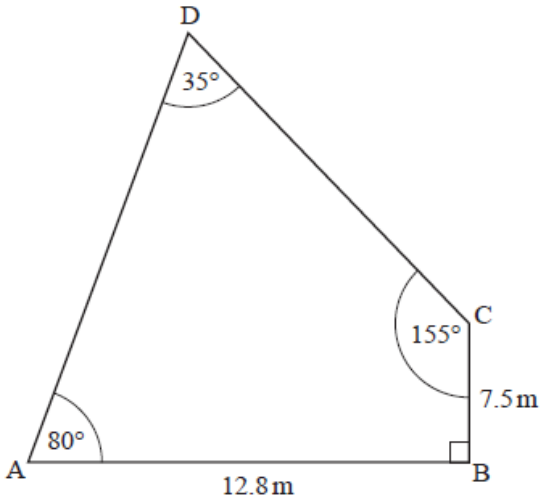
AS Level Questions

Trigonometry

1

Fig. 10.1 shows Jean's back garden. This is a quadrilateral ABCD with dimensions as shown.



Not to scale

Fig. 10.1

(i) (*A*) Calculate AC and angle ACB. Hence calculate AD. **[6]**

(*B*) Calculate the area of the garden. **[3]**

2

Fig. 7 shows a sketch of a village green ABC which is bounded by three straight roads. AB = 92 m, BC = 75 m and AC = 105 m.

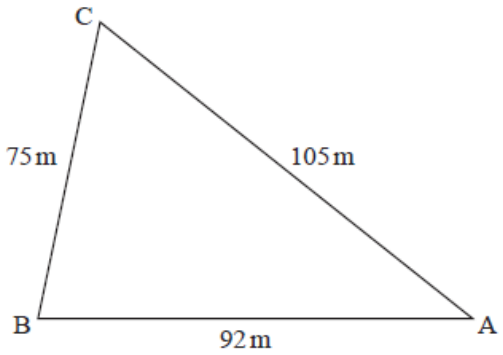


Fig. 7

Calculate the area of the village green. **[5]**

AS Level Questions

Algebra and graphs

3

Make r the subject of the formula $A = \pi r^2 (x + y)$, where $r > 0$. **[2]**

4

Make x the subject of the equation $y = \dfrac{x+3}{x-2}$. **[4]**

5

A line L is parallel to $y = 4x + 5$ and passes through the point $(-1, 6)$. Find the equation of the line L in the form $y = ax + b$. Find also the coordinates of its intersections with the axes. **[5]**

6

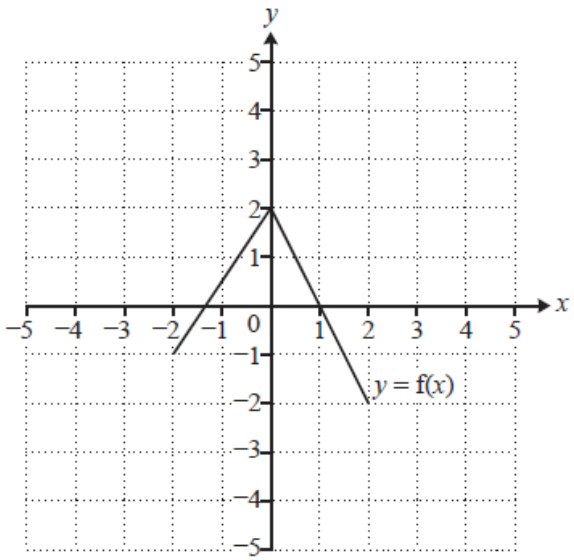


Fig. 3

Fig. 3 shows the graph of $y = \mathrm{f}(x)$. Draw the graphs of the following.

(i) $y = \mathrm{f}(x) - 2$ **[2]**

(ii) $y = \mathrm{f}(x - 3)$ **[2]**

7

The point $\mathrm{R}(6, -3)$ is on the curve $y = \mathrm{f}(x)$.

(i) Find the coordinates of the image of R when the curve is transformed to $y = \frac{1}{2}\mathrm{f}(x)$. **[2]**

(ii) Find the coordinates of the image of R when the curve is transformed to $y = \mathrm{f}(3x)$. **[2]**

AS Level Questions

8

Find the coordinates of the point of intersection of the lines $y = 5x - 2$ and $x + 3y = 8$. **[4]**

Indices and surds

9

Evaluate the following.

(i) 200^0 **[1]**

(ii) $\left(\frac{25}{9}\right)^{-\frac{1}{2}}$ **[3]**

10

(i) Evaluate $\left(\frac{1}{27}\right)^{\frac{2}{3}}$. **[2]**

(ii) Simplify $\frac{(4a^2c)^3}{32a^4c^7}$. **[3]**

11

(i) Expand and simplify $(3+4\sqrt{5})(3-2\sqrt{5})$. **[3]**

(ii) Express $\sqrt{72}+\frac{32}{\sqrt{2}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

Inequalities

12

Solve the inequality $\frac{4x-5}{7} > 2x+1$. **[3]**

13

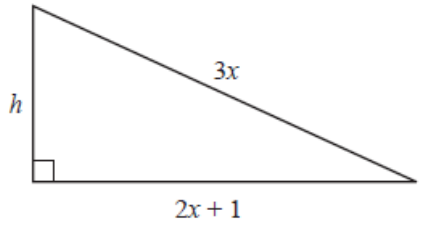
Solve the inequality $3x^2 + 10x + 3 > 0$. **[3]**

AS Level Questions

Quadratics and their graphs

14

Fig. 8 shows a right-angled triangle with base $2x+1$, height h and hypotenuse $3x$.



Not to scale

Fig. 8

(i) Show that $h^2 = 5x^2 - 4x - 1$. **[2]**

(ii) Given that $h = \sqrt{7}$, find the value of x, giving your answer in surd form. **[3]**

15

(i) Express $x^2 - 5x + 6$ in the form $(x-a)^2 - b$. Hence state the coordinates of the turning point of the curve $y = x^2 - 5x + 6$. **[4]**

(ii) Find the coordinates of the intersections of the curve $y = x^2 - 5x + 6$ with the axes and sketch this curve. **[4]**

16

Express $3x^2 - 12x + 5$ in the form $a(x-b)^2 - c$. Hence state the minimum value of y on the curve $y = 3x^2 - 12x + 5$. **[5]**

Proof

17

Factorise $n^3 + 3n^2 + 2n$. Hence prove that, when n is a positive integer, $n^3 + 3n^2 + 2n$ is always divisible by 6. **[3]**

18

$n-1$, n and $n+1$ are any three consecutive integers.

(i) Show that the sum of these integers is always divisible by 3. **[1]**

(ii) Find the sum of the squares of these three consecutive integers and explain how this shows that the sum of the squares of any three consecutive integers is never divisible by 3. **[3]**

Longer questions on graphs

19

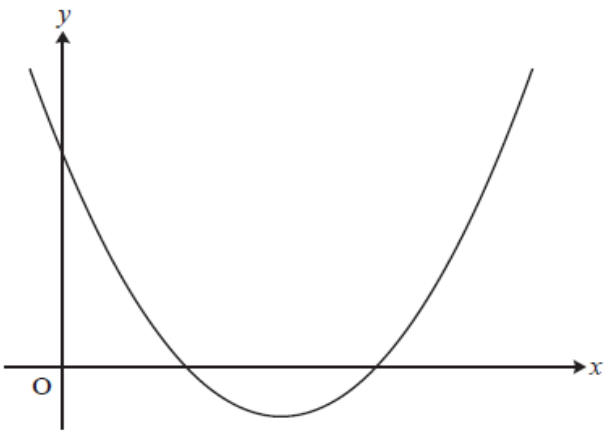


Fig. 11

Fig. 11 shows a sketch of the curve with equation $y = (x-4)^2 - 3$.

(i) Write down the equation of the line of symmetry of the curve and the coordinates of the minimum point. **[2]**

(ii) Find the coordinates of the points of intersection of the curve with the x-axis and the y-axis, using surds where necessary. **[4]**

(iii) The curve is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$. Show that the equation of the translated curve may be written as $y = x^2 - 12x + 33$. **[2]**

20

You are given that $\mathrm{f}(x) = (x+3)(x-2)(x-5)$.

(i) Sketch the curve $y = \mathrm{f}(x)$. **[3]**

(ii) Show that $\mathrm{f}(x)$ may be written as $x^3 - 4x^2 - 11x + 30$. **[2]**

(iii) Describe fully the transformation that maps the graph of $y = \mathrm{f}(x)$ onto the graph of $y = \mathrm{g}(x)$, where $\mathrm{g}(x) = x^3 - 4x^2 - 11x - 6$. **[2]**

AS Level Questions

Statistics and probability

1 The ages, x years, of the senior members of a running club are summarised in the table below.

Age (x)	$20 \leqslant x < 30$	$30 \leqslant x < 40$	$40 \leqslant x < 50$	$50 \leqslant x < 60$	$60 \leqslant x < 70$	$70 \leqslant x < 80$	$80 \leqslant x < 90$
Frequency	10	30	42	23	9	5	1

(i) Draw a cumulative frequency diagram to illustrate the data. **[5]**

(ii) Use your diagram to estimate the median and interquartile range of the data. **[3]**

2

Candidates applying for jobs in a large company take an aptitude test, as a result of which they are either accepted, rejected or retested, with probabilities 0.2, 0.5 and 0.3 respectively. When a candidate is retested for the first time, the three possible outcomes and their probabilities remain the same as for the original test. When a candidate is retested for the second time there are just two possible outcomes, accepted or rejected, with probabilities 0.4 and 0.6 respectively.

(i) Draw a probability tree diagram to illustrate the outcomes. **[3]**

(ii) Find the probability that a randomly selected candidate is accepted. **[2]**

(iii) Find the probability that a randomly selected candidate is retested at least once, given that this candidate is accepted. **[3]**

3

Each weekday, Marta travels to school by bus. Sometimes she arrives late.

- L is the event that Marta arrives late.
- R is the event that it is raining.

You are given that $\mathrm{P}(L) = 0.15$, $\mathrm{P}(R) = 0.22$ and $\mathrm{P}(L \mid R) = 0.45$.

(i) Use this information to show that the events L and R are not independent. **[1]**

(ii) Find $\mathrm{P}(L \cap R)$. **[2]**

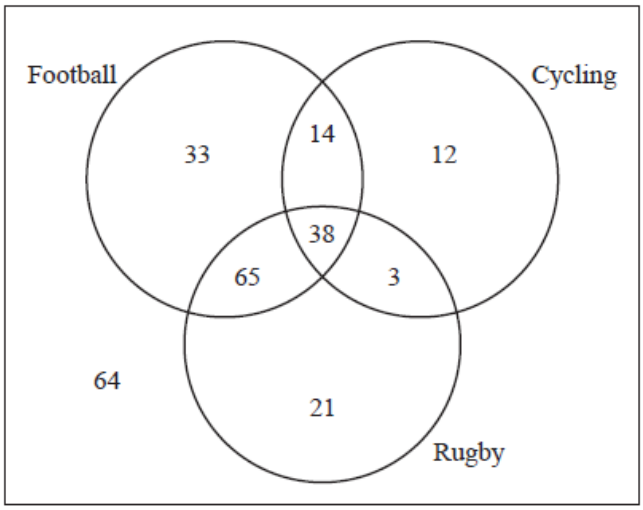
(iii) Draw a Venn diagram showing the events L and R, and fill in the probability corresponding to each of the four regions of your diagram. **[3]**

4

A survey is being carried out into the sports viewing habits of people in a particular area. As part of the survey, 250 people are asked which of the following sports they have watched on television in the past month.

- Football
- Cycling
- Rugby

The numbers of people who have watched these sports are shown in the Venn diagram.



One of the people is selected at random.

(i) Find the probability that this person has in the past month

(*A*) watched cycling but not football, **[1]**

(*B*) watched either one or two of the three sports. **[2]**

(ii) Given that this person has watched cycling, find the probability that this person has not watched football. **[2]**

Kinematic graphs

5

Fig. 1 shows the velocity-time graph of a cyclist travelling along a straight horizontal road between two sets of traffic lights. The velocity, v, is measured in metres per second and the time, t, in seconds. The distance travelled, s metres, is measured from when $t = 0$.

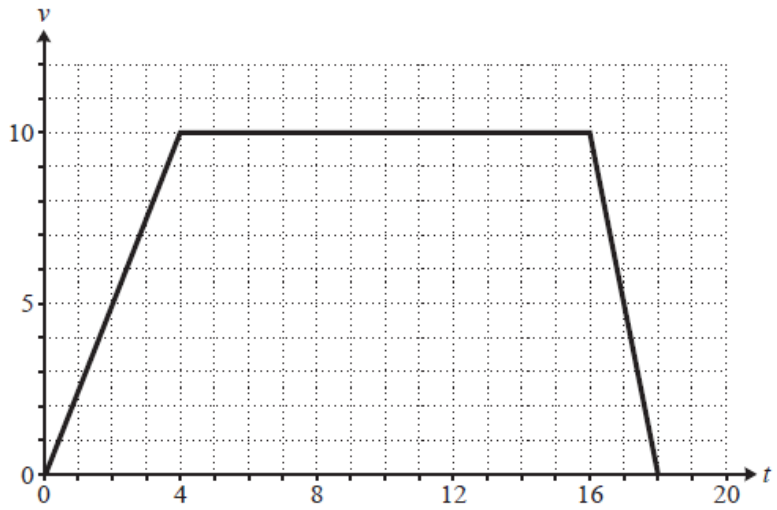


Fig. 1

(i) Find the values of s when $t = 4$ and when $t = 18$. **[3]**

(ii) Sketch the graph of s against t for $0 \leqslant t \leqslant 18$. **[3]**

AS Level Questions

1

Question		Answer	Marks	Guidance	
(i)	(A)	$AC^2 = 12.8^2 + 7.5^2$ oe	M1	allow correct application of cosine rule or from finding relevant angle and using trig	
		$AC = 14.83543056..$	A1	rot to 3 or more sf , or 15	B2 for 14.8 or better unsupported
		$\tan C = {}^{12.8}/_{7.5}$	M1	or $\sin C = {}^{12.8}/_{their14.8}$	or $\frac{\sin C}{12.8} = \frac{\sin 90}{their14.8}$
		or $C = 90 - \tan^{-1}({}^{7.5}/_{12.8})$ oe		or $\cos C = {}^{7.5}/_{their14.8}$	or $\cos C = \frac{their14.8^2 + 7.5^2 - 12.8^2}{2 \times 7.5 \times their14.8}$
		59.6 to 59.64	A1		
		$\frac{AD}{\sin(155 - their59.6)} = \frac{their14.8}{\sin 35}$ oe	M1		
		25.69 to 25.8	A1	allow **B2** for $25.69 \leq AD < 25.8$ unsupported.....but **B0** for 25.8 unsupported	**M0A0** for ${}^{14.8}/_{\cos 55} = 25.803...$
			[6]		
(i)	(B)	area of $ABC = 48$ soi	B1	may be implied by correct final answer in range or by sight of ½ × 12.8 × 7.5 oe	condone 48.0...
		½×their 14.8...×their 25.7...×sin(their 59.6 − 10)	M1	may be implied by 144.8 to 146	
		192.8 to 194[m^2]	A1		B3 for correct answer in range if unsupported
			[3]		

AS Level Questions

2

Answer	Marks	Guidance	
$\cos A = \frac{105^2 + 92^2 - 75^2}{2 \times 105 \times 92}$ oe	M1	or $\cos B = \frac{75^2 + 92^2 - 105^2}{2 \times 75 \times 92}$ oe	or $\cos C = \frac{105^2 + 75^2 - 92^2}{2 \times 105 \times 75}$ oe
0.717598…soi	A1	0.2220289…soi	0.519746…soi
A = 44.14345…° soi [0.770448553…]	A1	B = 77.1717719……° soi [1.346901422]	C = 58.6847827…° soi [1.024242678…]
			ignore minor errors due to premature rounding for second **A1** condone *A*, *B* or *C* wrongly attributed
½ × 92 × 105 × sin (*their* A)	M1	or ½ × 75 × 92 × sin (*their* B)	or ½ × 75 × 105 × sin (*their* C)
3360 or 3361 to 3365	A1		
			or **M3** for $\sqrt{136(136-75)(136-105)(136-92)}$ **A2** for correct answer 3360 or 3363 - 3364
	[5]		

3

Answer	Marks	Guidance	
$[r =]\sqrt{\frac{A}{\pi(x+y)}}$ or $[r =]\sqrt{\frac{A}{\pi x + \pi y}}$ as final answer	2	square root symbol must extend below fraction line; accept to power ½ with appropriate brackets **M1** for a triple decker fraction or for $r^2 = \frac{A}{\pi(x+y)}$ or for $[r =] \pm \sqrt{\frac{A}{\pi(x+y)}}$ or for their final answer for r ft their r^2	condone missing end bracket in denominator eg M1 for $[r =] \sqrt{\frac{A}{\frac{\pi}{(x+y)}}}$
	[2]		

AS Level Questions

4

$y(x-2) = (x+3)$	M1	for multiplying by $x-2$; condone missing brackets
$xy - 2y = x + 3$ or ft [ft from earlier errors if of comparable difficulty – no ft if there are no xy terms]	M1	for expanding bracket and being at stage ready to collect x terms
$xy - x = 2y + 3$ or ft	M1	for collecting x and 'other' terms on opposite sides of eqn
$[x =]\frac{2y+3}{y-1}$ o.e. or ft	M1	for factorising and division

5

$y = 4x + 10$	B3	**M1** for $y = 4x + b$ oe and **M1** for $y - 6 =$ their $a(x + 1)$ oe or for $(-1, 6)$ subst in $y =$ (their a)$x + b$ oe or **M1** for $y = ax + 10$
$(0, 10)$ or ft	B1	condone $y = 10$ isw
$(-10/4, 0)$ oe or ft	B1	condone $x = -10/4$ isw
	[5]	

6

Question		Answer	Marks	Guida
(i)		graph of shape with vertices at $(-2, -3)$, $(0, 0)$ and $(2, -4)$	2 [2]	M1 for 2 vertices correct
(ii)		graph of shape with vertices at $(1, -1)$, $(3, 2)$ and $(5, -2)$	2 [2]	M1 for 2 vertices correct or for shape with vertices at $(-5, -1)$, $(-3, 2)$ and $(-1, -2)$

AS Level Questions

7

Question	Answer	Marks	Guidanc
(i)	(6, −1.5) oe	B2 [2]	B1 for each value; allow $x = 6$, $y = -1.5$
(ii)	(2, −3)	B2 [2]	B1 for each value; allow $x = 2$, $y = -3$

8

$x + 3(5x - 2) = 8$ or $y = 5(8 - 3y) - 2$	M1	for subst to eliminate one variable; condone one error;
$16x = 14$ or $16y = 38$	M1	for collecting terms and simplifying; condoning one error ft
(7/8, 19/8) oe	A2 [4]	or $x = 14/16$, $y = 38/16$ oe isw allow **A1** for each coordinate

9

Question	Answer	Marks	Guidance
(i)	1	1 [1]	
(ii)	$\frac{3}{5}$ or 0.6	3 [3]	allow **B3** for ±0.6 oe; **M1** for $\left(\frac{25}{9}\right)^{-\frac{1}{2}} = \left(\frac{9}{25}\right)^{\frac{1}{2}}$ soi or $\frac{1}{\left(\frac{25}{9}\right)^{\frac{1}{2}}}$ and **M1** for at least one of 3 and 5 found

10

Question	Answer	Marks	Guida
(i)	$\frac{1}{9}$	2 [2]	isw conversion to decimal M1 for 9 or for 3^{-2} or for $\frac{1}{3}$ Except M0 for 9 from 27/3 or $\sqrt[3]{27}$
(ii)	$2a^2c^{-4}$ or $\frac{2a^2}{c^4}$ as final answer	3 [3]	B1 for each element; must be multiplied if B0, allow SC1 for $64a^6c^3$ obtained from numerator or for all elements correct but added

AS Level Questions

11

Question	Answer	Marks	Guidance
(i)	$-31+6\sqrt{5}$	3 [3]	**B2** for -31 or **B1** for $9-40$ or **SC1** for 49 and **B1** for $6\sqrt{5}$ if 0, allow **M1** for three terms correct in $9-6\sqrt{5}+12\sqrt{5}-40$
(ii)	$22\sqrt{2}$	2 [2]	**M1** for $\sqrt{72}=6\sqrt{2}$ soi or for $\frac{32}{\sqrt{2}}=16\sqrt{2}$ soi or for $\frac{12+32}{\sqrt{2}}$ oe

12

$4x-5>14x+7$	M1	for correctly multiplying by 7 to eliminate the fraction, including expanding bracket if this step done first
$-12>10x$ or $-10x>12$ or ft	M1	for correctly collecting x terms on one side and number terms on the other and simplifying
$x<-\frac{12}{10}$ or $-\frac{12}{10}>x$ oe isw or ft	M1 [3]	ft their ax [inequality] b, where $b\neq 0$ and $a\neq 0$ or ± 1

13

$(3x+1)(x+3)$	M1	or $3(x+1/3)(x+3)$ or for $-1/3$ and -3 found as endpoints eg by use of formula
$x<-3$ [or] $x>-1/3$ oe	A1 A1	mark final answers; allow only A1 for $-3>x>-1/3$ oe as final answer or for $x\leq -3$ and $x\geq -1/3$ if M0, allow SC1 for sketch of parabola the right way up with their solns ft their endpoints
	[3]	

14

Question	Answer	Marks	Guidance
(i)	$(3x)^2 = h^2 + (2x+1)^2$ oe	B1	for a correct Pythagoras statement for this triangle, in terms of x, with correct brackets
	$9x^2 = h^2 + 4x^2 + 4x + 1$ and completion to given answer , $h^2 = 5x^2 - 4x - 1$	B1	for correct expansion, with brackets or correct signs; must complete to the given answer with no errors in any interim working may follow $3x^2 = h^2 + (2x+1)^2$ oe for **B0 B1**
		[2]	
(ii)	$[0 =] 5x^2 - 4x - 8$	B1	for subst and correctly rearranging to zero
	$\frac{4 \pm \sqrt{(-4)^2 - 4\times5\times-8}}{2\times5}$ or ft	M1	for use of formula in their eqn rearranged to zero, condoning one error; ft only if their rearranged eqn is a 3-term quadratic; no ft from $5x^2 - 4x - 1$ [=0]
	$\frac{4+\sqrt{176}}{10}$ or $\frac{2}{5}+\frac{\sqrt{44}}{5}$ oe	A1	isw wrong simplification; **A0** if negative root also included
		[3]	

15

(i)		$\left(x - \frac{5}{2}\right)^2 - \frac{1}{4}$ oe	B3	B1 for $a = 5/2$ oe and M1 for $6 - $ *their* a^2 soi;
		$\left(\frac{5}{2}, -\frac{1}{4}\right)$ oe or ft	B1	accept $x = 2.5, y = -0.25$ oe
			[4]	

Question	Answer	Marks	Guida
(ii)	(2, 0) and (3, 0)	B2	B1 each or B1 for both correct plus an extra or M1 for $(x-2)(x-3)$ or correct use of formula or for $their\ a \pm \sqrt{their\ b}$ ft from (i)
	(0, 6)	B1	
	graph of quadratic the correct way up and crossing both axes	B1	ignore label of their tp; condone stopping at y-axis

16

$3(x-2)^2 - 7$ isw or $a = 3$, $b = 2$ $c = 7$ www	4	B1 each for $a = 3$, $b = 2$ oe and B2 for $c = 7$ oe or M1 for $[-]\frac{7}{3}$ or for $5 - their\ a(their\ b)^2$ or for $\frac{5}{3} - (their\ b)^2$ soi
-7 or ft	B1	B0 for $(2, -7)$
	[5]	

17

$n\,(n+1)(n+2)$	**M1**	condone division by n and then $(n+1)(n+2)$ seen, or separate factors shown after factor theorem used;
argument from general consecutive numbers leading to:		
at least one must be even	**A1**	or divisible by 2;
[exactly] one must be multiple of 3	**A1**	if M0: allow **SC1** for showing given expression always even

18

(i)		$3n$ isw	1 **[1]**

(ii)		at least one of $(n-1)^2$ and $(n+1)^2$ correctly expanded	M1	must be seen
		$3n^2+2$	B1	
		comment eg $3n^2$ is always a multiple of 3 so remainder after dividing by 3 is always 2	B1	dep on previous B1 B0 for just saying that 2 is not divisible by 3 – must comment on $3n^2$ term as well allow B1 for $\frac{3n^2+2}{3} = n^2 + \frac{2}{3}$
			[3]	

19

Question		Answer	Marks	Guida
(i)		$x = 4$	B1	
		$(4, -3)$	B1	or $x = 4, y = -3$
			[2]	
(ii)		$(0, 13)$ isw	1	or [when $x = 0$], $y = 13$ isw 0 for just $(13, 0)$ or $(k, 13)$ where $k \neq 0$
		[when $y = 0$,] $(x-4)^2 = 3$	M1	or $x^2 - 8x + 13$ [= 0]
		$[x =] 4 \pm \sqrt{3}$ or $\frac{8 \pm \sqrt{12}}{2}$ isw	A2	need not go on to give coordinate form A1 for one root correct
			[4]	
(iii)		replacement of x in their eqn by $(x-2)$	M1	may be simplified; eg $[y =] (x-6)^2 - 3$ or allow M1 for $(x - 6 - \sqrt{3})(x - 6 + \sqrt{3})$ [=0 or y]
		completion to given answer $y = x^2 - 12x + 33$, showing at least one correct interim step	A1	cao; condone using $f(x-2)$ in place of y
			[2]	

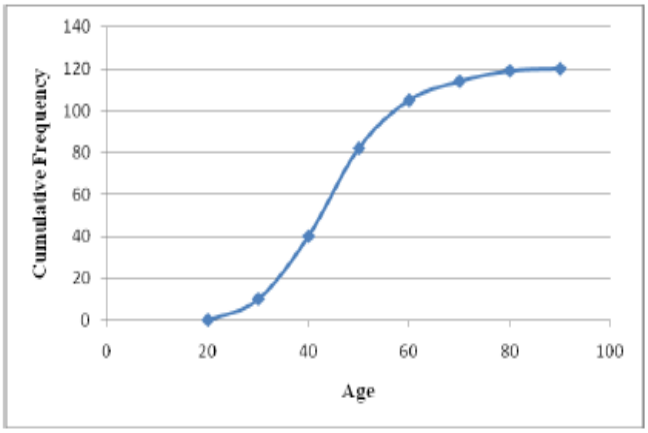
20

(i)		graph of cubic correct way up	B1	**B0** if stops at x-axis
		crossing x-axis at -3, 2 and 5	B1	on graph or nearby; may be in coordinate form mark intent for intersections with both axes
		crossing y-axis at 30	B1	or $x = 0$, $y = 30$ seen if consistent with graph drawn
			[3]	
(ii)		correct expansion of two of the linear factors	M1	may be 3 or 4 terms
		correct expansion and completion to given answer, $x^3 - 4x^2 - 11x + 30$	A1	must be working for this step before given answer
			[2]	

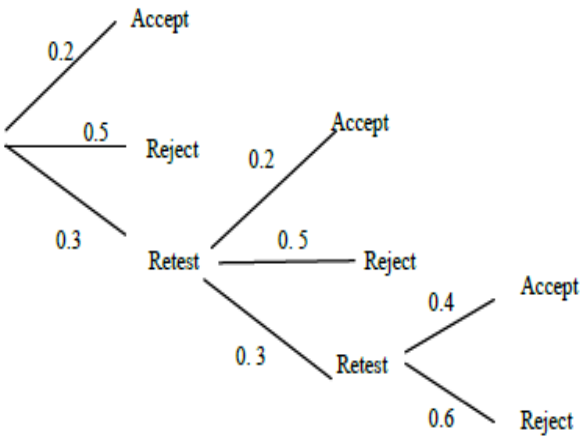
(iii)		translation	B1	0 for shift or move etc without stating translation
		$\begin{pmatrix} 0 \\ -36 \end{pmatrix}$	B1	or 36 down, or -36 in y direction oe
			[2]	

Statistics and probability

1

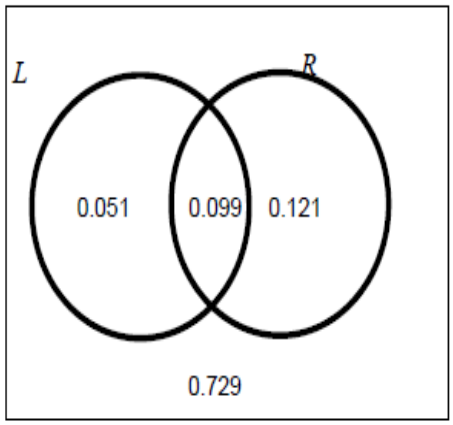
Question		Answer	Marks	Gu
(i)		<table><tr><td>Upper Bound</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr><tr><td>Cumulative Freq</td><td>0</td><td>10</td><td>40</td><td>82</td><td>105</td><td>114</td><td>119</td><td>120</td></tr></table> 	B1 G1 G1 G1 G1 [5]	Cumulative frequencies All correct For plotted points (Provided plotted at correct UCB positions) For joining points (within ½ a square) For scales For labels All marks dep on good attempt at cumulative frequency, but not cumulative fx's or other spurious values.
(ii)		Median = 45 Q1 = 37 Q3 = 53 Inter-quartile range = 53 – 37 = 16	B1 B1 B1 [3]	Allow answers between 44 and 46 without checking curve. Otherwise check curve. No marks if not using diagram. For Q3 or Q1 Allow Q1 between 37 and 38 without checking Allow Q3 between 52 and 54 without checking For IQR providing both Q1 and Q3 are correct

2

Question		Answer	Marks	Gu
(i)			G1 G1 G1 [3]	Do a vertical scan and give: First column Second column Final column Do not award if first two branches missing Branches two and three should come out of 'retest'
(ii)		$P(\text{Accepted}) = 0.2 + (0.3 \times 0.2) + (0.3 \times 0.3 \times 0.4)$ $= 0.2 + 0.06 + 0.036 = 0.296$	M1 A1 [2]	For second or third product CAO
(iii)		P(At least one retest given accepted) $= \frac{P(\text{At least one retest and accepted})}{P(\text{Accepted})}$ $= \frac{0.3 \times 0.2 + 0.3 \times 0.3 \times 0.4}{0.296} = \frac{0.096}{0.296}$ $= 0.324$	M1 M1 A1 [3]	For numerator For denominator FT their 0.296 and 0.096 Allow 0.32 with working

AS Level Questions

3

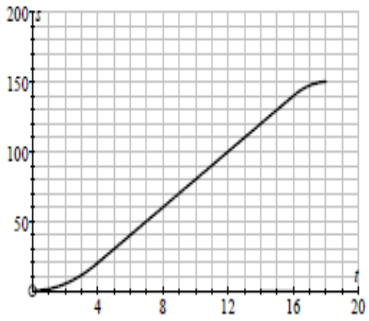
Question		Answer	Marks	Gu
(i)		Because $P(L \mid R) \neq P(L)$	E1 [1]	If two or more methods given and only one correct, do not award the mark Allow $0.45 \neq 0.15$
(ii)		$P(L \cap R) = P(L \mid R) \times P(R) = 0.45 \times 0.22$ $= 0.099$	M1 A1 [2]	For product CAO
(iii)			G1 G1 G1 [3]	For two labelled intersecting circles, provided no incorrect labelling. For at least 2 correct probabilities. FT their $P(L \cap R)$ from part (ii) provided ≤ 0.15 For remaining probabilities. FT their $P(L \cap R)$ providing probabilities between 0 and 1.

4

Question		Answer	Marks	
(i)	(A)	P(Watched cyc but not fb) $= \frac{15}{250} = \frac{3}{50} = 0.06$	B1 [1]	CAO (aef)
(i)	(B)	P(Watched one or two) $= \frac{33+12+21+14+3+65}{250}$ $= \frac{148}{250} = \frac{74}{125} = 0.592$	M1 A1 [2]	OR: $\frac{250-(64+38)}{250} =$ CAO (aef)
(ii)		P(Not watched fb|watched cyc) $= \frac{15}{67} = 0.224$ (0.223880597…)	M1 A1 [2]	 CAO (aef)

Kinematics

5

Question	Answer	Marks	Guidance
(i)	When $t=4$, $s=\frac{1}{2}\times 4\times 10$		Finding the area of the triangle or equivalent.
	$s=20$	B1	
	When $t=18$, $s=\frac{1}{2}\times(18+12)\times 10$	M1	A complete method of finding the area of the trapezium or equivalent.
	$s=150$	A1	CAO
		[3]	
(ii)			
	Graph joining (0,0), (4,20) and (18, 150)	B1	Allow FT for their (4,20) and (18, 150) Condone extension to (20, 150) with a horizontal line.
	The graph goes through (16, 140)	B1	
			Allow SC1 for the first two marks if there is a consistent displacement from a correct scale, eg plotting (18,150) at (19, 150)
	Curves at both ends	B1	The sections from $t=0$ to $t=4$ and from $t=16$ to $t=18$ are both curves
		[3]	