

## 2017 Paper 1 Marking Scheme

The Left Side is the solution.

The Right Side is a breakdown of how the marks were awarded

Q1	Model Solution – 25 Marks	Marking Notes
(a)	<p>(i) <math>BMI = \frac{77.5}{(1.63)^2}</math>  <math>= 29.169...</math>  <math>= 29.2</math> [1 D.P.]</p> <p>(ii) <math>w = BMI \times h^2</math>  <math>= 24 \times (1.63)^2</math>  <math>= 63.76...</math>  <math>= 63.8</math> [kg] [1 D.P.]</p>	<p><b>Scale 15D (0, 7, 9, 12, 15)</b></p> <p>Accept correct answers without work.  Accept correct answer without units in (ii).  <i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit in one part, for example: some correct substitution into either (i) <b>or</b> (ii).</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>(i) correct.</li> <li>Work of merit in both (i) <b>and</b> (ii).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Swaps 77.5 and 1.63 but finishes correctly.</li> <li>(ii) correct.</li> <li>(i) correct <b>and</b> work of merit in (ii).</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * to incorrect rounding the first time it occurs.</li> </ul>
(b)	<p><i>Answer:</i>  less than Jo's</p> <p><i>Justification – accept:</i>  Alex is dividing the same top line as Jo by a bigger number.</p> <p style="text-align: center;"><b>OR</b></p> $\frac{w}{(h + 0.10)^2} < \frac{w}{h^2}$ <p style="text-align: center;"><i>or any valid justification</i></p>	<p><b>Scale 10C (0, 5, 7, 10)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Correct answer.</li> <li>Work of merit in justification, for example: attempts to substitute in particular values to check.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Correct answer with work of merit in justification.</li> <li>Justification fully correct.</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * if answer given as "Jo's BMI is greater than Alex's"</li> </ul>

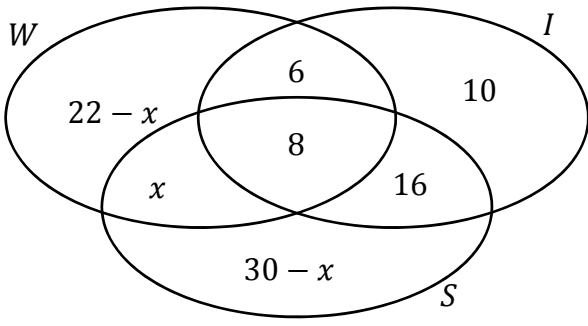
Q2	Model Solution – 20 Marks	Marking Notes
(a)	<p>Profit = <math>49 - 25 = €24</math></p> <p>(i) Mark up = <math>\frac{24}{25} \times 100 = 96 \%</math></p> <p>(ii) Margin = <math>\frac{24}{49} \times 100</math>  <math>= 48.9\ldots</math>  <math>= 49 \%</math> [nearest %]</p>	<p><b>Scale 15D (0, 7, 9, 12, 15)</b></p> <p>Accept correct answers without work.</p> <p>Accept correct answer without % sign (96 and 49).</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit in either (i) <b>or</b> (ii), for example: <math>49 - 25</math>; or something <math>\times 100</math>.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit in both (i) <b>and</b> (ii).</li> <li>Either (i) <b>or</b> (ii) correct.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>One part correct <b>and</b> work of merit in the other.</li> <li>Both correct as decimals rather than percentages (0.96 and 0.49).</li> <li>Calculates Margin in (i) and Mark up in (ii).</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * for incorrect rounding in (ii)</li> </ul>
(b)	<p>Markup = <math>50\% = 0.5 = \frac{\text{Profit}}{\text{Cost}}</math></p> <p><math>\Rightarrow P = 0.5C</math></p> <p><math>\Rightarrow \text{Selling Price (S)} = C + P = 1.5C</math></p> <p><math>\Rightarrow \text{Margin} = \frac{P}{S} = \frac{0.5C}{1.5C} = \frac{1}{3}</math>  <math>= 33\%</math> [nearest %]</p> <p><b>OR</b></p> <p><math>\frac{\frac{x}{2}}{x + \frac{x}{2}} \times 100 = \frac{1}{3} \times 100</math>  <math>= 33\frac{1}{3}</math>  <math>= 33\%</math> [nearest %]</p>	<p><b>Scale 5C (0, 2, 3, 5)</b></p> <p>Accept correct answer without work.</p> <p>Accept correct answer without % sign (33).</p> <p>Accept justification using particular values.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Makes relevant use of 50%, for example: 150%, or <math>1.5</math>, or <math>C = 2P</math>.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li><math>\frac{1}{3}</math>, or 0.33, or <math>0.\dot{3}</math></li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * for incorrect rounding, if not already applied in (a)(ii)</li> </ul>

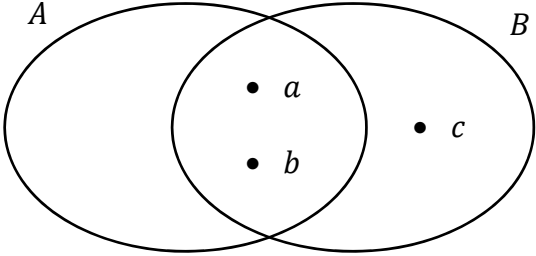
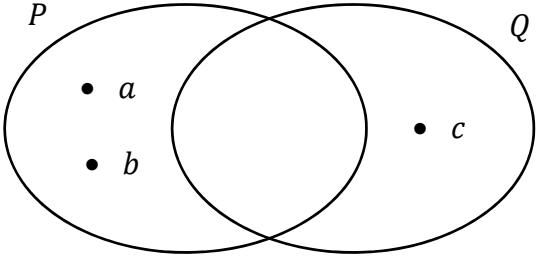
Q3	Model Solution – 15 Marks	Marking Notes
(a)	$868 \text{ million} = 868 \times 10^6$ $= 8.68 \times 10^2 \times 10^6$ $= 8.68 \times 10^8$	<p><b>Scale 5C (0, 2, 3, 5)</b></p> <p>Accept correct answer without work.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Some work of merit, for example: 1 000 000, or 8.68.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Correct value but not in correct form, for example: 868 000 000, or <math>868 \times 10^6</math></li> <li><math>8.68 \times 10^2</math> or <math>8.68 \times 10^6</math></li> </ul>
(b), (c)	<p>(b) 1.3 secs <math>\rightarrow</math> 380 000 km</p> <p>1 sec <math>\rightarrow \frac{380\,000}{1.3}</math> km</p> <p>1 min <math>\rightarrow 60 \times \frac{380\,000}{1.3}</math> km</p> <p><math>= 1.75 \times 10^7</math> [km/min] [2 D.P.]</p> <p>(c) <math>\frac{8.68 \times 10^8}{1.75 \times 10^7} = 49.6</math> [minutes]</p>	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Accept correct answers without units.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Some relevant calculation in either (b) <b>or</b> (c).</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>(b) <b>or</b> (c) correct</li> <li>Some relevant calculation in both (b) <b>and</b> (c).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>One part correct <b>and</b> some relevant calculation in the other</li> <li>Correct answers with no supporting work in (c)</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * for incorrect rounding in (b).</li> <li>Apply a * in (c) if candidate uses values in (c) other than their answer from (b).</li> </ul>

Q4	Model Solution – 15 Marks	Marking Notes
(a), (b)(i)	<p>(a) <math>£0.7241 = €1.00</math></p> <p><math>£1 = € \frac{1}{0.7241}</math></p> <p><math>£380 = € \frac{380}{0.7241}</math></p> <p><math>= €524.789 \dots</math></p> <p><math>= [€]524.79</math> [2 D.P.]</p> <p>(b)(i) <math>3 + 7 = 10</math></p> <p><math>\Rightarrow</math> Juice in <i>Fruitex</i> <math>= \frac{3}{10} \times 20</math></p> <p><math>= 6</math> [litres]</p>	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Accept correct answers without work.</p> <p>Accept correct answers without units.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Some relevant calculation in either (a) <b>or</b> (b).</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>Either (a) <b>or</b> (b) correct.</li> <li>Some relevant calculation in both (a) <b>and</b> (b).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Either (a) or (b) correct, <b>and</b> some relevant calculation in the other part.</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * for incorrect rounding in (a).</li> <li>Apply a * in (b)(i) if the amount of water is found (14 litres), or if 6 and 14 are found but answer is not identified.</li> </ul>
(b)(ii)	<p><math>7 + 8 = 15</math></p> <p><math>\Rightarrow</math> Juice in mix <math>= \frac{7}{15} \times 60</math></p> <p><math>= 28</math> litres</p> <p><math>\Rightarrow</math> Juice in <i>Juicy</i> <math>= 28 - 6 = 22</math> litres</p> <p><math>\Rightarrow</math> Water in <i>Juicy</i> <math>= 40 - 22 = 18</math> litres</p> <p><math>\Rightarrow</math> Ratio of juice to water in <i>Juicy</i></p> <p><math>= 22:18</math></p> <p><math>= 11:9</math></p> <p style="text-align: center;"><b>OR</b></p> <p><math>7:8 = 15</math> [Ratio in mixture]</p> <p><math>\Rightarrow 28:32 = 60</math> [Litres in mixture]</p> <p><math>- \underline{6:14}</math> [Litres in <i>Fruitex</i>]</p> <p><math>= 22:18</math> [Ratio in <i>Juicy</i>]</p> <p><math>= 11:9.</math> [Ratio in <i>Juicy</i>]</p>	<p><b>Scale 5C (0, 2, 3, 5)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit using the correct ratio, for example: <math>7 + 8</math></li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Finds 22 litres <b>or</b> 18 litres</li> <li>Correct answer without work</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>Apply a * for ratio not in simplest form.</li> </ul>

Q5	Model Solution – 25 Marks	Marking Notes
(a), (b)	<p>(a)(i) <math>20 + (5 \times 12) = [\text{€}] 80</math></p> <p>(a)(ii) <math>[\text{€}] 20 + 12n</math></p> <p>(b) <math>[\text{€}] 15 + 6n</math></p>	<p><b>Scale 15C (0, 8, 11, 15)</b></p> <p>Accept correct answers without work. Accept correct answers without units.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in one of the three parts, for example: in (a)(i): one relevant calculation; in (a)(ii): <math>7 + 12n</math> (coefficient of <math>n</math> correct), or <math>20 + 9n</math> (constant correct)</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (a)(ii) <b>and</b> (b)</li> <li>• (a)(ii) <b>or</b> (b) correct</li> </ul>

Q5	Model Solution – 25 Marks	Marking Notes
(c)	<p><b>Interpretation 1, Method 1:</b></p> $\frac{1}{4}(12n + 20) + \frac{2}{3}(6n + 15) = 200$ $3n + 5 + 4n + 10 = 200$ $7n + 15 = 200$ $7n = 185$ $n = \frac{185}{7} = 26.4 \dots$ <p>i.e. 27 [weeks]</p> <p style="text-align: center;"><b>OR</b></p> <p><b>Interpretation 1, Method 2:</b></p> <p>Pete: Starts with 5, plus 3 each week</p> <p>Maeve: Starts with 10, plus 4 each week</p> <p>In total: They start with 15, plus 7 each week</p> $\frac{200-15}{7} = 26.4 \dots$ <p>i.e. 27 [weeks]</p> <p style="text-align: center;"><b>OR</b></p> <p><b>Interpretation 2, Method 1:</b></p> <p>Pete: <math>\frac{1}{4}(12n + 20) = 200</math></p> $12n + 20 = 800$ $n = 65 \text{ [weeks]}$ <p>Maeve: <math>\frac{2}{3}(6n + 15) = 200</math></p> $12n + 30 = 600$ $n = 47.5$ <p>i.e. 48 [weeks]</p> <p style="text-align: center;"><b>OR</b></p> <p><b>Interpretation 2, Method 2:</b></p> <p>Pete: Starts with 5, plus 3 each week</p> $\frac{200-5}{3} = 65 \text{ [weeks]}$ <p>Maeve: Starts with 10, plus 4 each week</p> $\frac{200-10}{4} = 47.5$ <p>i.e. 48 [weeks]</p> <p style="text-align: center;"><b>OR</b></p> <p><b>Either Interpretation, Method 3:</b></p> <p>Solution via trial and improvement.</p>	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Accept correct answer without units.</p> <p>Accept solution using interpretation 1 or interpretation 2.</p> <p>If using trial and improvement, must have supporting work to show that the given answer is the smallest number of weeks that is sufficient.</p> <p>Consider the solution as having 4 steps:</p> <p><b>Step 1:</b> Sets up correct expression for either Pete <b>or</b> Maeve.</p> <p><b>Step 2:</b> Sets up correct expressions for Pete <b>and</b> Maeve; <b>OR</b> Solves correctly for either Pete <b>or</b> Maeve.</p> <p><b>Step 3:</b> Distributes the fractions correctly in equation(s).</p> <p><b>Step 4:</b> Solves equation(s).</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 1 step correct.</li> <li>• <math>12n + 20 + 6n + 15 = 200</math> solved correctly.</li> <li>• <math>12n + 20 = 200</math> <b>and</b> <math>6n + 15 = 200</math> both solved correctly.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 2 steps correct.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 3 steps correct.</li> <li>• Correct answer, but without supporting work to show that it is the smallest number of weeks that is sufficient.</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>• Apply * for incorrect / no rounding.</li> <li>• Apply * if <math>\frac{1}{4}</math> and <math>\frac{2}{3}</math> swapped.</li> </ul>

Q6	Model Solution – 35 Marks	Marking Notes
(a)		<p><b>Scale 15C (0, 8, 11, 15)</b></p> <p>Accept correct answer without work.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 2 regions correct</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 4 regions correct, which must include one of W only or S only, in terms of <math>x</math></li> </ul>
(b)	$36 + 10 + 16 + (30 - x) = 80$ $92 - x = 80$ $x = 12$	<p><b>Scale 5B (0, 2, 5)</b></p> <p>Accept correct answer without work.</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit, for example: some relevant use of 80 or <math>x</math>, or solves an incorrect linear equation correctly</li> </ul>
(c)	<p><b>S1:</b> 8 students have all 3 apps, <i>or equivalent</i></p> <p><b>S2:</b> <math>24 = \#(I \cap S)</math></p> <p><b>S3:</b> 10 students have Instagram only, <i>or equivalent</i></p> <p><b>S4:</b> <math>\#S &gt; \#W</math></p>	<p><b>Scale 15D (0, 7, 9, 12, 15)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in one of the four statements.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 2 statements correct.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 3 statements correct.</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>• Apply a * for a missing #, at most once.</li> </ul>

Q7	Model Solution – 5 Marks	Marking Notes
(a), (b)	<p>(a) Any two sets <math>A</math> and <math>B</math> for which <math>A \subset B</math>, for example: <math>A = \{1,2,3\}</math>; <math>B = \{1,2,3\}</math></p> <p style="text-align: center;"><b>OR</b></p>  <p style="text-align: center;"><i>or any other valid example</i></p> <p>(b) Any two sets <math>P</math> and <math>Q</math> for which <math>P \cap Q = \{ \}</math>, for example: <math>P = \{1,2,3,4\}</math>; <math>Q = \{5,6,7,8\}</math></p> <p style="text-align: center;"><b>OR</b></p>  <p style="text-align: center;"><i>or any other valid example</i></p>	<p><b>Scale 5D (0, 2, 3, 4, 5)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (a) <b>or</b> (b), for example: in (a), indication of a set fully inside a larger set; in (b), indication of mutually exclusive sets, or some explanation of what's left in <math>P</math> after taking away <math>Q</math></li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• (a) <b>or</b> (b) correct.</li> <li>• Work of merit in both (a) <b>and</b> (b).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• (a) or (b) correct, <b>and</b> work of merit in the other part.</li> </ul>



Q8	Model Solution – 30 Marks	Marking Notes
(a), (b)	<p>(a)</p> <p>Answer: <i>Lecky</i></p> <p>Reason: Cuts <math>y</math>-axis at <math>(0, 0)</math></p> <p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;"><math>b(x)</math> starts at 50 <i>or any other valid reason</i></p> <p>(b)</p> <p>Domain: <math>0 \leq x \leq 1000</math></p> <p>Range: <math>50 \leq l(x) \leq 325</math></p>	<p><b>Scale 15D (0, 7, 9, 12, 15)</b></p> <p>Accept 0, 1000 and 50, 325 in (b)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (a) <b>or</b> (b), for example: in (a), answer or reason correct; in (b), domain or range correct but in the wrong box; or a pair of values in either box with minimum or maximum correct.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in both (a) <b>and</b> (b)</li> <li>• Either (a) <b>or</b> (b) correct</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Either (a) or (b) correct, <b>and</b> work of merit in the other part.</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>• Apply a * to 275 given as the range in (b)</li> </ul>
(c)	<p>(i) <math>100 &lt; x &lt; 800</math></p> <p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;">“Between 100 and 800”</p> <p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;">(100, 800)</p> <p>(ii) “<i>Buzz</i> is cheaper if the number of units used is between these two values.”</p> <p style="text-align: center;"><i>or any other valid explanation</i></p>	<p><b>Scale 5D (0, 2, 3, 4, 5)</b></p> <p>Accept tolerance of <math>\pm 20</math> in (i)</p> <p>Note that answer to (i) must be in a valid form.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (i) <b>or</b> (ii), for example: in (i), 100 or 800 identified on graph; or relevant region of graph identified; in (ii), explanation of some merit.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Either (i) <b>or</b> (ii) correct.</li> <li>• Work of merit in both (i) <b>and</b> (ii).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Either (i) or (ii) correct, <b>and</b> work of merit in the other part.</li> </ul>

Q8	Model Solution – 30 Marks	Marking Notes
(d)	<p>(i)      Slope    <math>= \frac{325-50}{1000-0}</math>  <math>= \frac{275}{1000}</math> <b>or</b> 0.275 <b>or</b> <math>\frac{11}{40}</math></p> <p>(ii)    “The cost of electricity rises by €0.275 for every one unit increase of usage.”  <i>or any other valid explanation</i></p>	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Accept: “each unit costs €0.275”, or equivalent, in (ii)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (i) <b>or</b> (ii), for example:  in (i), uses diagram to show understanding of slope;  or <math>\frac{\text{Rise}}{\text{Run}}</math> with some substitution; or <math>\frac{11}{20}</math>;  in (ii), explanation of some merit.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Either (i) <b>or</b> (ii) correct.</li> <li>• Work of merit in both (i) <b>and</b> (ii).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Either (i) or (ii) correct, <b>and</b> work of merit in the other part.</li> </ul>

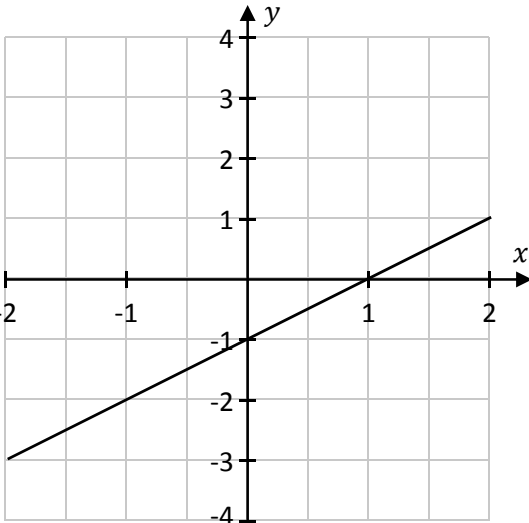
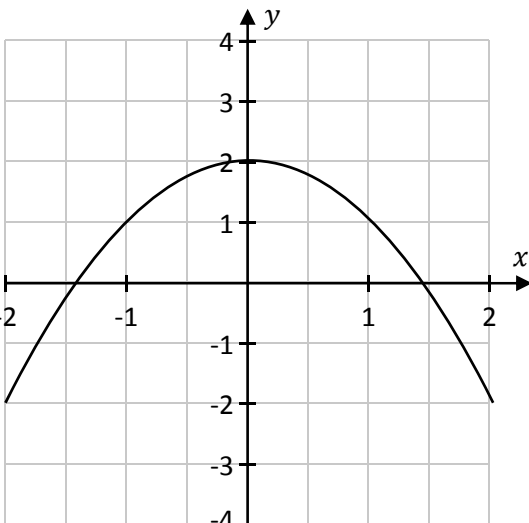
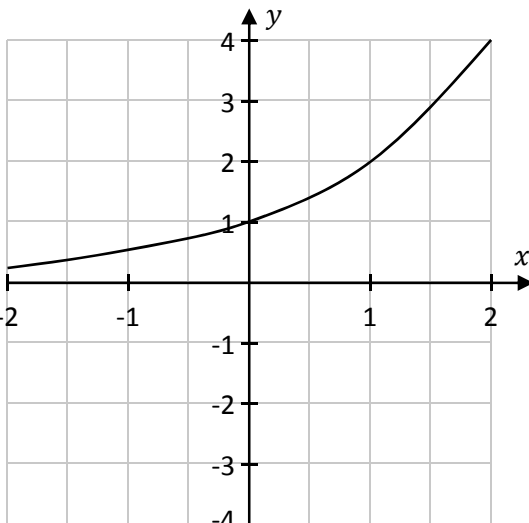
Q9	Model Solution – 25 Marks	Marking Notes																									
(a)	$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-4)}}{2(1)}$ $x = \frac{2 \pm \sqrt{20}}{2}$ $x = 1 \pm \sqrt{5}$	<p><b>Scale 10C (0, 5, 7, 10)</b></p> <p>Accept “<math>1 + \sqrt{5}</math> and <math>1 - \sqrt{5}</math>”.</p> <p>Consider the solution as having 3 steps:</p> <p><b>Step 1:</b> Identifies <math>a</math>, or <math>b</math>, or <math>c</math>.</p> <p><b>Step 2:</b> Full correct substitution into the quadratic formula.</p> <p><b>Step 3:</b> Evaluates the quadratic formula.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"><li>• 1 step</li></ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"><li>• 2 steps</li><li>• Correct answer without work</li></ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"><li>• Apply a * for the correct answer not in surd form (<math>-1.236 \dots</math> and <math>3.236 \dots</math>)</li></ul>																									
(b)	$(c + \sqrt{d})^2$ $= (c + \sqrt{d}) \cdot (c + \sqrt{d})$ $= c^2 + c\sqrt{d} + c\sqrt{d} + (\sqrt{d})^2$ $= c^2 + 2c\sqrt{d} + d$	<p><b>Scale 5C (0, 2, 3, 5)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"><li>• <math>(c + \sqrt{d}) \cdot (c + \sqrt{d})</math></li><li>• <math>c^2</math></li><li>• <math>c\sqrt{d}</math></li></ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"><li>• <math>c^2 + c\sqrt{d} + c\sqrt{d} + (\sqrt{d})^2</math></li></ul>																									
(c)	<table><tr><td></td><td>N</td><td>Z</td><td>Q</td><td><math>\mathbb{R} \setminus \mathbb{Q}</math></td></tr><tr><td>16</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td></tr><tr><td><math>\sqrt{6}</math></td><td>No</td><td>No</td><td>No</td><td>Yes</td></tr><tr><td><math>\frac{2}{3}</math></td><td>No</td><td>No</td><td>Yes</td><td>No</td></tr><tr><td><math>-4</math></td><td>No</td><td>Yes</td><td>Yes</td><td>No</td></tr></table>		N	Z	Q	$\mathbb{R} \setminus \mathbb{Q}$	16	Yes	Yes	Yes	No	$\sqrt{6}$	No	No	No	Yes	$\frac{2}{3}$	No	No	Yes	No	$-4$	No	Yes	Yes	No	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Note that 12 answers are required.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"><li>• 4 answers correct</li></ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"><li>• 1 row or 1 column fully correct</li></ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"><li>• 2 rows or 2 columns fully correct</li></ul>
	N	Z	Q	$\mathbb{R} \setminus \mathbb{Q}$																							
16	Yes	Yes	Yes	No																							
$\sqrt{6}$	No	No	No	Yes																							
$\frac{2}{3}$	No	No	Yes	No																							
$-4$	No	Yes	Yes	No																							

Q10	Model Solution – 10 Marks	Marking Notes
(a)	$2^{3+5+10} = 2^{18}$	<p><b>Scale 5B (0, 2, 5)</b></p> <p>Accept correct answer without work.</p> <p><i>No Credit</i></p> <ul style="list-style-type: none"> <li>Evaluates the given number.</li> </ul> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit involving indices, for example: <math>18, 2^8, 2^{13}, 2^{15}</math></li> </ul>
(b), (c)	<p>(b) <math>8^{25} = (2^3)^{25} = 2^{75}</math></p> <p>(c) <math>\sqrt{8} = (2^3)^{\frac{1}{2}} = 2^{\frac{3}{2}}</math> <b>or</b> <math>2^{1.5}</math></p>	<p><b>Scale 5D (0, 2, 3, 4, 5)</b></p> <p>Accept correct answer without work for both parts.</p> <p><i>No Credit</i></p> <ul style="list-style-type: none"> <li>Evaluates the given number.</li> </ul> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>Work of merit in either (b) <b>or</b> (c) involving indices, for example: 8 written as <math>2^3</math> in (b) or (c); or a square root written as a power of <math>\frac{1}{2}</math> in (c).</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>Either (b) <b>or</b> (c) correct.</li> <li>Work of merit in both (b) <b>and</b> (c).</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>Either (b) or (c) correct, <b>and</b> work of merit in the other part.</li> </ul>

Q11	Model Solution – 20 Marks	Marking Notes
(a)	$116 - 40 = 76$ $\frac{76}{4} = 19$ $40 - 19 = 21$ $40 + 19 = 59$ , etc.  Answer: 21, 40, 59, 78, 97, 116	<b>Scale 10C (0, 5, 7, 10)</b> Accept correct answer without work. <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>Applies knowledge of linear sequences, for example: <math>116 - 40</math>, or indicates a common difference.</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li>Finds or uses 19.</li> <li>Uses <math>\frac{76}{n}</math> (for <math>n \in \mathbb{N}, n \neq 4</math>) and finishes correctly from one of the given values.</li> </ul>
(b)	1st differences: 1, 3, 5, 8, 8, 11 2nd differences: 2, 2, 3, 0, 3  1st differences should be: 1, 3, 5, 7, 9, 11, i.e. 2nd difference of 2.  Answer: 5, 6, 9, 14, 21, 30, 41	<b>Scale 10C (0, 5, 7, 10)</b> Accept correct answer without work. Accept correct sequence not written in answer boxes. <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>Finds 2 first differences of given sequence.</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li>Finds all 2nd differences of given sequence.</li> <li>Identifies 2 as the correct 2nd difference.</li> </ul>

Q12	Model Solution – 35 Marks	Marking Notes									
(a)	$(n - 2)(n - 9)$ <b>OR</b> <table border="1"> <tr> <td></td><td><math>n</math></td><td><math>-9</math></td></tr> <tr> <td><math>n</math></td><td><math>n^2</math></td><td><math>-9n</math></td></tr> <tr> <td><math>-2</math></td><td><math>-2n</math></td><td><math>18</math></td></tr> </table> so $(n - 2)(n - 9)$ <b>OR</b> $n^2 - 11n + 18$ $= n^2 - 9n - 2n + 18$ $= n(n - 9) - 2(n - 9)$ $= (n - 9)(n - 2)$		$n$	$-9$	$n$	$n^2$	$-9n$	$-2$	$-2n$	$18$	<b>Scale 5C (0, 2, 3, 5)</b> Accept correct answer without work. <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>Work of merit, for example:  <math>(n - 2)</math> or <math>(n - 9)</math>, or any pair of factors of 18, or <math>n^2 - 9n - 2n + 18</math>.</li> <li>Some correct substitution into the quadratic formula</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li>Factors which multiply to give 2 correct coefficients of the given expression, including the signs, for example:  <math>(n + 2)(n + 9)</math>, or <math>(n - 5)(n - 6)</math>.</li> <li><math>n(n - 9) - 2(n - 9)</math></li> <li>Solves <math>n^2 - 11n + 18 = 0</math> (without factorising).</li> </ul>
	$n$	$-9$									
$n$	$n^2$	$-9n$									
$-2$	$-2n$	$18$									
(b)	$y(w - 1) + 1(w - 1)$ $= (w - 1)(y + 1)$ or $(1 - w)(-y - 1)$ <b>OR</b> $w(y + 1) - 1(y + 1)$ $= (y + 1)(w - 1)$ or $(1 - w)(-y - 1)$	<b>Scale 5C (0, 2, 3, 5)</b> <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>Work of merit, for example: a common factor identified from given expression</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li><math>w(y + 1) - 1(y + 1)</math></li> <li>Correct answer without work</li> </ul>									
(c)	$\frac{5}{3(4)-2} - \frac{7}{6(4)-12}$ $= \frac{5}{10} - \frac{7}{12}$ $= -\frac{5}{60} = -\frac{1}{12}$ <b>or</b> $-0.083 \dots$	<b>Scale 10B (0, 5, 10)</b> Accept correct answer without work <i>Partial Credit</i> <ul style="list-style-type: none"> <li><math>3(4) - 2</math> or <math>6(4) - 12</math></li> </ul>									
(d)	$\frac{(2e-3)(2e+3)}{(2e-3)(e+3)}$ $= \frac{(2e+3)}{(e+3)}$	<b>Scale 5D (0, 2, 3, 4, 5)</b> <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>Work of merit in either numerator <b>or</b> denominator</li> </ul> <i>Mid Partial Credit</i> <ul style="list-style-type: none"> <li>Numerator <b>or</b> denominator factorised correctly</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li>Numerator or denominator factorised correctly, <b>and</b> work of merit in the other</li> </ul>									

Q12	Model Solution – 35 Marks	Marking Notes												
(e)	<p><b>Method 1:</b></p> $(x - 3)(ax^2 + bx + c)$ $= ax^3 + bx^2 + cx - 3ax^2 - 3bx - 3c$ <p><math>x^3</math> term: <math>a = 2</math></p> <p>constant: <math>c = 4</math></p> <p><math>x^2</math> term: <math>b - 3a = -13</math></p> $b = -13 + 3(2) = -7$ <p style="text-align: center;"><b>OR</b></p> <p><b>Method 2:</b></p> $\begin{array}{r} 2x^2 - 7x + 4 \\ x - 3 \overline{) 2x^3 - 13x^2 + 25x - 12} \\ \underline{2x^3 - 6x^2} \phantom{+ 12} \\ -7x^2 + 25x - 12 \\ \underline{-7x^2 + 21x} \phantom{- 12} \\ 4x - 12 \\ \underline{4x - 12} \\ 0 \end{array}$ $\Rightarrow a = 2, b = -7, c = 4$ <p style="text-align: center;"><b>OR</b></p> <p><b>Method 3:</b></p> <table border="1"><tr><td></td><td><math>2x^2</math></td><td><math>-7x</math></td><td><math>4</math></td></tr><tr><td><math>x</math></td><td><math>2x^3</math></td><td><math>-7x^2</math></td><td><math>4x</math></td></tr><tr><td><math>-3</math></td><td><math>-6x^2</math></td><td><math>21x</math></td><td><math>-12</math></td></tr></table> $\Rightarrow a = 2, b = -7, c = 4$		$2x^2$	$-7x$	$4$	$x$	$2x^3$	$-7x^2$	$4x$	$-3$	$-6x^2$	$21x$	$-12$	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p>Accept <math>2x^2 - 7x + 4</math> as answer.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"><li>• Multiplication set up (Method 1)</li><li>• Division set up (Method 2)</li><li>• Array set up (Method 3) with either <math>2x^3</math> or <math>-12</math> placed correctly</li></ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"><li>• 1 coefficient correct</li></ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"><li>• 2 coefficients correct</li><li>• Correct answer without work</li></ul>
	$2x^2$	$-7x$	$4$											
$x$	$2x^3$	$-7x^2$	$4x$											
$-3$	$-6x^2$	$21x$	$-12$											

Q13	Model Solution – 15 Marks	Marking Notes
	<p>Points on <math>y = x - 1</math> are <math>(-2, -3)</math> and <math>(2, 1)</math>.</p> 	<p><b>Scale 15D (0, 7, 9, 12, 15)</b></p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> <li>• Work of merit for 1 graph, for example: 1 point found, with supporting work; or y-intercept correct; or slope correct for line; or two points correct on graph.</li> </ul> <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 1 correct graph <b>and</b> work of merit on 1 other graph.</li> <li>• Work of merit on all 3 graphs.</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• 2 correct graphs <b>and</b> work of merit on 3rd</li> <li>• 5 points plotted for all 3 graphs</li> </ul> <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> <li>• Apply a * for one point incorrectly plotted</li> </ul>
	<p>Points on <math>y = 2 - x^2</math> are:  <math>(-2, -2)</math>; <math>(-1, 1)</math>; <math>(0, 2)</math>; <math>(1, 1)</math>; <math>(2, -2)</math>.</p> 	<p>Points on <math>y = 2^x</math> are:  <math>(-2, 0.25)</math>; <math>(-1, 0.5)</math>; <math>(0, 1)</math>; <math>(1, 2)</math>; <math>(2, 4)</math>.</p> 



Q14	Model Solution – 20 Marks	Marking Notes
(a), (c)	(a) $360 + 180 = 540^\circ$ $540 + 180 = 720^\circ$  (c) $\frac{360}{4} = 90^\circ$ $\frac{540}{5} = 108^\circ$ $\frac{720}{6} = 120^\circ$	<b>Scale 10D (0, 4, 6, 8, 10)</b> Accept correct answers without units (degree symbol). <i>Low Partial Credit</i> <ul style="list-style-type: none"> <li>1 of the 5 values correct.</li> </ul> <i>Mid Partial Credit</i> <ul style="list-style-type: none"> <li>(a) or (c) correct.</li> </ul> <i>High Partial Credit</i> <ul style="list-style-type: none"> <li>(a) or (c) correct, <b>and</b> 1 value correct in the other part.</li> </ul>
(b)	$180(n - 2)$ [degrees] <b>OR</b> $180n - 360$ [degrees]	<b>Scale 5B (0, 2, 5)</b> Accept correct answer without units. Accept correct formula in words. <i>Partial Credit</i> <ul style="list-style-type: none"> <li>Work of merit, for example: <math>180n</math>, or <math>360n - 360</math>.</li> </ul>
(d)	$\frac{180(n-2)}{n}$ [degrees] <b>OR</b> $\frac{180n-360}{n}$ [degrees]	<b>Scale 5B (0, 2, 5)</b> Accept correct answer without units. Accept correct formula in words. <i>Partial Credit</i> <ul style="list-style-type: none"> <li>Work of merit, for example: <math>\frac{k}{n}, k \in \mathbb{R}</math>.</li> </ul>

Q15	Model Solution – 5 Marks	Marking Notes
	Answer: C Reason: Some $x$ values have more than one $y$ value <i>or any other valid reason</i>	<b>Scale 5B (0, 2, 5)</b> <i>Partial Credit</i> <ul style="list-style-type: none"> <li>C identified as answer</li> <li>Shows understanding of the relevant feature of a function, for example: vertical line drawn.</li> </ul>