For **AQA**

Mathematics

Paper 1 (Non-Calculator)

Higher Tier

Churchill Paper 1C – 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 1C Marking Guide – AQA Higher Tier

1 $91 = 7 \times 13$

71 79 [✓ 91] 97 B1 Total 1

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2 32 38 46 50 56 59

Median = $\frac{1}{2}(46 + 50) = 48$

If e.g. 46 becomes 60 new median = $\frac{1}{2}(50 + 56) = 53$, up 5

If e.g. 50 becomes 30 new median = $\frac{1}{2}(38 + 46) = 42$, down 6

Largest change = 6

4 5 [✓ 6] 6.5 B1 Total 1

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3 Gradient of $L = \dfrac{2 - 0}{(-3) - 0} = -\frac{2}{3}$

Gradient of options is m in $y = mx + c$

Gradients = $-\frac{2}{3}$ $\frac{2}{3}$ $-\frac{3}{2}$ $\frac{3}{2}$

Parallel so same gradient, hence $y = 4 - \frac{2}{3}x$

[✓ $y = 4 - \frac{2}{3}x$] $y = \frac{2}{3}x - \frac{1}{3}$ $y = 2 - \frac{3}{2}x$ $y = \frac{3}{2}x + 1$ B1 Total 1

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4 **(a)** Common difference = 6 so nth term = $6n + c$

0^{th} term = $12 - 6 = 6$

nth term = $6n + 6$

$18n - 6$ $12n + 6$ $6n - 6$ [✓ $6n + 6$] B1

(b) $u_3 = 8 = \dfrac{16}{u_2 - 2}$

$8(u_2 - 2) = 16$ M1

$8u_2 - 16 = 16$

$8u_2 = 32$

$u_2 = 4$ M1

$u_2 = 4 = \dfrac{16}{u_1 - 2}$

$4(u_1 - 2) = 16$

$4u_1 - 8 = 16$

$4u_1 = 24$

$u_1 = 6$ So, $u_1 = 6$ A1 Total 4

5 10% of 50 = 5
40% of 50 = 4 × 5 = 20 go into 2nd round
25% of 20 = 20 ÷ 4 = 5
75% of 20 = 3 × 5 = 15 go into 3rd round M1
We know 9 go into 4th round
Fraction of wins in 3rd round = $\frac{9}{15} = \frac{3}{5}$ M1
Percentage wins in 3rd round = $\frac{3}{5} \times 100\%$
$= 3 \times 20\% = 60\%$ A1 Total 3

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6 **(a)** $= \frac{1}{2} \times \frac{7}{4}$ M1
$= \frac{7}{8}$ A1

(b) $= \frac{\cancel{12}}{5} \times \frac{15}{\cancel{4}}$ M1
$= \frac{3}{\cancel{5}} \times \frac{\cancel{15}}{1}$
$= \frac{3}{1} \times \frac{3}{1}$
$= 9$ M1 A1 Total 5

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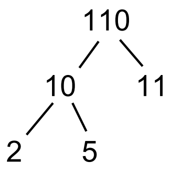
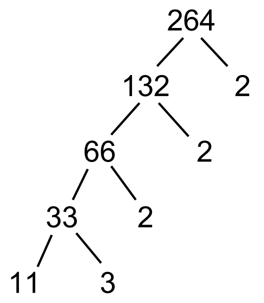
7 e.g.





110 = 2 × 5 × 11 B1
264 = 2^3 × 3 × 11
HCF = 2 × 11 = 22 M1 A1 Total 3

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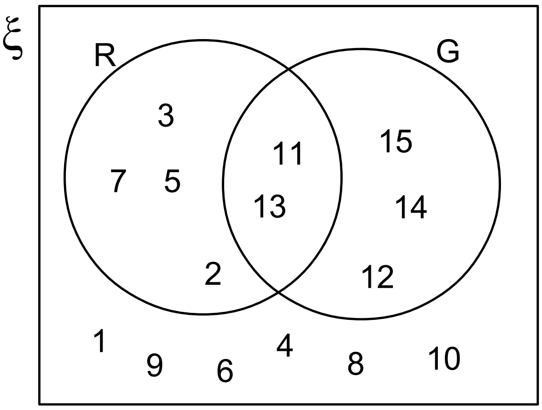
8 Let the number of fourspots used be x
She will have used $3x$ twospots and $2x$ eightspots
The numbers she has left will be:
twospot: $300 - 3x$
fourspot: $300 - x$ M1
eightspot: $300 - 2x$

Hence, $300 - x = 2(300 - 3x)$ M1
$300 - x = 600 - 6x$
$5x = 300$
$x = 60$
Number of eightspots left = 300 – (2 × 60) = 300 – 120 = 180 A1 Total 3

9 **(a)**



B2

(b) $\frac{2}{15}$ B1

(c) $\frac{2}{5}$ B1 Total 4

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10 Opposite angles add up to 180º so:

$4x + 7 + 4x - 3 = 180$
$8x = 176$
$x = 22$

$4x - 3 = 4 \times 22 - 3 = 88 - 3 = 85$º
$4x + 7$ is obviously bigger
$3x + 20 = 3 \times 22 + 20 = 66 + 20 = 86$º
As less than 90º, the opposite angle will be more than 90º
Smallest angle is 85º

80º 81º 83º [✓ 85º] B1 Total 1

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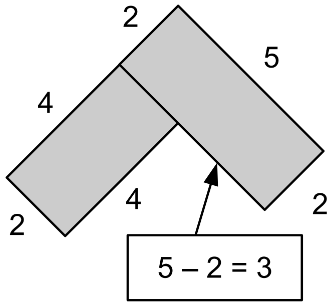
11 **(a)**



M1

Perimeter = 2 + 4 + 2 + 5 + 2 + 3 + 4 = 22 cm A1

(b) $= 11^2 + (7 \times 11) + 4 = 121 + 77 + 4 = 202$ cm B1

(c) $n^2 + 7n + 4 = 82$ M1
$n^2 + 7n - 78 = 0$
$(n + 13)(n - 6) = 0$ M1
$n = -13$ or 6
Stage number must be positive so stage 6 A1 Total 6

12 Let no. of LH people = x

At first, no. of RH people = $\frac{15}{2}x$

12 RH join so new no. of RH people = $\frac{15}{2}x + 12$ M1

Ratio is now 9 : 1 so $\frac{15}{2}x + 12 = 9x$ M1

$12 = \frac{3}{2}x$

$x = 8$

There are 8 left-handed people A1 Total 3

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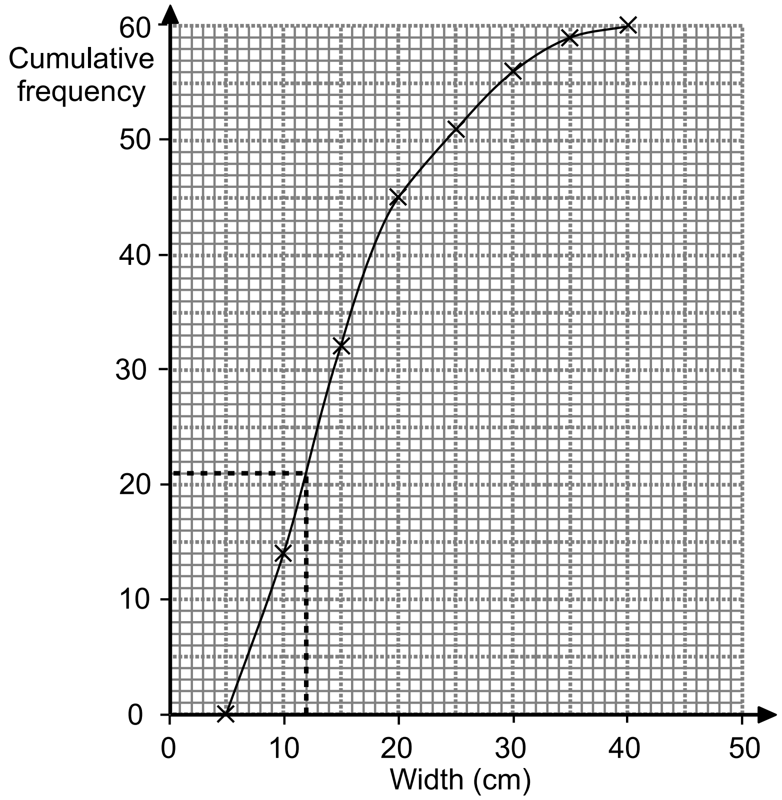
13 **(a)**

Width (w cm)	No. fossils	Width (w cm)	Cum. Freq.
$0 \le w < 5$	0	$0 \le w < 5$	0
$5 \le w < 10$	14	$0 \le w < 10$	14
$10 \le w < 15$	18	$0 \le w < 15$	32
$15 \le w < 20$	13	$0 \le w < 20$	45
$20 \le w < 25$	6	$0 \le w < 25$	51
$25 \le w < 30$	5	$0 \le w < 30$	56
$30 \le w < 35$	3	$0 \le w < 35$	59
$35 \le w < 40$	1	$0 \le w < 40$	60

M1



M1 A1

(b) From graph, number of fossils with width ≤ 12 cm = 21

Using table, no. of fossils 5 to 12 = 21 M1

12 to 25 = 51 – 21 = 30

25 to 40 = 60 – 51 = 9

Total price ≈ 21 × £6 + 30 × £20 + 9 × £50 M1

= 126 + 600 + 450 = £1176 A1 Total 6

14 First model: $\frac{1}{4}$ off so $\frac{3}{4}$ of original price = £180 M1

$\frac{1}{4}$ of original price = £180 ÷ 3 = £60

original price = 4 × £60 = £240 A1

Second model: 40% off so 60% of original price = £180

10% of original price = £180 ÷ 6 = £30

original price = 10 × £30 = £300 M1

Difference in pre-sale prices = 300 – 240 = £60 A1 Total 4

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15 **(a)** $\frac{1}{3} \times (2.4 \times 10^{17}) = 0.8 \times 10^{17} = 8 \times 10^{16}$

0.8×10^{17} 8×10^{18} $8 \times 10^{5.67}$ [✓ 8×10^{16}] B1

(b) Underestimate B1

e.g. 0.32 has been rounded down to $\frac{3}{10}$ which is 0.3
2.387 has been rounded up to 2.39
The percentage that 0.32 has been rounded down is much bigger than the percentage 2.387 has been rounded up B1

(c) e.g. Jaime's method gives the more accurate estimate
The error in rounding 0.32 down to 0.3 is bigger than in rounding it up to $\frac{1}{3}$ (or 0.333...)
Although Jaime's method rounds the 2.387 the other way, for both of them, the error from rounding the 2.387 is much smaller than the error from rounding the 0.32 B2 Total 5

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16 $8^{-\frac{4}{3}} = \left(\sqrt[3]{8}\right)^{-4} = 2^{-4} = \frac{1}{2^4} = \frac{1}{16}$

$\frac{1}{128}$ [✓ $\frac{1}{16}$] $\frac{1}{2}$ 16 B1 Total 1

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17 **(a)** [✓ $\sqrt{3}$] $\frac{\sqrt{3}}{2}$ $\frac{\sqrt{3}}{3}$ $\frac{\sqrt{2}}{2}$ B1

(b)

$$\frac{4 - \tan 45^\circ}{2 - \tan 60^\circ} = \frac{4 - 1}{2 - \sqrt{3}}$$

$$= \frac{3}{2 - \sqrt{3}} \times \frac{2 + \sqrt{3}}{2 + \sqrt{3}} \qquad \text{M1}$$

$$= \frac{3\left(2 + \sqrt{3}\right)}{2^2 - \left(\sqrt{3}\right)^2}$$

$$= \frac{3\left(2 + \sqrt{3}\right)}{4 - 3} \qquad \text{M1}$$

$$= \frac{3\left(2 + \sqrt{3}\right)}{1} = 3(2 + \sqrt{3}) = 6 + 3\sqrt{3} \qquad \text{A1} \quad \text{Total 4}$$

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18 **(a)** $y = \tan x$ B1

(b) $y = \frac{1}{x}$ B1

(c) $y = 1 + \sin x$ B1

(d) $y = x^3 - 2$ B1 Total 4

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19 **(a)** By taking *BC* as the “base” of triangle *ABC* and *BE* as the “base” of triangle *ABE*, the two triangles have the same perpendicular height. As the length of *BC* is one third of the length of *BE*, the base of triangle *ABC* is one third of the base of triangle *ABE*.

The area of a triangle is $\frac{1}{2}$ × base × perpendicular height so the area of triangle *ABC* is one third of the area of triangle *ABE*. B2

(b) e.g. Triangle *ABE* is equilateral so we know
1) angle *ABC* = angle *AED* (= 60°) M1
2) length *AB* = length *AE* (= side length of triangle *ABE*)
Also, we are told that *BC* = (*CD* =) *DE* M1
We have two pairs of equal sides and the angle between them is also equal, hence congruent by SAS A1 Total 5

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20 Let the number of red counters be x

P (1^{st} counter is red) = $\frac{x}{10}$

P (2^{nd} is red given 1^{st} is red) = $\frac{x-1}{9}$ M1

P (both red) = $\frac{x}{10} \times \frac{x-1}{9}$

So $\frac{x}{10} \times \frac{x-1}{9} = \frac{2}{15}$ M1

$15x(x-1) = 180$
$x(x-1) = 12$
$x^2 - x - 12 = 0$
$(x+3)(x-4) = 0$ M1
$x = -3$ or 4

x is the number of red counters so can't be negative, hence $x = 4$
There are 4 red counters A1 Total 4

21	**(a)**	Area $= \frac{1}{2} \times 2x \times 3x \times \sin 60°$	M1	
		$= x \times 3x \times \frac{\sqrt{3}}{2} = \frac{3}{2}x^2\sqrt{3}$		
		So $\frac{3}{2}x^2\sqrt{3} = 24\sqrt{3}$	M1	
		$\frac{3}{2}x^2 = 24$		
		$x^2 = \frac{2 \times 24}{3} = 16$		
		$x = \pm\sqrt{16} = \pm 4$	M1	
		x is a length so it must be positive		
		$x = 4$	A1	
	(b)	$BC^2 = AB^2 + AC^2 - 2 \times AB \times AC \times \cos 60°$		
		$x = 4$ so $AB = 8$ and $AC = 12$		
		$BC^2 = 8^2 + 12^2 - 2 \times 8 \times 12 \times \frac{1}{2}$	M1	
		$BC^2 = 64 + 144 - 96 = 112$		
		$BC = \sqrt{112} = \sqrt{4 \times 28}$	M1	
		$= \sqrt{16 \times 7} = \sqrt{16} \times \sqrt{7} = 4\sqrt{7}$ cm	A1	Total 7
22	e.g.	$\overrightarrow{XM} = \overrightarrow{XO} + \overrightarrow{OM} = -\overrightarrow{OX} + \overrightarrow{OM}$	M1	
		$= -6\mathbf{p} + 7\mathbf{p} + 2\mathbf{q}$		
		$= \mathbf{p} + 2\mathbf{q}$	A1	
		As M is the midpoint of XY, $\overrightarrow{MY} = \overrightarrow{XM} = \mathbf{p} + 2\mathbf{q}$		
		$\overrightarrow{NY} = \overrightarrow{NO} + \overrightarrow{OM} + \overrightarrow{MY} = -\overrightarrow{ON} + \overrightarrow{OM} + \overrightarrow{MY}$		
		$= -(5\mathbf{p} + 4\mathbf{q}) + 7\mathbf{p} + 2\mathbf{q} + \mathbf{p} + 2\mathbf{q}$	M1	
		$= -5\mathbf{p} - 4\mathbf{q} + 7\mathbf{p} + 2\mathbf{q} + \mathbf{p} + 2\mathbf{q}$		
		$= 3\mathbf{p}$		
		As N is the midpoint of YZ, $\overrightarrow{ZY} = 2\overrightarrow{NY} = 6\mathbf{p}$	M1	
		Hence $\overrightarrow{ZY} = \overrightarrow{OX}$ so ZY and OX have the same length		
		and are parallel meaning $OXYZ$ is a parallelogram	A1	Total 5

TOTAL FOR PAPER: 80 MARKS