For **AQA**

Mathematics

Paper 2 (Calculator)

Higher Tier

Churchill Paper 2A – 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 2A Marking Guide – AQA Higher Tier

1 **C** lies on a straight line with an angle that is corresponding to 119º
So **C** = 180 – 119 = 61º
A, **B** and **D** are not connected to the 119º by parallel lines so are unknown

A **B** **C** **D** B1 Total 1

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2 $(\sqrt{2})^2 = 2$
$(\sqrt{2})^8 = \{(\sqrt{2})^2\}^4 = 2^4 = 16$

4 8 16 64 B1 Total 1

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3 40% = 0.4 so men : women = 1 : 1.4
= 10 : 14
= 5 : 7

5 : 7 5 : 2 2 : 3 2 : 5 B1 Total 1

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4 Common difference = 7 so nth term = $7n$ + ?
0th term = 4 – 7 = –3
nth term = $7n$ – 3

$4n + 7$ $4 + 7n$ $7n + 11$ $7n - 3$ B1 Total 1

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5 **(a)** $= \frac{3}{2} \times 4 = 6$ eggs B1

(b) 75 ÷ 30 = 2.5 M1
2.5 × 250 = 625 ml of milk A1

(c) 20 ÷ 4 = 5 lots of 4 eggs
2000 ÷ 250 = 8 lots of 250 ml milk M1
500 ÷ 30 = 16 and a bit lots of 30 g butter
Smallest of these is 5 lots of 4 eggs
She can make 5 × 2 = 10 portions A1 Total 5

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6 Let the amount Eileen received be £x
Layla received £(x + 60)
Naira received £1.5x B1
Total = £900 so: $x + x + 60 + 1.5x = 900$ M1
$3.5x = 840$
$x = 840 \div 3.5 = 240$ M1
Naira received 1.5 × 240 = £360 A1 Total 4

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7 £500 = €1.38 × 500 = €690 M1
€690 – €465 = €225
€225 = £225 ÷ 1.31 = £171.76 M1 A1 Total 3

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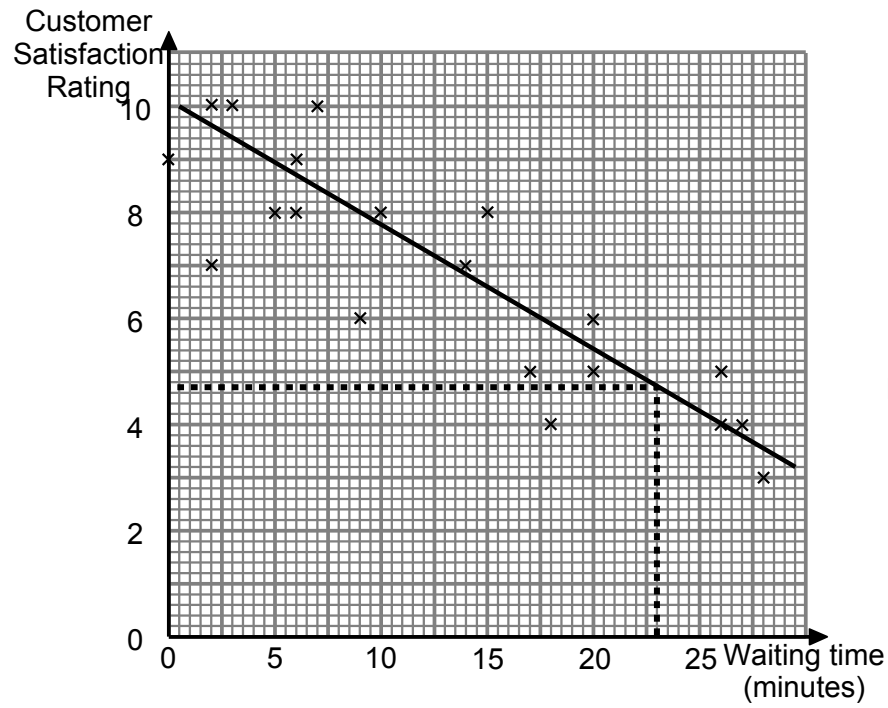
8 **(a)** 9 callers gave a rating of 8 or more

Percentage = $\frac{9}{20}$ × 100% = 45%

25% (45%) 55% 60% B1

(b)



M1

5 (from their line, accept nearest whole number or raw value) A1 Total 3

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9 **(a)** Median = $\frac{1}{2}(n + 1)$th value = $\frac{1}{2}(31 + 1)$th value = 16th value

There are 6 in first class

There are 6 + 10 = 16 in 1st & 2nd classes so 16th is in second class M1

The median is in the class $25 < N \leq 30$ A1

(b) e.g. The class intervals have different widths and the 5 values between 50 and 70 could pull the mean above 35 B1 Total 3

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10 Let Joel's age be J and his son's age be S

Now: $J = 5S$

In 2 years: $J + 2 = 4(S + 2)$

So: $5S + 2 = 4(S + 2)$

$5S + 2 = 4S + 8$

$S = 6$

$J = 5 \times 6 = 30$

24 28 (30) 34 B1 Total 1

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11 y-intercept = –1 B1

Gradient [using (–4, 1) to (4, –3)] = $\frac{-3-1}{4-(-4)} = \frac{-4}{8} = -\frac{1}{2}$ M1

Equation is $y = -\frac{1}{2}x - 1$ A1 Total 3

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12 Radius = 49 244 ÷ 2 = 24 622

Mean dist. From Sun = 30.069 × 149 597 871 = 4 498 258 383 M1

Mean dist. ÷ radius = 4 498 258 383 ÷ 24 622 M1

= 182692.6...

= 1.83×10^5 times (3sf) A1 Total 3

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13 $1^{st} = 1$, $2^{nd} = 2$, $3^{rd} = 2^2$, $4^{th} = 2^3$ etc.

So on 31^{st} she gives $2^{(31-1)} = 2^{30}$

$2^{30} - 1$ 2^{30} $2^{31} - 1$ 2^{31} B1 Total 1

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14 **(a)** This approximation will have lowered her estimate as the actual value of π is larger than 3, i.e. 3.14... B1

(b) She has assumed the lichen covers a circular area. B1

The shape of the lichen will not be a perfect circle. It will have indents and bits sticking out which means that the actual area could be bigger or smaller. B1 Total 3

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15 **(a)** As a is even, let $a = 2n$ where n is a whole number

Now $a^2 = (2n)^2 = 4n^2 = 2 \times 2n^2$ M1

As $2n^2$ is a whole number, a^2 is even A1

(b) e.g. When $p = 3$ and $q = 1$:

$(pq + 1)^2 = (3 + 1)^2 = 16$ which is even B2

(c) If $(pq + 1)^2$ is even then $pq + 1$ must be even

Hence pq must be odd M1

Therefore both the numbers p and q must be odd A1 Total 6

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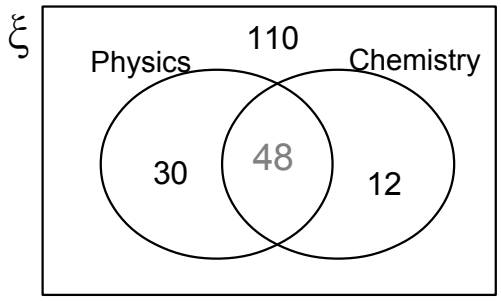
16 **(a)** 78 – 48 = 30, 60 – 48 = 12
30 + 48 + 12 = 90 M1
200 – 90 = 110



A1

(b) $= \frac{12}{60}$ $\left[= \frac{1}{5} \right]$ M1 A1 Total 4

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17 Angle *ACB* = angle *DCE* as they are opposite B1
Angle *ABE* = angle *ADE* as they are angles in the same segment M1
Hence, angle *ABC* = angle *CDE*
Angle *BAD* = angle *BED* as they are angles in the same segment
Hence, angle *BAC* = angle *CED*
As the three angles in triangles *ABC* and *CDE* are equal the triangles must be similar A1 Total 3

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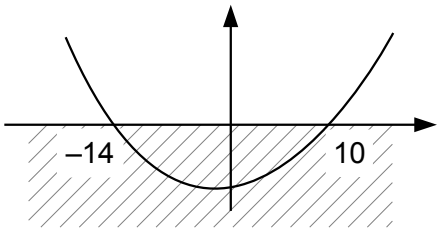
18 Width of vent = $(x + 4)$ cm
Area of XS = $x(x + 4)$ cm^2

Therefore $x(x + 4) \geq 140$ M1
$x^2 + 4x - 140 \geq 0$
For c.v. $(x + 14)(x - 10) = 0$ M1
$x = -14$ or 10 A1



$x \leq -14$ or $x \geq 10$ M1
x is a length so can't be negative
The smallest value of x is 10 A1 Total 5

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19 $700 = \dfrac{7}{\text{area}}$

$700 \times \text{area} = 7$

Area $= 7 \div 700 = 0.01$ m^2 M1

Side length of cube $= \sqrt{0.01} = 0.1$ m M1

Volume of cube $= (0.1)^3 = 0.001$ m^3 M1

$\text{Density} = \dfrac{\text{mass}}{\text{volume}}$

$720 = \dfrac{\text{mass}}{0.001}$

Mass $= 720 \times 0.001 = 0.72$ kg A1 Total 4

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20 **(a)** On 1st Jan 2016, $t = 1$

When $t = 1$, $V = 2500 \times 1.3 = £3250$ B1

(b) 30% B1

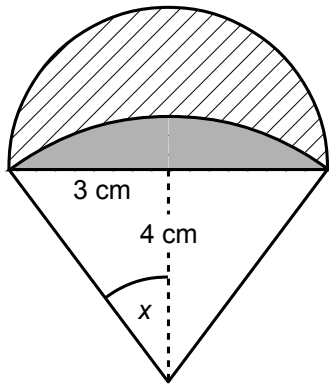
(c) When $t = 2$, $V = 3660$

Sub in: $3660 = 2500 \times k^2$ M1

$k^2 = \dfrac{3660}{2500} = 1.464$

$k = \sqrt{1.464} = 1.2099... = 1.21$ (3sf) M1 A1 Total 5

21



Small circle: area $= \pi r^2 = \pi \times 3^2 = 28.274...$

Semi-circle: area $= \frac{1}{2} \times 28.27 = 14.137...$ M1

Triangle: area $= 2 \times \frac{1}{2} \times 3 \times 4 = 12$ B1

Angle: $\tan x = \dfrac{\text{opposite}}{\text{adjacent}} = \frac{3}{4}$ M1

$x = \tan^{-1} \frac{3}{4} = 36.869...$

Sector: angle $= 2x = 73.739...$

$\text{area} = \dfrac{\text{angle}}{360} \times \pi r^2$

$= \dfrac{73.74}{360} \times \pi \times 5^2$ M1

$= 16.087...$

Segment: area = sector – triangle

$= 16.09 - 12 = 4.087...$ M1

Crescent = semi-circle – segment

$= 14.14 - 4.09 = 10.049... = 10.0$ cm^2 (3sf) A1 Total 6

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22 P(doesn't end in 1st) = 1 – 0.1 = 0.9
P(doesn't end in 2nd) = 1 – 0.11 = 0.89

P(reaches 3rd round) = P(doesn't end in 1st or 2nd)
= 0.9 × 0.89 = 0.801

0.011 0.099 0.21 (0.801) B1 Total 1

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23 Width of shelf < 1.25 m B1
Thickness of game ≥ 13.5 mm
1.25 m = 125 cm and 13.5 mm = 1.35 cm
Max. no. on shelf = 125 ÷ 1.35 = 92.59... M1
The maximum is 92 A1 Total 3

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24 Volume scale factor = 625 ÷ 40 = 15.625 B1
Length scale factor = $\sqrt[3]{15.625}$ = 2.5 M1

Let Don's model be d cm tall $2.5 \times d = d + 21$ M1
$1.5d = 21$
$d = 21 \div 1.5 = 14$
14 + 21 = 35
Paul's model is 35 cm tall A1 Total 4

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25 Perimeter = 8 m so width + length = 4 m

$x - 1 + \dfrac{4x}{2x - 1} = 4$ M1
$(2x – 1)(x – 1) + 4x = 4(2x – 1)$ M1
$2x^2 – 3x + 1 + 4x = 8x – 4$
$2x^2 – 7x + 5 = 0$
$(2x – 5)(x – 1) = 0$ M1
$x = \frac{5}{2}$ or $x = 1$

x can't be 1 as the width, $x – 1$, would be 0 so $x = \frac{5}{2}$ A1

Width = $\frac{5}{2} – 1 = \frac{3}{2}$

Length = $\dfrac{4 \times \frac{5}{2}}{2 \times \frac{5}{2} - 1} = \dfrac{10}{5 - 1} = \frac{5}{2}$ M1

Area = $\frac{3}{2} \times \frac{5}{2} = \frac{15}{4} = 3\frac{3}{4} = 3.75$ m^2 A1 Total 6

TOTAL FOR PAPER: 80 MARKS