For **AQA**

Mathematics

Paper 2 (Calculator)

Higher Tier

Churchill Paper 2C – Marking Guide

Method marks (M) are awarded for a correct method which could lead to a correct answer

Accuracy marks (A) are awarded for a correct answer, having used a correct method, although this can be implied

(B) marks are awarded independent of method

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Churchill Paper 2C Marking Guide – AQA Higher Tier

1 $\frac{1}{6} = 0.1666...$

0.16   0.166   0.167   0.17   B1   Total 1

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2 3 **× 3** = 9 so 18 **× 3** = 54

6   24   54   324   B1   Total 1

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3 $2.05 \le w < 2.15$ $2.1 \le w < 2.2$

$2.05 < w < 2.15$ $2.095 \le w < 2.15$ B1   Total 1

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4 **(a)** $0 \le N \le 9$ $10 \le N \le 19$ $20 \le N \le 29$ $30 \le N \le 39$ B1

(b)

Number of Apps (N)	Frequency	Midpoint	Frequency × midpoint
$0 \le N \le 9$	4	4.5	18
$10 \le N \le 19$	11	14.5	159.5
$20 \le N \le 29$	6	24.5	147
$30 \le N \le 39$	7	34.5	241.5
$40 \le N \le 49$	2	44.5	89

Total no. of apps = 18 + 159.5 + 147 + 241.5 + 89 = 655   M1

Mean $\approx \frac{655}{30}$ = 21.8 (3sf)   M1 A1   Total 4

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5 **(a)** e.g.
Gethin has run 5.5 km in 30 minutes
He would run 1 km in 30 ÷ 5.5 = 5.45... minutes   M1
He would run 20 km in 20 × 5.45...   M1
= 109.09... minutes
= 1 hour 49 minutes (nearest minute)   A1

(b) e.g. It is likely to have led to a smaller answer than is realistic   B1
as he will probably get tired and slow down   B1   Total 5

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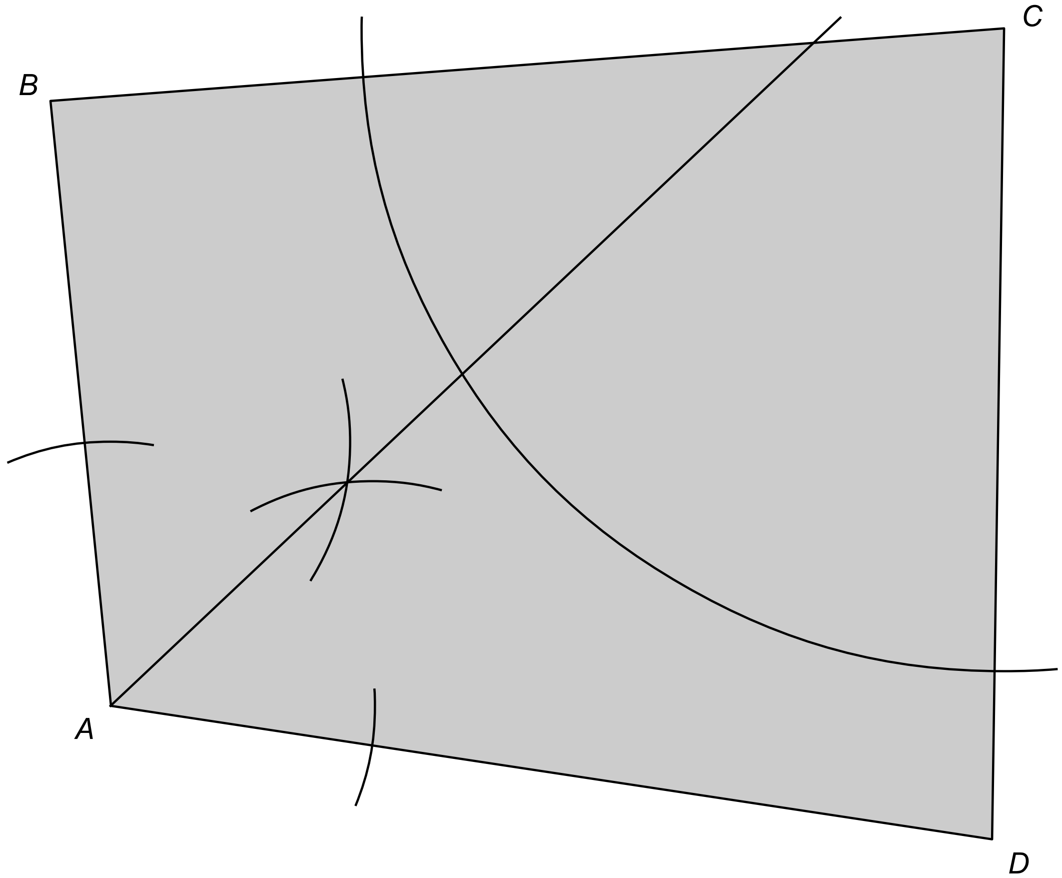
6



Arc of circle centre *C*, radius 8.5 cm	B1	
Correct method of construction of bisector of angle *BAC*	M1	
On the drawing, distance ≈ 9.3 cm	M1	
The tree is 465 m from *D* *[Accept 440 to 490]*	A1	Total 4

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7 **(a)** $1\text{ m}^2 = 100^2\text{ cm}^2 = 10000\text{ cm}^2$

$0.4\text{ m}^2 = 0.4 \times 10000 = 4000\text{ cm}^2$

40 cm^2 $\quad$ 4000 cm^2 $\quad$ $40\,000\text{ cm}^2$ $\quad$ $400\,000\text{ cm}^2$ B1

(b) 5 miles $= 5 \times 5289\text{ ft} = 26445\text{ ft}$

$= 12 \times 26445\text{ in} = 317340\text{ in}$ M1

$= 2.54 \times 317340\text{ cm} = 806043.6\text{ cm}$

$= 8060.436\text{ m}$

$= 8.060436\text{ km}$ M1

Error $= 8.060436 - 8\text{ km} = 0.060436\text{ km}$

$$\%\text{ error} = \frac{0.060436}{8.060436} \times 100\%$$

$= 0.7497...\% = 0.750\%$ (3sf) A1 Total 4

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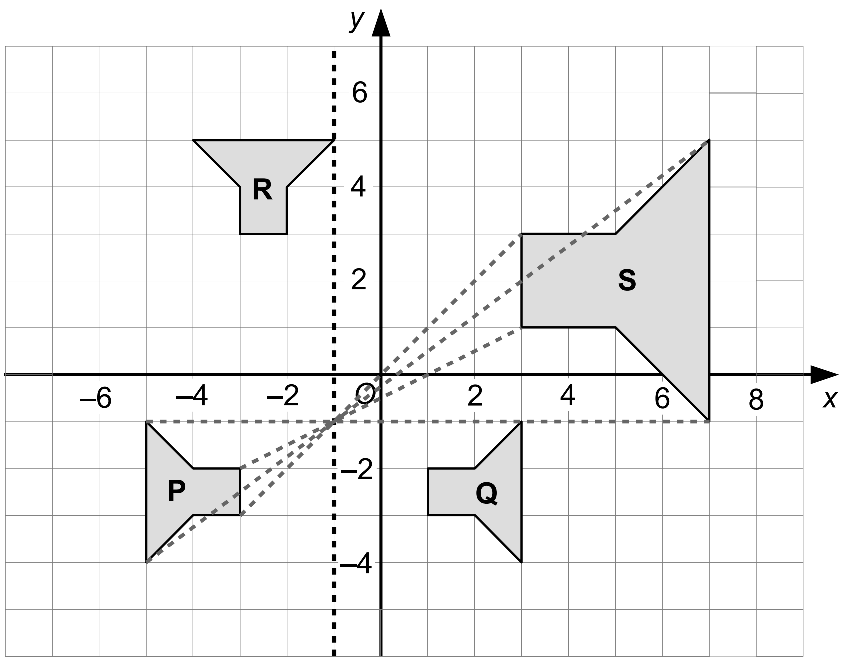
8	**(a)**	$4m - 2 < 5$		
		$4m < 7$	M1	
		$m < \frac{7}{4}$ [or $m < 1.75$]	A1	
	(b)	$-12 + 7 \leq 4n \leq 5 + 7$	M1	
		$-5 \leq 4n \leq 12$		
		$-\frac{5}{4} \leq n \leq 3$	M1	
		{ –1, 0, 1, 2, 3 }	A1	Total 5

9	**(a)**	Lily paid £12 to play 12 games		
		£6 profit so she got 6 + 12 = £18 in winnings	M1	
		[Lily won 18 ÷ 3 = 6 times]		
		Mila paid £25		
		£4 loss so she got 25 – 4 = £21 in winnings		
		[Mila won 21 ÷ 3 = 7 times]		
		Mila won more games	A1	
	(b)	Total games = 12 + 25 = 37		
		Total winnings = 18 + 21 = £39		
		No. of games won = 39 ÷ 3 = 13	M1	
		Probability of winning = $\frac{13}{37}$	A1	
	(c)	Owner received £200 for 200 games played		
		Owner paid out 200 – 32 = £168		
		No. of games won = 168 ÷ 3 = 56	M1	
		Probability of winning = $\frac{56}{200}$		
		$= \frac{7}{25}$	A1	
	(d)	e.g. The second estimate is likely to be more accurate as it is based on a larger number of games	B1	Total 7

10



(a)	M1 A1	
(b)	M1 A1	
(c)	M1 A1	
		Total 6

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11 $(\sqrt{6} + \sqrt{8})^2 = (\sqrt{6} + \sqrt{8})(\sqrt{6} + \sqrt{8})$

$= 6 + \sqrt{6}\sqrt{8} + \sqrt{6}\sqrt{8} + 8$ M1

$= 14 + \sqrt{48} + \sqrt{48}$

$= 14 + 2\sqrt{48}$

$= 14 + 2\sqrt{16 \times 3}$ M1

$= 14 + 2 \times 4\sqrt{3}$

$= 14 + 8\sqrt{3}$ A1 Total 3

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12 e.g. Let first odd number be $2n + 1$ where n is an integer

Next 2 odd numbers are $2n + 3$ and $2n + 5$ M1

Sum $= 2n + 1 + 2n + 3 + 2n + 5$

$= 6n + 9$

$= 3(2n + 3)$ M1

$2n + 3$ is an integer so $3(2n + 3)$ will be a multiple of 3 A1 Total 3

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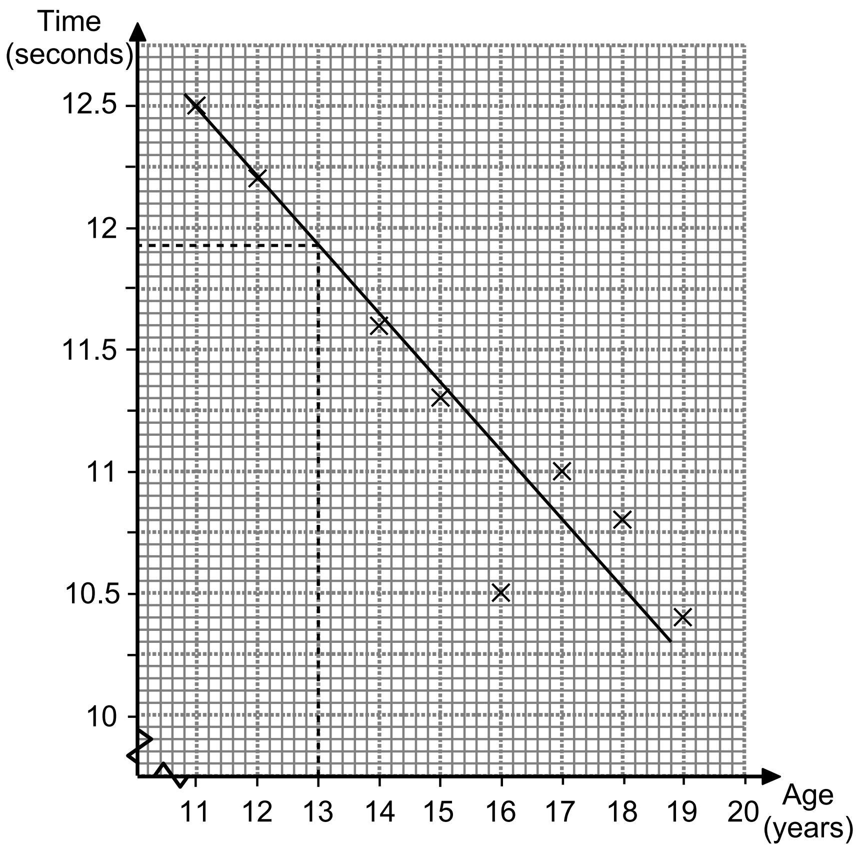
13 **(a)** e.g. Because that point is an outlier – it does not fit with the trend of the rest of the data B1

(b) e.g. No, because the points plotted are the best for each age – it only takes one exceptional athlete to produce an outlier so it could be correct B1

(c)



M1

≈ 11.9 seconds (from line of best fit) A1

[Line can consider or ignore the outlier]

(d) e.g. Because age 30 is outside the range of the data – it requires extrapolation and we don't know if the trend continues B1 Total 5

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14 Angle VWX = exterior angle = 360 ÷ 8 = 45º
Angle UVW = interior angle = 180 – 45 = 135º
By symmetry, angle RVW = 135 ÷ 2 = 67.5º
Angles on a straight line total 180º so angle WVX = 180 – 67.5 = 112.5º
Angles in a triangle total 180º so angle VXW = 180 – (45 + 112.5) = 22.5º

21.5º   22.5º   24º   25º   B1   Total 1

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15 $81 = 3^4$, $27 = 3^3$, $9 = 3^2$ so $\left(3^4\right)^{32} \times \left(3^3\right)^{40} = \left(3^2\right)^x$
$3^{128} \times 3^{120} = 3^{2x}$
$128 + 120 = 2x$
$x = 248 \div 2 = 124$

72   124   248   372   B1   Total 1

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16 Volume = $x \times (x - 2) \times 3$
$= 3x(x - 2)$

So	$3x(x - 2) = 72$	M1	
	$3x^2 - 6x - 72 = 0$		
	$x^2 - 2x - 24 = 0$		
	$(x + 4)(x - 6) = 0$	M1	
	$x = -4$ or 6		
x is a length so can't be negative, hence $x = 6$		A1	Total 3

17

Volume of cylinder = $\pi r^2 h$		
Volume of coin = $\pi \times (1.2)^2 \times 0.2 = 0.9047...$ cm^3	M1	
Mass = volume × density		
Mass of coin = 0.9047... × 10.5 = 9.500... g	M1	
= 0.009500... kg		
Number of atoms = $0.009500... \div 1.79 \times 10^{-25}$	M1	
$= 5.31 \times 10^{22}$ (3sf)	A1	Total 4

18

(a)	$= (x + 2)^2 - 2^2 + 7$	M1	
	$= (x + 2)^2 - 4 + 7$		
	$= (x + 2)^2 + 3$	A1	
(b)	(–2, 3)	B1	Total 3

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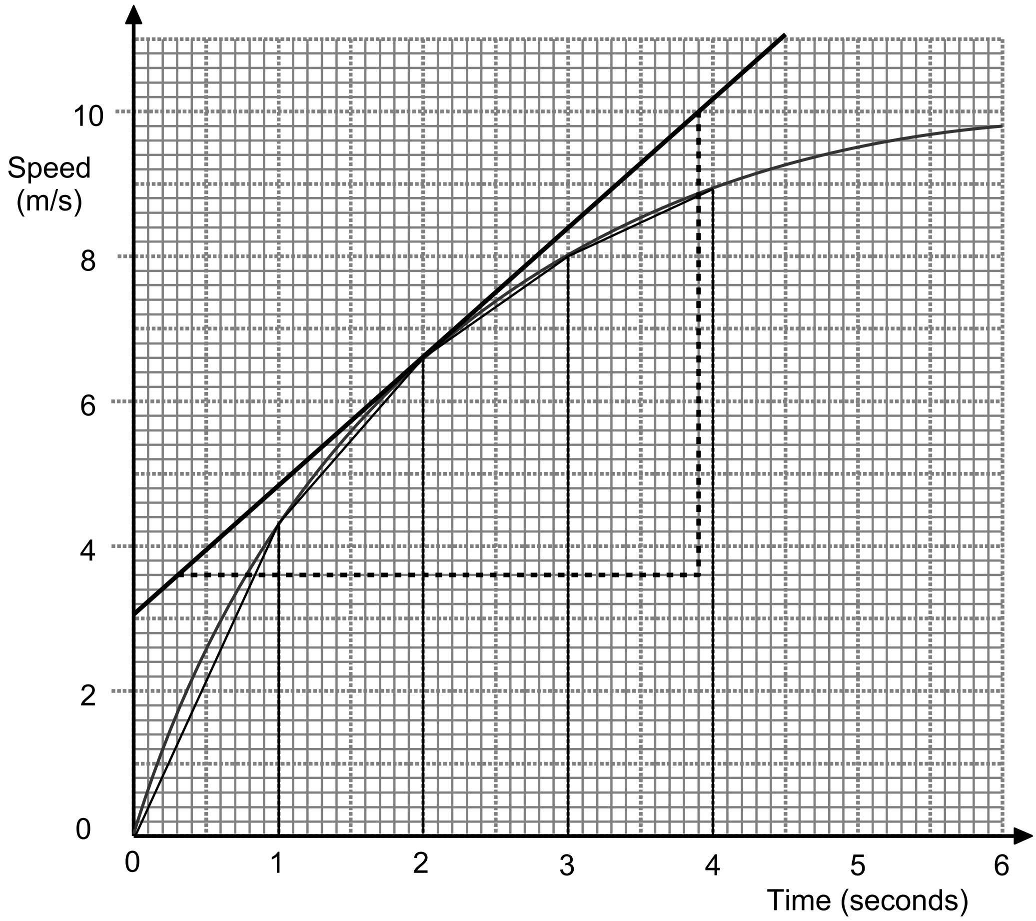
19 (a)



Acceleration = gradient of tangent — M1

$\approx \dfrac{10 - 3.6}{3.9 - 0.3}$ — M1

$= 1.777...$

Acceleration $\approx 1.8 \text{ ms}^{-2}$ — A1

(b) Distance = area under graph

$\approx \frac{1}{2} \times 1 \times 4.3 + \frac{1}{2} \times 1 \times (4.3 + 6.6)$

$+ \frac{1}{2} \times 1 \times (6.6 + 8) + \frac{1}{2} \times 1 \times (8 + 8.9)$ — M2

$= \frac{1}{2} \times (4.3 + 10.9 + 14.6 + 16.9) = \frac{1}{2} \times 46.7 = 23.35$

Distance $\approx$ 23 m — A1

(c) Underestimate as the graph is above the top of the triangle and trapeziums used — B1 — Total 7

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20	**(a)**	$f(-2) = [5 \times (-2)] - 2 = -12$ $ff(-2) = f(-12) = [5 \times (-12)] - 2 = -62$		
		–62 –42 3 18	B1	
	(b)	Let $y = f(x)$ so $y = 5x - 2$		
		For inverse, swap x and y: $x = 5y - 2$	M1	
		$x + 2 = 5y$		
		$\frac{x+2}{5} = y$		
		Hence, $f^{-1}(x) = \frac{x+2}{5}$	A1	Total 3

21	For up to 3 years the first account is better	B1	
	First account 4 years: $(1.03)^4 \times 4000 = 4502$		
	5 years: $(1.03)^5 \times 4000 = 4637$ (4637.10)	M1	
	6 years: $(1.03)^6 \times 4000 = 4776$		
	Second account 4 years: $1.02 \times 1.025 \times 1.03 \times 1.035 \times 4000 = 4458$	M1	
	5 years: $1.04 \times 4458.22 = 4637$ (4636.55)		
	6 years: $1.045 \times 4636.55 = 4845$		
	e.g. If you are likely to withdraw the money within 5 years you should choose the first account to gain the most interest.	M1	
	If you are more likely to leave the money in the account for longer then the second account pays more (with the difference increasing more quickly the longer you leave it in).	A1	Total 5

22	Area of rectangle = $12 \times 10 = 120$ cm^2		
	Area of quadrilateral = area of rectangle – areas of 4 white triangles	M1	
	Length from A to top left corner = $12 - 4 = 8$ cm		
	Length from D to top left corner = $(10 - x)$ cm		
	Areas of triangles: $\frac{1}{2} \times 4 \times 5 = 10$, $\frac{1}{2} \times 5 \times 6 = 15$,		
	$\frac{1}{2} \times 6 \times x = 3x$, $\frac{1}{2} \times 8 \times (10 - x) = 40 - 4x$	M1	
	Area of quadrilateral $= 120 - 10 - 15 - 3x - (40 - 4x)$		
	$= 95 - 3x - 40 + 4x$		
	$= 55 + x$	M1	
	As $0 \le x \le 10$, maximum area = $55 + 10 = 65$ cm^2	A1	
	[Alternatively can consider maximum area of triangle ACD with AC as base. Greatest perpendicular height when D is at top left etc.]		Total 4

TOTAL FOR PAPER: 80 MARKS

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