**9**	
10	a		<table><tr><th>Pattern number</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>n</th></tr><tr><td>Number of white tiles</td><td>7</td><td>13</td><td>19</td><td>25</td><td>31</td><td>$6n+1$</td></tr><tr><td>Number of grey tiles</td><td>8</td><td>12</td><td>16</td><td>20</td><td>24</td><td>$4n+4$</td></tr></table> Any Two values of 24, 25, 20, 31 in place Other Two values of 24, 25, 20, 31 in place $6n+1$ $4n+4$	B1 B1 B1 B1	
	b		$6n+1=487 \Rightarrow 6n=486 \Rightarrow n=81$ No of grey tiles = 4x81 + 4 = 328	Equates 487 to expression for number of white tiles $n=81$ substitutes value of n in expression for grey tiles 328 grey tiles	M1 A1 M1 A1	10
	c		$4n+4=101 \Rightarrow 4n=97 \Rightarrow n=24.25$ Not possible since n is not an integer Accept explanations like: “not possible because 101 is odd” … award M2		M1 M1	
Total:					**10**	
11	a		15 euro		A1	2
	b		36 students		A1	
Total:					**2**	

12						10
	a		$V_A = 5t$ Accept $y = 5x$ but **not** $x = 5y$		B1	
	b		t: 0, 2, 4, 6, 8, 10, 12, 14, 16 V_B: 0, 14, 24, 30, 32, 30, 24, 14, 0 1 mark for two correct values, rounding up if necessary		B3	
	c		Plotting of graph: subtract one mark for 2 points plotted incorrectly		A3	
	d		when $t = 6$ minutes		B1	
	e		maximum volume of tank B is <u>32 litres</u> when when <u>$t = 8$ minutes</u>		<u>B1</u>,<u>B1</u>	
Total:					**10**	
13	a		In ΔOAP, ∠A = 90°, OA= 9 cm, OP = 15 cm By Pythagoras $15^2 = 9^2 + PA^2$ PA = 12 cm or by Pythagorean triples PQ is 24 cm	Shows two or three properties below: ∠A = 90°, OA= 9 cm, OP = 15 cm Appropriate use of Pythagoras thm Or Pythagorean triples and PA =12 PQ = 24	M1 M1 A1	6
	b		In ΔOBR, ∠B = 90°, RB= 8.5 cm, OR= 15cm By Pythagoras $15^2 = 8.5^2 + OB^2$ $OB^2 = OR^2 – BR^2 = 225 – 72.25 = 152.75$ OB= 12.36 AB = OB -OA = 12.36 – 9 = 3.36 cm	Shows two or three properties below: ∠B = 90°, RB= 8.5 cm, OR= 15cm OB = 12cm or more accurate AB = 3 cm of more accurate	M1 A1 A1	
Total:					**6**	

PAPER II

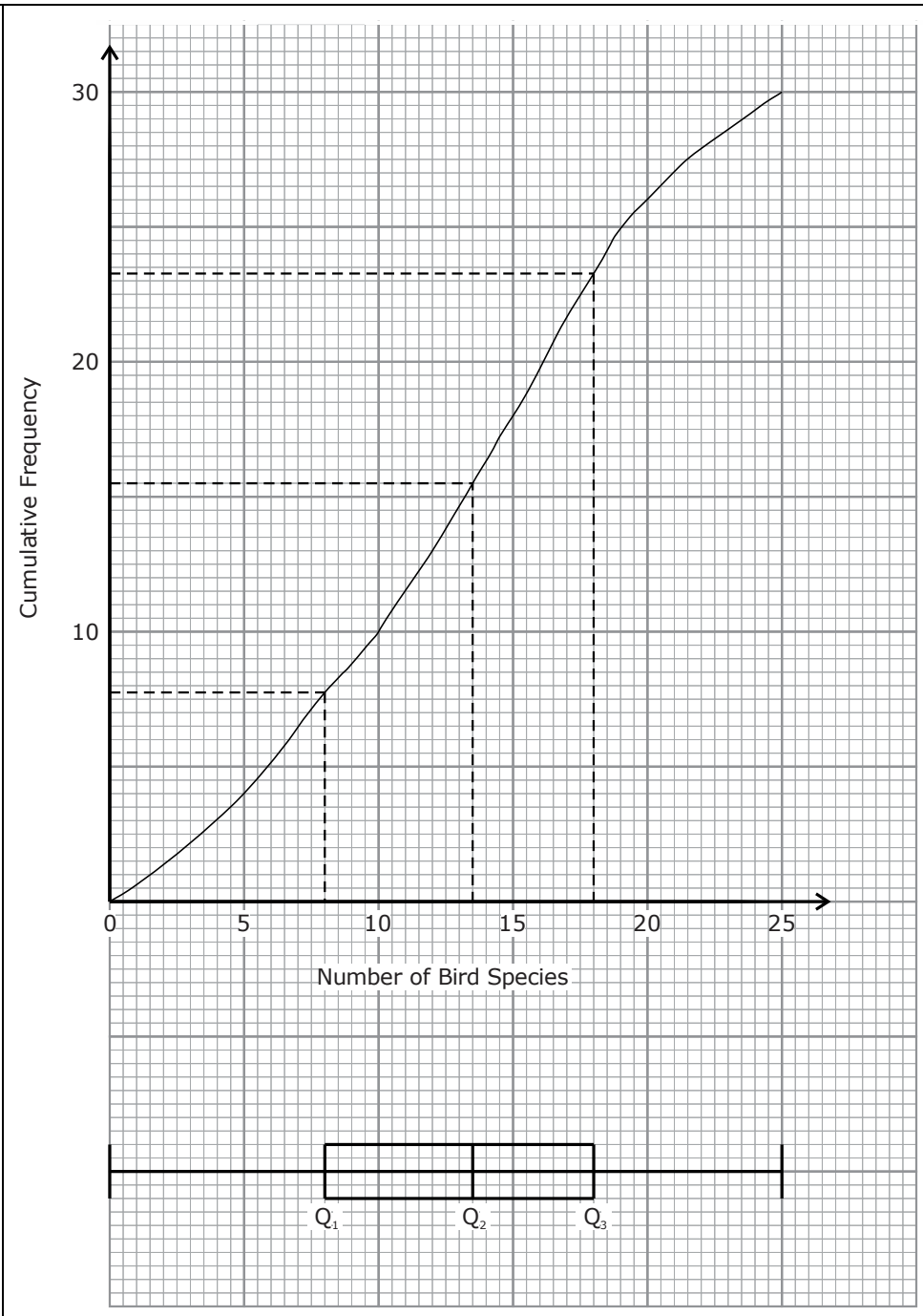
[Level 3-3*]

Question			Solution	Further Criteria	Marks	
1	a		$60 \times 60 \times 24 \times 7 = 604800$ $= 6.05 \times 10^5$	604800 6.05×10^5	A1 A1ft fmnw	9
	b	i	$400 = 2^4 \times 5^2$ Accept if answer is not in index form Accept if answer also includes x1 $1080 = 2^3 \times 3^3 \times 5$		A1 A1	
		ii	$\sqrt{400} = 2^2 \times 5 = 20$ Accept $\sqrt{2^4 \times 5^2 = 20}$ Do not accept 20 only		A1	
		iii	1080 is not a cube number as the power of 5 is not a multiple of 3 Accept" 5 does not have power 3" Do not accept "no" without proper explanation Zero mark for no when candidate is not using answers to part (b)(i)		M2	
	c		(i) LCM = $2^4 \times 3^3 \times 5^2$ or 10800 (ii) HCF = $2^3 \times 5$ or 40		B1 B1	
Total:						**9**
2						
	a	i	Line $y = -x$ Correct reflection, possibly in the wrong line, usually y=x, y=0, x=0 Correct image Q		A1 M1 A1	7
		ii	Correct enlargement by 3, possibly about a wrong centre Accept any triangle which is an enlargement by 3 Correct image R		M1 A1	

	b		 Correct construction award B1 when middle cross is missing or partly missing Award zero for order 2. Award B1 when triangles correctly placed but not shaded Award B1 for shading the whole square Award B2 for a correct shape of order 4 … which includes the given ans		B2	
Total:						**9**
3	a			B1- 3 correct values B2- 4 - 8 correct B3- 9 to 12 correct B4- 13 correct values	B4	11
	b		P (each child gets an orange $= \frac{4}{10} \times \frac{3}{9} \times \frac{2}{8} = \frac{1}{30}$	multiplies relevant probabilities $\frac{1}{30}$	M1 A1ft fmnw	

	c		P (one child gets an apple other two get an orange) = $\frac{6}{10}\times\frac{4}{9}\times\frac{3}{8} + \frac{4}{10}\times\frac{6}{9}\times\frac{3}{8} + \frac{4}{10}\times\frac{3}{9}\times\frac{6}{8} = \frac{3}{10}$	$\frac{6}{10}\times\frac{4}{9}\times\frac{3}{8}$ or any of the other expressions $\frac{6}{10}\times\frac{4}{9}\times\frac{3}{8}$ mult by 3 OR works out the addn shown on the left $\frac{3}{10}$	M1 M1 A1	
	d		P(at least an apple selected) = $1-\frac{1}{30} = \frac{29}{30}$	Works out the prob of cases where one apple or more apples are selected and then adds OR Works as shown on the left $\frac{29}{30}$ Ft from answer to (b)	M1 A1 ft fmnw	
Total:					**11**	
4	a		**Pattern number** | **1** | **2** | **3** | **4** | **5** | n **Number of white tiles** | 7 | 13 | 19 | 25 | 31 | $6n+1$ **Number of grey tiles** | 8 | 12 | 16 | 20 | 24 | $4n+4$ two of 25, 20,31,24 in place other two in place $6n+1$ $4n+4$		B1 B1 B1 B1	
	b		$6n+1 = 487 \Rightarrow 6n = 486 \Rightarrow n = 81$ No of grey tiles = 4x81 + 4 = 328	487 = number of white tiles as f(n) $n = 81$ uses n obtained in expression for grey tiles 328 grey tiles	M1 A1 M1 A1	10
	c		$4n+4 = 101 \Rightarrow 4n = 97 \Rightarrow n = 24.25$ Not possible since n is not an integer interprets that possibility only occurs for integral n Accept no, because 101 is odd… (M1, M1)		M1 M1	
Total:					**10**	

5



a

Number of Bird Species	Number of Locations
0 – 5	4
6 – 10	6
11 – 15	8
16 – 20	8
21 – 25	4

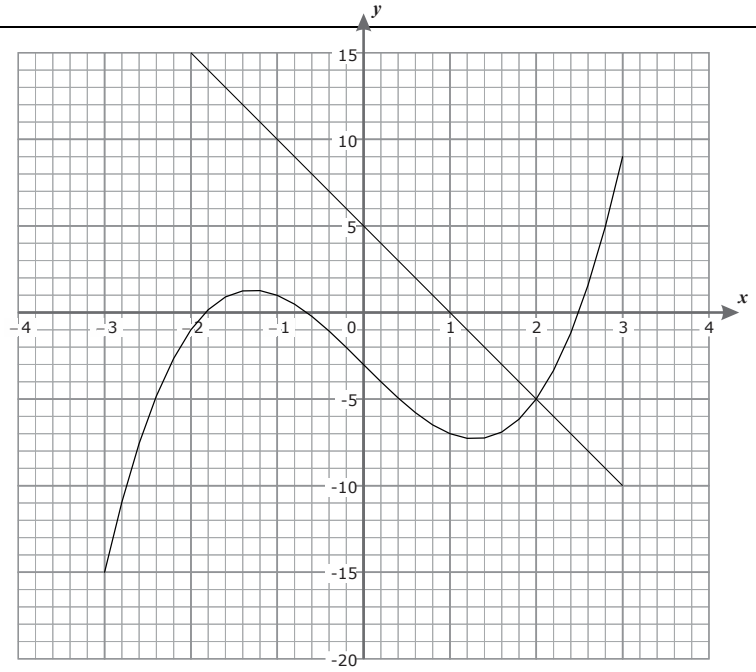
No of Bird Species	Cumulative Frequency
≤ 5	4
≤ 10	10
≤ 15	18
≤ 20	26
≤ 25	30

One mark for any 3 values correct. Another mark for other 2 values correct.

B2

9

	b	i	median is the no of species corresponding to a CF of $\frac{30+1}{2}$ = 15.5, i.e. 13.5 OR no of species corresponding to a CF of $\frac{30}{2}$ = 15, i.e. 13.25	Median considered as corresponding to CF of 15 or 15.5 AND finds correctly the corresponding no of species	M1	
		ii	1st quartile is the no of species corresponding to the CF of $\frac{30+1}{4}$ = 7.75 (or $\frac{30}{4}$= 7.5), i.e. 8 (or7.8) 3rd quartile is the no of species corresponding to the CF of $3 \times \frac{30+1}{4}$=23.25 (or $3 \times \frac{30}{4} = 22.5$) i.e. 18 (or 17.5) 3rd quartile is Interquartile range is 10 (or 9.7)	Uses 3rd quartile – 1st quartile 9.5 - 10	M1 A1	
	c		Box and whisker plot on page **Error! Bookmark not defined.**	Good shape of a whisker plot; plots values of quartiles and median corresponding to correct working in 5bii. Correct box and whisker plot	M1 A1	
	d		16 species correspond to a CF of 19.5. These locations have 16 species or less and 10 (30-19.5) locations had more than 16 species; 33.3% of the locations had more than 16 species.	19.5 -20 locations have 16 species or less 33-35% of the locations had more than 16 species	M1 M1 fmnw	
Total:						**9**
6			118% → €55000 100% → $\frac{55000}{1.18}$ = 46610.17	Considers 55000 to represent 118% Works out the right proportion…i.e. $\frac{55000}{1.18}$ €46610 or more accurate ans needs to be 2 dp or 46610	M1 M1 A1	
Total:						

<table>
<tr><td>7</td><td></td><td></td><td colspan="2"> 
</td><td></td><td></td></tr>
<tr><td></td><td>a</td><td></td><td colspan="2"><table>
<tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y</td><td>-15</td><td>-1</td><td>1</td><td>-3</td><td>-7</td><td>-5</td><td>9</td></tr>
</table>
Values in grey cells
1 or 2 correct values: B1
3 or 4 correct values: B2</td><td>B2</td><td rowspan="6">15</td></tr>
<tr><td></td><td>b</td><td></td><td colspan="2">Graph on page Error! Bookmark not defined.
1 or 2 points plotted correctly: 1 mark
3 or 4 points plotted correctly: 1 mark
5 or 6 or 7 points plotted correctly: 1 mark
All points plotted correctly and smooth curve: 1 mark</td><td>B4</td></tr>
<tr><td></td><td>c</td><td></td><td>Actual values are -1.83, -0.66, 2.49</td><td>-1.8±0.2, -0.7±0.2, 2.5±0.2
A mark each value
Do not accept answers which came from a calculator.</td><td>A3</td></tr>
<tr><td></td><td>d</td><td></td><td>Plot of the line $y = -5x + 5$
See graph page Error! Bookmark not defined.</td><td>a correct method for plotting line
Correct plot</td><td>M1
A1
fmnw</td></tr>
<tr><td></td><td>e</td><td></td><td colspan="2">equation $x^3 - 5x - 3 = -5x + 5$ or equivalent
$x = 2$ do not accept (2, -5)</td><td>M1
M1</td></tr>
<tr><td></td><td>f</td><td></td><td>$x^3 - 5x - 3 = -5x + 5$
$x^3 = 8$
$x = \sqrt[3]{8} = 2$</td><td>$x^3 = 8$ or $x^3 - 8 = 0$
$x = \sqrt[3]{8} = 2$

Do not penalise (2, -5)
This M1 is not to be obtained from working to part(e)</td><td>M1
A1</td></tr>
<tr><td colspan="7">Total:</td></tr>
</table>

<table>
<tr><td>8</td><td>a</td><td></td><td>Method 1
After one yr… 24,500 x 0.8 = 19600
After the next four yrs….19600 x 0.9^4= 12859.56</td><td>Method 1
Value car after one yr… uses 80% or subtracts 20% of its value

Uses mult factor of 0.9
Multiplies value after one yr by 0.9^4
accept 12860, 12859.56, 12859.60, 12859.6</td><td>M1

M1
M1
A1</td><td></td></tr>
<tr><td></td><td></td><td>Method 2
<table>
<tr><td></td><td>original value</td><td>24500</td></tr>
<tr><td>Depreciation of 20%</td><td>depreciation 1st yr</td><td>4900</td></tr>
<tr><td></td><td>value after 1yr</td><td>19600</td></tr>
<tr><td>Depreciation of 10%</td><td>depreciation 2nd yr</td><td>1960</td></tr>
<tr><td></td><td>value after 2 yrs</td><td>17640</td></tr>
<tr><td>Depreciation of 10%</td><td>depreciation 3rd yr</td><td>1764</td></tr>
<tr><td></td><td>value after 3 yrs</td><td>15876</td></tr>
<tr><td>Depreciation of 10%</td><td>depreciation 4th yr</td><td>1587.6</td></tr>
<tr><td></td><td>value after 4 yrs</td><td>14288.4</td></tr>
<tr><td>Depreciation of 10%</td><td>depreciation 5th yr</td><td>1428.84</td></tr>
<tr><td></td><td>value after 5 yrs</td><td>12859.56</td></tr>
</table>
Method marks…ignore rounding…
A1 … accept 12860, 12859.56, 12859.60, 12859.6</td><td>M1

M1

M1

A1</td><td>7</td></tr>
<tr><td></td><td>b</td><td></td><td>Method 1
15000 x 1.015^6= 16401.65</td><td>Method 1
Uses a multiplication factor of 1.015
Uses mult factor 1.015 or 1.15 and raises it to the power of 6.

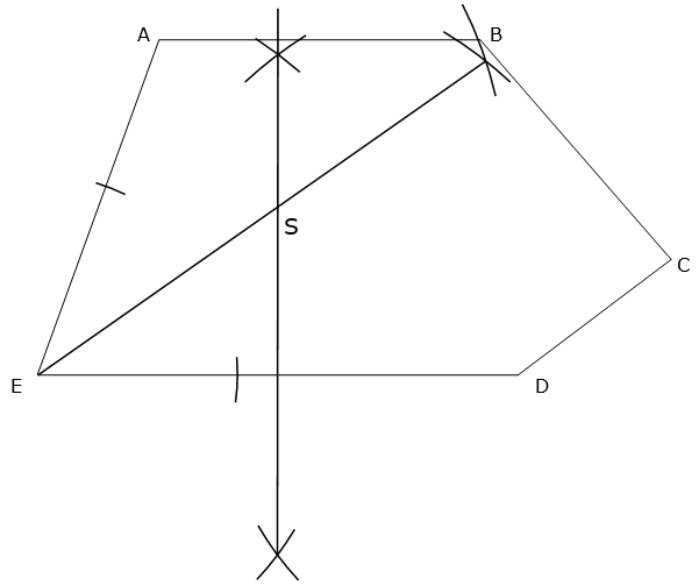
Accept 16402, 16401.7, 16401.70, 16401.65</td><td>M1
M1

A1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Method 2
<table>
<tr><td></td><td>principal</td><td>15000</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 1st yr</td><td>225</td></tr>
<tr><td></td><td>amount after 1 yr</td><td>15225</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 2nd yr</td><td>228.375</td></tr>
<tr><td></td><td>amount after 2 yr</td><td>15453.38</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 3rd 'yr</td><td>231.8006</td></tr>
<tr><td></td><td>amount after 3 yr</td><td>15685.18</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 4th yr</td><td>235.2776</td></tr>
<tr><td></td><td>amount after 4 yr</td><td>15920.45</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 5th yr</td><td>238.8068</td></tr>
<tr><td></td><td>amount after 5 yr</td><td>16159.26</td></tr>
<tr><td>At 1.5% of preceding amt</td><td>interest for 6th yr</td><td>242.3889</td></tr>
<tr><td></td><td>amount after 6 yr</td><td>16401.65</td></tr>
</table></td><td>M1

M1

M1

A1</td><td></td></tr>
<tr><td colspan="5">Total:</td><td>7</td></tr>
</table>

9	a	i	angle BOC = 34 x 2 = 68° (angle at centre = 2 x angle at circumference	Angle BOC = 68° Valid explanation	B1 M1	9
		ii	angle OCA = 34° (base angles in isosceles triangle – equal radii)….equal radii needed here angle ACD = 90 – 34 = 56° (radius perpendicular to tangent)	angle ACD = 56° valid explanation	B1 M2	
	b		$C = 2\pi r$ $\quad 63.8 = 2\pi r$ $AB = 10.154\ldots \times 2 = 20.308$ $sin34 = BC/20.308$ $BC = 20.308\ldots \times sin34 =$ $= 11.4cm(1d.p.)$	$63.8 = 2\pi r$ Diameter = $2r$ $\sin 34 = \mathrm{BC}/20.308$ BC = 11 or more accurate	M1 M1 M1 A1	
Total:						**9**
10						
	a		Constructs perpendicular bisector of ED Accurate perp bisector Constructs bisector of angle AED Accurate bisection of angle Fully accurate construction with labelling of S		M1 A1 M1 A1 A1	8
	b			$EC^2=80^2+32^2-2(80)(32)\cos(143)$ $EC^2=6400+1024-2(80)(32)\cos(143)$ EC =107.3m.... accept unrounded ans Answer in metres correct to 1 dp… for evidence of correct rounding	M1 A1 M1	
Total:						**8**

11	a			(i) $3x + 5 > 29$…with correct sign $x > \frac{29-5}{3}$….. ignore incorrect sign $x > 8$ (ii) x = 9	M1 M1 A1 B1	
	b		(i) $x + 2y = 80, \quad xy = 600$ (ii) substituting $x = 80 - 2y$ in $xy = 600 \Rightarrow$ $(80 - 2y)y = 600$ $80y - 2y^2 = 600$ Eliminates one unknown $y^2 - 40y + 300 = 0$ Rearranges to quadratic, not necessarily simplified $(y - 10)(y - 30) = 0$ Factorises quadratic appropriately $y = 10, y = 30$ Solves quadratic When $y = 10$, $x = 80 - 2(10) = 60$. Ans 10 m by 60 m Finds other unknown		A1, A1 M1 M1 M1 M1 A1 A1	12
Total:						