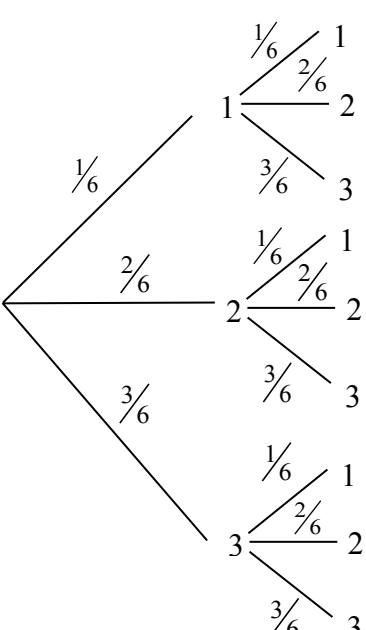


Question Number	Scheme	Marks																																																	
1.	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="border-right: 1px solid black; padding-right: 5px;"></td> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">3</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">4</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> </tr> <tr> <td style="border-right: 1px solid black; padding-right: 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">6</td> </tr> </table> <p style="margin-left: 20px;">∴ P (sum at least 5) = <math>\frac{21}{36} = \frac{7}{12}</math></p>		1	2	2	3	3	3	1	2	3	3	4	4	4	2	3	4	4	5	5	5	2	3	4	4	5	5	5	3	4	5	5	6	6	6	3	4	5	5	6	6	6	3	4	5	5	6	6	6	<p style="text-align: right;"><math>2 \times (1, 2, \dots, 3)</math> M1</p> <p style="text-align: right;">Adding M1</p> <p style="text-align: right;">All <math>\geq 5</math> correctly indicated A1</p> <p style="text-align: right;">Attempt to count <math>\geq 5</math> M1</p> <p style="text-align: right;"><math>\frac{21}{36}; \frac{7}{12}; 0.58\dot{3}; 0.583</math> A1</p> <p style="text-align: right;"><b>(5 marks)</b></p>
	1	2	2	3	3	3																																													
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Alt 1	 <p style="margin-left: 20px;">Tree with relevant branches M1</p> <p style="margin-left: 20px;">All correct - <math>\frac{2}{6}, \frac{3}{6}</math> on those branches A1</p> <p style="margin-left: 20px;"><math>P(\text{sum at least } 5) = \left(\frac{2}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{2}{6}\right) + \left(\frac{3}{6} \times \frac{3}{6}\right)</math> (At least 2 pairs &amp; adding) M1</p> <p style="margin-left: 20px;"><math>= \frac{21}{36}; \frac{7}{12}; 0.58\dot{3}; 0.583</math> A1</p>	<p style="text-align: right;">M1</p> <p style="text-align: right;">A1</p> <p style="text-align: right;">M1</p> <p style="text-align: right;">A1</p> <p style="text-align: right;">A1 (5)</p>																																																	

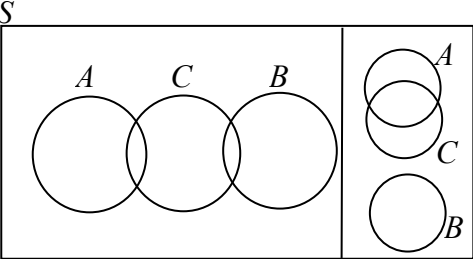
Question Number	Scheme	Marks												
<p><b>Alt 2</b></p>	<p>Outcomes (2, 3), (3, 3), (3, 2)</p> $\left(\frac{2}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{2}{6}\right)$ $\frac{21}{36}$	<p>Recognising 2 pairs All correct Can be implied Multiplying 2 pairs of 2 probs. &amp; adding All correct</p> <p>M1 A1 M1 A1 A1 (5)</p>												
<p><b>Alt 3</b></p>	<p><math>P(\text{sum} \geq 5) = 12 \left(\frac{1}{6} \times \frac{1}{6}\right) + 9 \left(\frac{1}{6} \times \frac{1}{6}\right)</math></p> $\frac{21}{36}$	<p><math>a(p_1 \times p_2)</math> or <math>b(p_1 \times p_2)</math> <math>p_1 = p_2 = \frac{1}{6}</math> <math>a() + b()</math> 21 or 12 + 9</p> <p>M1 A1 M1 A1 A1 (5)</p>												
<p><b>Alt 4</b></p>	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 5px;"><math>x</math></td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> </tr> <tr> <td style="padding: 5px;"><math>P(X=x)</math></td> <td style="padding: 5px;"><math>\frac{1}{36}</math></td> <td style="padding: 5px;"><math>\frac{4}{36}</math></td> <td style="padding: 5px;"><math>\frac{10}{36}</math></td> <td style="padding: 5px;"><math>\frac{12}{36}</math></td> <td style="padding: 5px;"><math>\frac{9}{36}</math></td> </tr> </table> <p><math>P(X \geq 5) = \frac{12}{36} + \frac{9}{36}</math></p> $\frac{21}{36}$	$x$	2	3	4	5	6	$P(X=x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$	<p>2, 3, 4, 5, 6 Adding probability All correct Adding P(5) &amp; P(6)</p> <p>M1 M1 A1 M1 A1 (5)</p>
$x$	2	3	4	5	6									
$P(X=x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$									

Question Number	Scheme	Marks
2. (a)	Scatter diagram Labels (not $x, y$ ) Sensible scales allow axis interchange Points (-1 ee)	B1 B1 B2 (4)
(b)	$S_{hc} = 884484 - \frac{1562 \times 5088}{9} = 1433\frac{1}{3}$ $S_{hh} = 1000\frac{2}{9}; S_{cc} = 2550$ (NB: accept :- 9; i.e.: - 159 $\frac{7}{27}$ ; 111 $\frac{11}{81}$ ; 283 $\frac{1}{3}$ )	correct use of $S$ 1433 $\frac{1}{3}$ ; 1433. $\dot{3}$ 1000 $\frac{2}{9}$ , 1000. $\dot{2}$ ; 2550 M1 A1 A1; A1 (4)
(c)	$r = \frac{1433\frac{1}{3}}{\sqrt{1000\frac{2}{9} \times 2550}}$ $= 0.897488\dots$	substitution in correct formula AWRT 0.897(accept 0.8975) A1 ft A1 (3)
(d)	Taller people tend to be more confident	context B1 (1)
(e)	$b = \frac{1433.\dot{3}}{1000.\dot{2}} = 1.433014\dots$	M1
(f)	$a = \frac{5088}{9} - \frac{1433.\dot{3}}{1000.\dot{2}} \times \frac{1562}{9} = 316.6256\dots$ $\therefore c = 317 + 1.43h$	allow use of their $b$ 3sf A1 (3)
(g)	$h = 180 \Rightarrow c = 574.4 \text{ or } 574.5683\dots$	sub. of 180 574 - 575 M1 A1 (2)
(g)	$161 \leq h \leq 193$	B1 (1)
NB (a) No graph paper $\Rightarrow$ 0/4		<b>(18 marks)</b>

Question Number	Scheme	Marks
3.	(a) $0.5 + b + a = 1$ $0.3 + 2b + 3a = 1.7$ $\therefore a = 0.4$	use of $\sum P(X=x) = 1$ use of $E(x) = \sum xP(X=x)$ M1 A1 M1 A1
	(b) $b = 0.1$ $P(0 < X < 1.5) = P(X = 1) = 0.3$	$a = 0.4, b = 0.1$ B1 (5) B1 (1)
	(c) $E(2X - 3) = 2E(X) - 3$ $= 2 \times 1.7 - 3 = 0.4$	Use of $E(aX + b)$ M1 A1 (2)
	(d) $\text{Var}(X) = (1^2 \times 0.3) + (2^2 \times 0.1) + (3^2 \times 0.4) - 1.7^2$ $= 1.41$ (*)	Use of $E(x^2) - \{E(x)\}^2$ M1 A1 ft (3)
	(e) $\text{Var}(2X - 3) = 2^2 \text{Var}(X)$ $= 4 \times 1.41 = 5.64$	CSO Use of Var M1 A1 (2)
		<b>(13 marks)</b>

Question Number	Scheme	Marks												
4. (a)(i)	$\bar{x} = \frac{270}{16} = 16.875$	16.875, $16\frac{7}{8}$ ; 16.9; 16.88												
	$sd = \sqrt{\frac{4578}{16} - 16.875^2}$	$\frac{\sum x^2}{16} - \bar{x}^2$ & $\sqrt{\quad}$												
	= 1.16592....	All correct AWRT 1.17												
	(ii) Mean % attendance = $\frac{16.875}{18} \times 100 (= 93.75)$	cao	B1 ft (5)											
	(b)	First 4 1 means 14      Second 1 8 means 18												
	(1)                    4   1    4 4 4                    (3)    Both Labels and 1 key	B1												
	(1)                    5   1    5 5 5 5                    (4)    Back-to-back													
	(3)                    6 6 6   1    6 6 6                    (3)    S and L	M1												
	(5)                    7 7 7 7 7   1    7                    (1)    (ignore totals)	dep.												
	(6)                    8 8 8 8 8 8   1    8 8 8                    (3)    Sensible splits of 1		M1											
	(0)                      1    9                    (1)    First-correct		A1											
	(0)                      2    0                    (1)    Second - correct		A1 (5)											
(c)	<table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Mode</th> <th>Median</th> <th>IQR</th> </tr> </thead> <tbody> <tr> <td>First</td> <td>18</td> <td>17</td> <td>2</td> </tr> <tr> <td>Second</td> <td>15</td> <td>16</td> <td>3</td> </tr> </tbody> </table>		Mode	Median	IQR	First	18	17	2	Second	15	16	3	B1 B1 B1 B1 B1 B1 (6)
	Mode	Median	IQR											
First	18	17	2											
Second	15	16	3											
(d)	<p>Median<sub>S</sub> &lt; Median<sub>F</sub>; Mode<sub>F</sub> &gt; Mode<sub>S</sub>;  Second had larger spread/IQR  Only 1 student attends all classes in second  Mean%<sub>F</sub> &gt; Mean%<sub>S</sub></p>	<p>ANY THREE sensible  comments</p>	B1 B1 B1 (3)											
		<b>(19 marks)</b>												

Question Number	Scheme	Marks
<p>5.</p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	<p>Let <math>L</math> represent length of visit <math>\therefore L \sim N(90, \sigma^2)</math></p> <p><math>P(L &lt; 125) = 0.80</math> or <math>P(L &gt; 125) = 0.20</math></p> <p><math>\therefore P\left(Z &lt; \frac{125 - 90}{\sigma}\right) = 0.8</math> <math>\therefore P\left(L &gt; \frac{125 - 90}{\sigma}\right) = 0.20</math></p> <p><math>\therefore \frac{125 - 90}{\sigma} = 0.8416</math></p> <p><math>\therefore \sigma = \frac{35}{0.8416} = 41.587\dots</math></p> <p><math>P(L &lt; 25) = P\left(Z &lt; \frac{125 - 90}{41.587\dots}\right)</math></p> <p><math>= P(Z &lt; -1.56)</math></p> <p><math>= 1 - P(Z &lt; 1.56)</math> For use of symmetry or <math>\Phi(-z) = 1 - \Phi(z)</math>; <math>p &lt; 0.5</math></p> <p><math>= 0.0594</math></p> <p><math>90 + 3\sigma = 215 \Rightarrow 6.25</math> pm for latest arrival</p> <p><math>90 + 2\sigma = 173.3 \Rightarrow 7.07</math> pm for latest arrival</p> <p><math>\therefore</math> This normal distribution is <u>not</u> suitable.</p>	<p>Standardising, <math>\pm(125 - 90), \sigma/\sigma^2/\sqrt{\sigma}</math></p> <p>M1</p> <p>0.8416 B1</p> <p><math>\frac{\pm(125 - 90)}{\sigma} = z</math> value M1</p> <p>AWRT 41.6 A1 (4)</p> <p>Standardising 25, 90, their +ve 41.587 M1</p> <p>M1</p> <p>A1 (3)</p> <p>B1</p> <p>Based on <math>2\sigma/3\sigma</math> rule</p> <p>B1 (2)</p> <p><b>(9 marks)</b></p>

Question Number	Scheme	Marks
<p>6. (a)</p>	 <p><math>A, B, C</math> inside <math>S</math>  <math>A, B</math> no overlap  <math>A, C</math> overlap</p>	<p>B1                  B1                  B1 (3)</p>
(b)	$P(A C) = \frac{P(A \cap C)}{P(C)} = \frac{P(A)P(C)}{P(C)} = P(A)$ <p style="text-align: right;">Use of independence</p>	<p>M1                  A1 (2)</p>
(c)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ <p style="text-align: right;">use of <math>P(A \cup B)</math> &amp; <math>P(A \cap B) = 0</math> can be implied</p> $= 0.2 + 0.4 - 0$ $= 0.6$	<p>M1                  A1 (2)</p>
(d)	$P(A \cup C) = P(A) + P(C) - P(A \cap C)$ <p style="text-align: right;">Use of <math>P(A \cup C)</math> &amp; independence</p> $\therefore 0.7 = 0.2 + P(C) - 0.2 P(C)$ $\therefore 0.5 = P(C) \{1 - 0.2\}$ <p style="text-align: right;">Solving for <math>P(C)</math> from an equation with <math>2P(C)</math> terms</p> $\therefore P(C) = \frac{5}{8}$	<p>M1                  A1                  M                  A1 (4)</p>
<p>NB <math>P(B \cup C) = P(B) + P(C) - P(B \cap C)</math>  <math>= 0.4 + 0.625 - P(B \cap C) \Rightarrow P(B \cap C) &gt; 0</math></p>		<p><b>(11 marks)</b></p>