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.
1 75% of 70% = 0.75 \times 0.7 = 0.525 = 52.5%

100 – 70 = 30% of animals are not dogs
40% of 30% = 0.4 \times 0.3 = 0.12 = 12%
% of all that come back within 1 month = 52.5 + 12 = 64.5%

| 55.5% | 64.5% | 65.5% | 67.5% | B1 | Total 1 |

2 e.g.

\[ y = 5 \]
\[ x = -3 \]
\[ y = 2x - 5 \]
\[ y = -3x + 1 \]

| y = 5 | x = -3 | B1 | Total 1 |

3 (a) \[ 225 + 110 + 270 + 85 = 690 \]
\[ 690 \div 30 = 23g \]

15g 17g 19g 23g

(b) \[ \frac{180}{270} = \frac{2}{3} \]
\[ \frac{2}{3} \text{ of } 30 = 20 \text{ cookies} \]

15 18 20 24

(c) To make 30 costs:

\[ \frac{225}{250} \times 85 + \frac{110}{2000} \times 245 + \frac{270}{1500} \times 100 + \frac{85}{100} \times 80 \]
\[ = 76.6 + 13.475 + 18 + 68 \]
\[ = 175.975 \text{p} \]

1 cookie costs \[ 175.975 \div 30 = 5.86...\text{p} = 5.9 \text{p (1dp)} \]

A1 | Total 5 |

4 First rectangle: Height = 6 + 4 = 10 cm
Width = 2 \times 6 = 12 cm
Perimeter = 2 \times (10 + 12) = 2 \times 22 = 44 cm

Second rectangle: Height = 6 cm
Width = 5 \times 4 = 20 cm
Perimeter = 2 \times (6 + 20) = 2 \times 26 = 52 cm

Increase in perimeter = 52 – 44 = 8 cm

% increase = \[ \frac{8}{44} \times 100\% = 18.18...\% \]

The perimeter increases by 18.2% (3sf)

A1 | Total 3 |
Quarter circle radius 10 cm  
Quarter circles radius 6, 4 and 3 cm  
All correct and accurate

6  
\[
\begin{align*}
1 \text{ m}^2 &= 100 \times 100 = 10000 \text{ cm}^2 \\
20 \text{ cm}^2 &= 20 \div 10000 \text{ m}^2 = 0.002 \text{ m}^2
\end{align*}
\]

0.2 m\(^2\) 0.02 m\(^2\) 0.002 m\(^2\) 0.0002 m\(^2\)  
B1 Total 1
7 e.g.

<table>
<thead>
<tr>
<th></th>
<th>Year 10</th>
<th>Year 11</th>
<th>Total</th>
</tr>
</thead>
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<tr>
<td>Boys</td>
<td>13</td>
<td></td>
<td>37</td>
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<tr>
<td>Girls</td>
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</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
<td>75</td>
</tr>
</tbody>
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Leading to

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<td>20</td>
<td>38</td>
</tr>
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<td>75</td>
</tr>
</tbody>
</table>

\[ P(\text{Yr10 girl}) = \frac{18}{75} = \frac{6}{25} \] A1 Total 3

8 (a) £8800

(b) Marketing Fund (£)

\[
\text{Gradient} \approx \frac{4600 - 8800}{25 - 0} = -168
\] M1 A1

(c) e.g. That the charity spent £168 per day from the marketing fund B1 Total 4
9  Let Ayyub have \( x \) eggs
Bran has \((x + 1)\) eggs
Curtis has \(1.5(x + 1)\) eggs

So, \[ x + (x + 1) + 1.5(x + 1) = 48 \]
\[ 3.5x + 2.5 = 48 \]
\[ 3.5x = 45.5 \]
\[ 7x = 91 \]
\[ x = 13 \]

Curtis has \(1.5(13 + 1) = 1.5 \times 14 = 21\) eggs
He must end up with \(48 \div 3 = 16\) eggs
Curtis gives away 5 eggs

10  Common ratio = 0.5
\[ 5^{th} = 2 \div 2 = 1, \quad 6^{th} = 1 \div 2 = 0.5, \]
\[ 7^{th} = 0.5 \div 2 = 0.25, \quad 8^{th} = 0.25 \div 2 = 0.125 \]

11  \[ \frac{x^2 - 6x + 9}{2x - 6} = \frac{(x - 3)^2}{2(x - 3)} = \frac{x - 3}{2} \]
\[ \frac{x^2 + 9}{2} \quad x^2 - 8x + 15 \quad \frac{x - 15}{2} \quad \frac{x - 3}{2} \]

12  (a) e.g. The median of 5 numbers will be the 3rd one when they are arranged in order of size so it will be one of the numbers. As all the numbers are odd, the median will be odd.
(b) e.g. No. For example, if we have 2, 4, 6, 8, 12, the total of the numbers is 32 and the mean is \(32 \div 5 = 6.4\) which is not an even number.

13  (a) \[ x = \frac{x+10}{x^2+4} \]
e.g. He has cancelled the \(x\) on top with the one on the bottom. This is wrong because neither \(x\) is a factor, you cannot subtract something from top and bottom of a fraction without changing it
(b) In multiplying out the bracket she hasn’t multiplied the \(x\) by the 4
In factorising the quadratic the signs are the wrong way round
(c) \[ x^2 + 4x = x + 10 \]
\[ x^2 + 3x - 10 = 0 \]
\[ (x + 5)(x - 2) = 0 \]
\[ x = -5 \quad \text{or} \quad 2 \]
14  (a)  e.g.  7 is a prime number
When \( p = 7 \), \( 2p + 1 = 15 \)
\( 15 = 3 \times 5 \) so 15 is not prime, hence Faruq is not correct  

\[ [There \ are \ many \ other \ values \ of \ p \ that \ can \ be \ used.] \]

(b)  e.g.  2 is the only even prime number
As \( p \) and \( q \) are both greater than 2 they must be odd
\( pq \) will be odd \( \times \) odd giving an odd answer
\( pq + 1 \) will be odd \( + \) 1 giving an even answer
\( pq + 1 \) is greater than 2 so the answer cannot be prime

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15  Area of triangle \( ABC = \frac{1}{2} \times 7.5 \times 4 = 15 \text{ cm}^2 \)

Pythagoras:\n\( AC^2 = 7.5^2 + 4^2 \)
\( = 56.25 + 16 = 72.25 \)
\( AC = \sqrt{72.25} = 8.5 \text{ cm} \)

Similarity:\n\( \frac{DC}{8.5} = \frac{7.5}{4} \)
\( DC = \frac{8.5 \times 7.5}{4} = 15.9375 \text{ cm} \)

Area of triangle \( ACD = \frac{1}{2} \times 8.5 \times 15.9375 = 67.73... \text{ cm}^2 \)

Area of quadrilateral \( ABCD = 15 + 67.73... = 82.7 \text{ cm}^2 \) (3sf)

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16  \(-1 \leq \sin x \leq 1\)
\(-3 \leq 3 \sin x \leq 3\)
\(5 \leq 8 - 3 \sin x \leq 11\)

\(3\ 5\ 8\ 11\)

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17  (a)  e.g.  After 1 minute, 20% of the original amount is lost.
After another minute, 20% of the new, smaller amount is lost
which is less than 20% of the original amount. Hence, after
5 minutes they haven't lost 100% (5 \( \times \) 20\%) of the original.

(b)  When reduced by 20\%, 80\% or 0.8 is left
After 1 minute, amount left is 0.8 \( \times \) \£8000 ( = \£6400 )
After 2 full minutes, amount left = 0.8 \( \times \) 0.8 \( \times \) \£8000 = \£5120
Time ≈ 144 seconds

(b) Speed = gradient of tangent
At 800 m, speed ≈ \(\frac{880 - 680}{174 - 96} = 2.56\ldots\) m/s
At 400 m, speed ≈ \(\frac{740 - 0}{114 - 12} = 7.25\ldots\) m/s
7.25 \div 2 = 3.6...
Speed at end is less than half speed at halfway point
Gill is correct

A1 Total 4
19 (a) \[ y \]

(b) \[ y \]

20 (a) \[ T \propto m^2 \]

\[ T = km^2 \]

When \( m = 2 \), \( T = 15 \) so

\[ 15 = k \times 2^2 = 4k \]

\[ k = 15 + 4 = 3.75 \]

Hence, \( T = 3.75m^2 \)

When \( m = 6 \)

\[ T = 3.75 \times 6^2 \]

\[ T = 3.75 \times 36 = 135 \] as required

(b) e.g. If \( m \) increases by 4 again we have \( m = 10 \)

When \( m = 10 \)

\[ T = 3.75 \times 10^2 \]

\[ T = 3.75 \times 100 = 375 \]

However, 135 + 120 = 255 so \( T \) has not increased by 120

21 (a) Will's: \[ x_1 = 2.7071... \] Grace's: \[ x_1 = 2.3268... \]

\[ x_2 = 2.0853... \] \[ x_2 = 2.3506... \]

\[ x_3 = 2.6106... \] \[ x_3 = 2.3522... \]

\[ x_4 = 2.1511... \] \[ x_4 = 2.3523... \]

\[ x_5 = 2.5413... \] \[ x_5 = 2.3523... \]

Grace's process as it converges much more quickly

(b) Using Grace's process:

\[ x_4 = 2.352384... \]

\[ x_5 = 2.352392... \]

\[ x_6 = 2.352392... \]

\[ x = 2.3524 \text{ (4dp)} \]
22. Density = \[ \frac{\text{mass}}{\text{volume}} \]

\[ 3 = \frac{400}{\text{volume}} \]

Hence \( \frac{1}{2} \times \frac{4}{3} \pi r^3 = \frac{400}{3} \)

\[ r^3 = \frac{200}{\pi} \]

\[ r = \sqrt[3]{\frac{200}{\pi}} = 3.9929\ldots \text{ cm} \]

Volume of box = \( 7.99 \times 7.99 \times 3.99 \)

\[ = 254.6\ldots = 255 \text{ cm}^3 \text{ (3sf)} \]

A1

Total 4

23. (a) 1\textsuperscript{st} tablet can be any type (so probability = 1)

After 1\textsuperscript{st} tablet, there are 3 left of that type and 4 each of other types

\[ P(2\text{nd tablet is different type}) = \frac{8}{11} \]

After 2\textsuperscript{nd} tablet, and given 1\textsuperscript{st} and 2\textsuperscript{nd} were different, there are 3 left of each type that she's had already and 4 left of the third type

\[ P(3\text{rd tablet is different type from 1\textsuperscript{st} and 2\textsuperscript{nd}}) = \frac{4}{10} \]

\[ P(\text{one of each type}) = 1 \times \frac{8}{11} \times \frac{4}{10} = \frac{32}{110} = \frac{16}{55} \]

M1 A1

(b) e.g. I have assumed that each type of tablet is equally likely to come out

B1

Total 4

24. (a) \[ \vec{AB} = \vec{OC} = 4q \]

\[ \vec{MB} = \frac{3}{4} \vec{AB} = 3q \]

\[ \vec{OB} = \vec{OA} = 2p \]

\[ \vec{NB} = \frac{1}{2} \vec{OA} = p \]

\[ \vec{MN} = \vec{MB} + \vec{BN} = \vec{MB} - \vec{NB} \]

\[ = 3q - p \quad \text{or} \quad -p + 3q \]

A1

(b) \[ \vec{OB} = \vec{OA} + \vec{AB} = 2p + 4q \]

\[ \vec{AM} = \frac{1}{4} \vec{AB} = q \]

\[ \vec{MP} = \frac{3}{5} \vec{MN} = \frac{3}{5}(-p + 3q) = -\frac{3}{5}p + \frac{9}{5}q \]

M1

\[ \vec{OP} = \vec{OA} + \vec{AM} + \vec{MP} \]

\[ = 2p + q + (-\frac{3}{5}p + \frac{9}{5}q) \]

\[ = \frac{7}{5}p + \frac{14}{5}q \]

\[ = \frac{7}{5}(p + 2q) \]

\[ = \frac{7}{10}(2p + 4q) = \frac{7}{10} \vec{OB} \]

So \( P \) is \( \frac{7}{10} \) of the way from \( O \) to \( B \) and therefore lies on \( OB \)

Dinesh is correct

A1

Total 6

TOTAL FOR PAPER: 80 MARKS