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.
Churchill Paper 1E Marking Guide – AQA Higher Tier

1  
3 \times 1.2 = 3.6
1.6 + 2 = 0.8
3.6 + 0.8 = 4.4

\[ \frac{3}{5} \div 2 = \frac{27}{45} \div \frac{10}{45} = \frac{17}{45} \]

\[ \frac{1}{4} \quad \frac{1}{45} \quad \frac{6}{45} \quad \frac{17}{45} \]

\[ 4.4 \quad 4.2 \quad 3.8 \quad 2.6 \]  B1  Total 1

2  
\[ (3, 1) \quad (3, -1) \quad (-3, 1) \quad (-3, -1) \]  B1  Total 1

4  
e.g. 7.9 is just 7.9 (!)  
\[ \sqrt{65} \] is a bit bigger than \[ \sqrt{64} \] so a bit bigger than 8  
\[ (2.1)^3 \] is a bit bigger than \[ 2^3 \] so a bit bigger than 8

\[ \frac{1}{0.1} = 10 \] and as 0.09 is less than 0.1, \[ \frac{1}{0.09} > 10 \] so is the largest

\[ \sqrt{65} \quad \frac{1}{0.09} \quad 7.9 \quad (2.1)^3 \]  B1  Total 1

5  
e.g.  
\[ C \quad S \quad V \]

5 : 4  
3 : 2

\[ 5 : 4 = 15 : 12 \]
\[ 3 : 2 = 12 : 8 \]  M1

Giving

\[ C \quad S \quad V \]

15 : 12 : 8  Choc to Vanilla = 15 : 8  M1 A1  Total 3

6  
e.g.  Total cost = 140 + 315 = £455
Total income = 12 \times 62
= 620 + 124 = £744  B1

Money raised = 744 - 455 = £289
Money raised per person = £289 \div 62:

\[
\begin{array}{c|cccc}
62 & 2 & 8 & 9 & 0 \\
\hline
62 & 4 & 1 & 0 \\
3 & 7 & 2 \\
3 & 8 & 0 \\
3 & 7 & 2 \\
\hline
8 & 0
\end{array}
\]

\[ 4.66 \text{ (to the nearest penny)} \]  A1  Total 4
7 (a) In the 5th week he will have added 10 minutes on four times
1 hour + 4 × 10 minutes = 1 hour 40 minutes  
M1
A1
(b) 2 hours has been added on to the original time
2 hours = 120 minutes = 12 × 10 minutes  
M1
He spends 3 hours in the 13th week of the year  
A1
(c) In 52nd week he’d spend 1 hour + 51 × 10 minutes  
51 × 10 minutes = 510 minutes
510 minutes = 510 ÷ 60 hours = 8.5 hours  
M1
In 52nd week he’d spend 1 + 8.5 = 9.5 hours on the treadmill
There are 24 × 7 = 168 hours in a week  
M1
Naz is wrong, 9.5 hours is less than a tenth of the hours in a week  
A1
Total 7

8 (a) \[
\frac{1}{2} x + 9 > 3x - 6 \\
\frac{1}{2} x + 15 > 3x \\
x + 30 > 6x \\
30 > 5x \\
x < 6
\]
M1
A1
(b) B1

(c) By inspection, \( x \) can be +ve or -ve but it's magnitude must be larger than or equal to \( \sqrt{16} = 4 \)
\[
x \leq -4 \quad \text{or} \quad x \geq 4
\]
M1 A1
[OR: \( x^2 - 16 \geq 0 \), \( (x + 4)(x - 4) \geq 0 \), c.v. = ±4

\text{graph or table etc. leading to above answer}]  
Total 5

9 e.g. \[
\sqrt{26} + 1.98 = \frac{5 + 2}{36 - 8} = \frac{7}{28} = \frac{1}{4}
\]

\[
-8 \quad -3.5 \quad 0.25 \quad 1.4
\]
B1  Total 1

10 \[
1 - \frac{3}{8} = \frac{5}{8} \text{ of income not on rent}
\]
\[
1 - \frac{6}{11} = \frac{5}{11} \text{ of rest of income is saved}
\]
M1
Fraction saved = \( \frac{5}{11} \times \frac{5}{8} = \frac{25}{88} \)
M1 A1  Total 3
11 (a) \( \frac{1}{7} \) of 140 = 20
Let the no. of non-fiction paperbacks be \( x \)
The number of fiction hardbacks must be 140 – (80 + 20 + \( x \))
= 40 – \( x \)
So \( 80 + (40 - x) = 80 + x + 10 \)
120 – \( x \) = 90 + \( x \)
30 = 2\( x \)
\( x = 15 \) \hspace{1cm} [Intuitive methods are easier and fine!]

\[
\begin{array}{ccc}
& P & F \\
15 & 20 & \text{(20 and 80)} \hspace{1cm} \\
80 & & \\
25 & & \text{(15 and 25)} \\
\end{array}
\]

(b) \( \frac{20}{45} \) \hspace{1cm} \( = \frac{4}{9} \) \hspace{1cm} B1 

12 (a) \( f(11) = \frac{11 + 1}{2} = 6 \) \hspace{1cm} B1

(b) \( \frac{3}{x} = 9 \)
\( 3 = 9x \)
\( x = \frac{3}{9} = \frac{1}{3} \) \hspace{1cm} A1

(c) \( f\left(\frac{1}{2}\right) = \frac{\frac{1}{2} + 1}{2} = \frac{\frac{3}{2}}{2} = \frac{3}{4} \)
\( g\left(\frac{1}{2}\right) = g\left(\frac{3}{4}\right) = \frac{3}{3} = \frac{4}{3} = 4 \) \hspace{1cm} M1 A1

13 (a) 4 hours = 4 \times 60 \text{ minutes} = 6 \times 40 \text{ minutes}
Doubling 6 times = \( \times 2^6 = \times 64 \)
64 \times \( \frac{3}{4} \) million = 48 million
12 million 24 million 48 million 96 million \hspace{1cm} B1

(b) Each year the previous year's value is multiplied by 0.63
So new value = 63% of previous value
Annual % decrease = 100 – 63 = 37%
14 \( (a) \quad = (93 \times 10^6) + (8 \times 10^6) \)
\[= 101 \times 10^6 \quad \text{M1} \]
\[= 1.01 \times 10^8 \quad \text{A1} \]

\( (b) \quad = \frac{4.2}{1.4} \times \frac{10^4}{10^8} \)
\[= 3 \times 10^{10} \quad \text{M1 A1 Total 4} \]

15 Tangent perpendicular to radius:
Angle \(OAP = angle \ OCP = 90^\circ\)

Angles in quadrilateral total 360\(^\circ\):
\[Angle \ AOC = 360 - (90 + 90 + 36) = 360 - 216 = 144^\circ \quad \text{M1} \]

Angles around a point total 360\(^\circ\):
Reflex angle \(AOC = 360 - 144 = 216^\circ \quad \text{M1} \)

Angle subtended at centre is twice angle subtended on circumference:
\[Angle \ ABC = 216 \div 2 = 108^\circ \quad \text{A1 Total 3} \]

16 e.g. Let the average speed of both drivers be \(v\) mph

Speed = \(\frac{\text{distance}}{\text{time}}\) so time = \(\frac{\text{distance}}{\text{speed}}\)

For Gethin, time = \(\frac{85}{v}\) and for Bella, time = \(\frac{75}{v}\) \(\text{M1} \)

Gethin's journey takes 12 minutes longer = \(\frac{1}{5}\) hour longer

So,
\[\frac{85}{v} = \frac{75}{v} + \frac{1}{5} \quad \text{M1} \]
\[85 = 75 + \frac{1}{5}v \]
\[\frac{1}{5}v = 10 \quad \text{M1} \]
\[v = 50 \quad \text{A1} \]

Bella's journey time = \(\frac{75}{50} = 1.5\) hours = 1 hour 30 mins
They arrive at 10.42 am

[Note, quick method: Gethin must have covered 10 miles in 12 minutes] \(\text{Total 4}\)
(a) Number of sales (S) | Number of days | Class width | Frequency density
---|---|---|---
10 ≤ S < 30 | 5 | 20 | 0.25
30 ≤ S < 40 | 8 | 10 | 0.8
40 ≤ S < 45 | 9 | 5 | 1.8
45 ≤ S < 50 | 6 | 5 | 1.2
50 ≤ S < 60 | 2 | 10 | 0.2

(b) e.g. The advert has been successful as there is a higher frequency density for more than 40 sales and a lower frequency density for less than 40 sales meaning that sales have increased.

(c) \[ 5 \times 0.6 + 5 \times 2.0 + 5 \times 1.4 + 10 \times 0.4 = 3 + 10 + 7 + 4 = 24 \text{ days} \]

(d) e.g. It assumed that the days in the 30 to 40 class were split evenly with half being below 35 and half being 35 or over.
18. Triangle $BDE$ is equilateral so each internal angle = $60^\circ$

Angle $CBD = \text{angle } BDE = 60^\circ$ (alternate angles)  

\[
\tan 60^\circ = \frac{CD}{BD} \quad \text{so} \quad \sqrt{3} = \frac{CD}{8} \\
CD = 8\sqrt{3} \text{ cm} \\
\cos 60^\circ = \frac{BD}{BC} \quad \text{so} \quad \frac{1}{2} = \frac{8}{BC} \\
\frac{1}{2} BC = 8 \Rightarrow BC = 16 \text{ cm} \\
AB = 21 - 16 = 5 \text{ cm} \\
\text{Angle } ABE = \text{angle } BED = 60^\circ \text{ (alternate angles)} \\
AE^2 = AB^2 + BE^2 - 2 \times AB \times BE \times \cos 60^\circ \\
AE^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \times \frac{1}{2} \\
AE^2 = 25 + 64 - 40 = 49 \\
AE = 7 \text{ cm (length so positive)} \\
\text{Perimeter} = 21 + 8\sqrt{3} + 8 + 7 = (36 + 8\sqrt{3}) \text{ cm}  

19. Triangle $ABC$ is similar to triangle $AMN$

Length scale factor = $\frac{15}{6} = \frac{5}{2}$  

Area scale factor = $\left(\frac{5}{2}\right)^2 = \frac{25}{4}$  

Area of triangle $AMN$ to area of triangle $ABC = 4 : 25$  

Area of triangle $AMN$ to area of quadrilateral $BCNM = 4 : 21$

20. (a) $27^{\frac{2}{3}} = \left(27^{\frac{1}{3}}\right)^{\frac{2}{1}} = 3^2 = 9$  

(b) $25^{\frac{1}{3}} = (5^2)^{\frac{1}{3}} = 5^{\frac{2}{3}}$  

\[
125^{\frac{1}{3}} = (\text{5}^3)^{\frac{1}{3}} = 5^{-1} \\
\text{So, } \quad 5^{2x} = \frac{7}{2} \times 5^{-1} \\
5^{2x} = \frac{7}{2} \times 1 = 5^2 \\
2x = \frac{5}{2} \\
x = \frac{5}{4} 
\]
21  e.g.  Regular hexagon so length of $PQ = \text{length of } ST$
$PS$ is common to both triangles so length is the same
B1
Regular hexagon so opposite sides are parallel
Therefore angles $QPS$ and $TSP$ are alternate and equal
M1
We have two pairs of equal sides and the angle between them
is also equal, hence congruent by SAS
A1 Total 3

22  Rearrange:  
$3x + 2y = 26$
$2y = 26 - 3x$
$y = 13 - \frac{3}{2}x$
Gradient of tangent $= -\frac{3}{2}$
M1
Gradient of radius perpendicular to tangent $= \frac{-1}{-\frac{3}{2}} = \frac{2}{3}$
M1
Radius passes through origin so equation is  
$y = \frac{2}{3}x$
Sub $y = \frac{2}{3}x$ into $3x + 2y = 26$ to find point on circle:
$3x + 2\left(\frac{2}{3}x\right) = 26$
$9x + 4x = 78$
$13x = 78$
$x = 6$
When $x = 6$, $y = \frac{2}{3} \times 6 = 4$
Hence $(6, 4)$ is point where tangent touches circle
Let radius be $r$:  
$r^2 = 6^2 + 4^2$
$r^2 = 36 + 16 = 52$
Equation of circle is  
$x^2 + y^2 = r^2$
So,  
$x^2 + y^2 = 52$
A1 Total 5

23  $(4x + a)(x - 2) = 4x^2 - 8x + ax - 2a$
$(2x + 1)^2 = 4x^2 + 4x + 1$
So,  
$4x^2 - 8x + ax - 2a \equiv 4x^2 + 4x + 1 + b$
Hence:  
$-8 + a = 4$
$a = 12$
M1
And:  
$-2a = 1 + b$
$-24 = 1 + b$
$b = -25$
A1 Total 5

TOTAL FOR PAPER: 80 MARKS