

# **Leaving Certificate 2023**

## **Mathematics**

### **Marking Scheme**

#### **Ordinary Level**

#### **Paper 2**

## Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect). Scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

Scale label	A	B	C	D
No of categories	2	3	4	5
5-mark scale		0, 3, 5	0, 3, 4, 5	0, 2, 3, 4, 5
10-mark scale			0, 4, 6, 10	0, 4, 6, 8, 10
15-mark scale			0, 5, 10, 15	0, 5, 8, 12, 15

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

### Marking scales – level descriptors

#### B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

#### C-scales (four categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

#### D-scales (five categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (mid partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work, or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may also be awarded. Such cases are denoted with a \* and this level of credit is referred to as *Full Credit -1*. Thus, for example, in Scale 10C, *Full Credit -1* of 9 marks may be awarded.

The only marks that may be awarded for a question are those on the scale above, or *Full Credit -1*.

A rounding penalty is applied each time it occurs in the scheme. There is no penalty for omitted units if the question specifies the unit to be used in the answer, and there is generally no penalty for an omitted euro symbol in questions involving money.

Throughout the scheme a correct relevant formula written is regarded as Work of merit, award the lowest non-zero level of credit (typically *Partial Credit* or *Low Partial Credit*, as appropriate).

In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

Unless otherwise specified, an answer without sufficient supporting work is generally awarded the lowest non-zero level of credit (typically *Partial Credit* or *Low Partial Credit*, as appropriate).

### Summary of mark allocations and scales to be applied

Section A (150) Answer any five questions		Section B (150) Answer any three questions	
<b>Question 1 (30)</b>	<b>Question 4 (30)</b>	<b>Question 7 (50)</b>	<b>Question 9 (50)</b>
(a)(i) 10C	(a)(i) 5C	(a)(i) 10C	(a)(i)(iii) 10C
(a)(ii) 10C	(a)(ii) 10C	(a)(ii) 10C	(a)(ii) 5C
(b) 5C	(a)(iii) 5B	(a)(iii) 10C	(a)(iv) 15C
(c)(i)(ii) 5D	(b) 10C	(a)(iv) 10C	(b)(i) 10C
		(b) 5C	(b)(ii) 5C
		(c) 5C	(b)(iii) 5D
<b>Question 2 (30)</b>	<b>Question 5 (30)</b>		<b>Question 10 (50)</b>
(a)(i)(ii) 10D	(a)(b) 10D	<b>Question 8 (50)</b>	(a) 10C
(a)(iii) 5C	(c) 5C	(a) 10C	(b) 10C
(b) 15D	(d) 5C	(b)(i) 10C	(c)(i) 10C
	(e) 10C	(b)(ii) 10C	(c)(ii) 5C
<b>Question 3 (30)</b>	<b>Question 6 (30)</b>	(c)(i) 5C	(c)(iii) 5C
(a)(i) 5C	(a) 15D	(c)(ii) 5C	(d) 10C
(a)(ii) 10C	(b) 5C	(c)(iii) 10D	
(a)(iii) 5B	(c) 10C		
(b)(i)(ii) 10D			

## Palette of annotations available to examiners

Symbol	Name	Meaning in the body of the work	Meaning when used in the right margin
	Tick	Work of relevance	The work presented in the body of the script merits full credit
	Cross	Incorrect work (distinct from an error)	The work presented in the body of the script merits 0 credit
	Star	Rounding / Unit / Arithmetic error Misreading	
	Horizontal wavy	Error	
<b>P</b>			The work presented in the body of the script merits partial credit
<b>L</b>			The work presented in the body of the script merits low partial credit
<b>M</b>			The work presented in the body of the script merits mid partial credit
<b>H</b>			The work presented in the body of the script merits high partial credit
	F star		The work presented in the body of the script merits Full Credit (– 1)
	Left Bracket		Another version of this solution is presented elsewhere and it merits equal or higher credit
	Vertical wavy	No work on this page (portion of the page)	
	Oversimplify	The candidate has oversimplified the work	
	Work of Merit	There is some value in the work	

**Note:** Where work of substance is presented in the body of the script, the annotation on the right margin should reflect a combination of annotations in the work

In a **C scale** where \* and and appear in the body of the work, then **L** should be placed in the right margin.

In the case of a **D scale** with the same annotations, **M** should be placed in the right margin.

A in the body of the work may sometimes be used to indicate where a portion of the work presented has value and has merited one of the levels of credit described in the marking scheme. The level of credit is then indicated in the right margin.

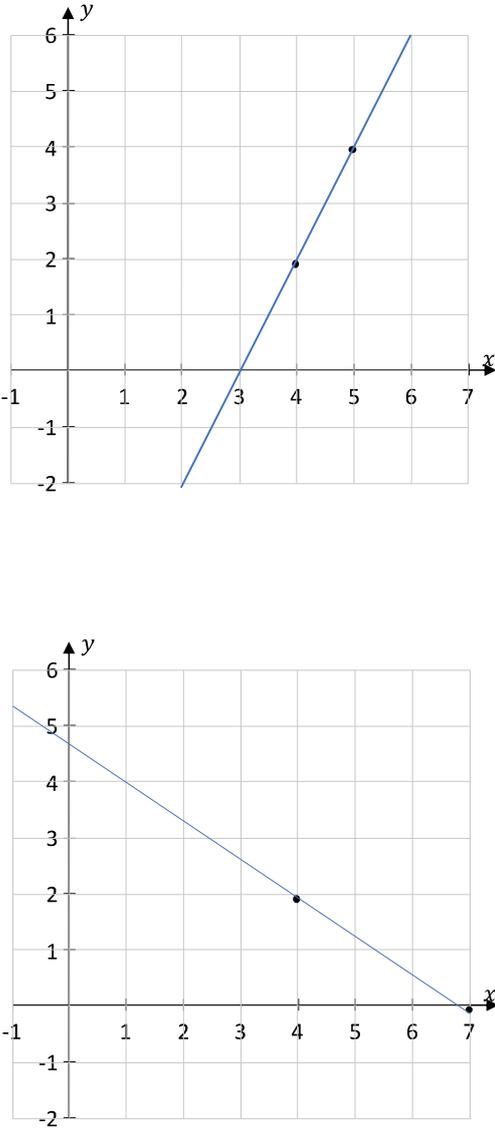
## Detailed marking notes

### Model Solutions & Marking Notes

**Note:** The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

Q1	Model Solution – 30 Marks	Marking Notes
(a) (i)	<p>Slope of A(4,2) to B(1,8)</p> $= \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{8 - 2}{1 - 4}$ $= -2$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• Error(s) in substitution but finishes correctly</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(a) (ii)	<p>Distance of (4,2) to (1,8)</p> $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(1 - 4)^2 + (8 - 2)^2}$ $= \sqrt{(-3)^2 + (6)^2}$ $= \sqrt{9 + 36}$ $= \sqrt{45}$ <p>or <math>3\sqrt{5}</math></p> <p>or (6 · 7....)</p>	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• Error(s) in substitution but finishes correctly</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>

Q1	Model Solution – 30 Marks	Marking Notes
(b)	$y - y_1 = m(x - x_1)$ $y - 7 = \frac{1}{3}[x - (-2)]$ $3(y - 7) = 1(x + 2)$ $3y - 21 = x + 2$ $x - 3y + 23 = 0$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• One error in substitution but finishes correctly</li> <li>• Answer not in required format</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• <math>x - 3y + 23</math></li> </ul>

Q1	Model Solution – 30 Marks	Marking Notes
<p>(c) (i) &amp; (ii)</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 (i) <u>or</u> (ii)</li> <li>• In(c)(i) line drawn with slope <math>-2</math> <u>or</u> In(c)(ii) line drawn with slope <math>\frac{2}{3}</math></li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <b>and</b> (ii)</li> <li>• One part correct</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One part correct and work of merit in the other</li> <li>• In(c)(i) line drawn with slope <math>-2</math> <u>and</u> In(c)(ii) line drawn with slope <math>\frac{2}{3}</math></li> </ul> <p><b>Note:</b> Accept correct line segments outside the Range and Domain for Full Credit</p>

Q2	Model Solution – 30 Marks	Marking Notes
<p>(a)</p> <p>(i)</p> <p>&amp;</p> <p>(ii)</p>	<p>(i)</p> <p>Centre = (0, 0)</p> <p>Radius = 5</p> <p>(ii)</p> $(3)^2 + (-4)^2 = 25$ $9 + 16 = 25$ $\Rightarrow \text{On the circle}$ <p>or</p> <p>Distance from (0,0) to (3, -4)</p> $\sqrt{(3 - 0)^2 + (-4 - 0)^2} = 5$ $= \text{radius} \Rightarrow \text{on circle}$	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <b>or</b> (ii)</li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <b>and</b> (ii)</li> <li>• One part correct</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One part correct and work of merit in the other</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• No conclusion in (ii)</li> </ul>
<p>(a)</p> <p>(iii)</p>	<p>Any two points on the circle given</p> <p>e.g. (3,4), (-3,4), (0,5), (5,0) etc.</p>	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> <li>e.g. Some substitution into equation of s</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One correct point given</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul> <p><i>Full Credit(-1):</i></p> <ul style="list-style-type: none"> <li>• Answers not given as a pair of coordinates</li> </ul>

Q2	Model Solution – 30 Marks	Marking Notes
(b)	$y = 5x - 13$ $x^2 + (5x - 13)^2 = 13$ $x^2 + 25x^2 - 130x + 169 - 13 = 0$ $26x^2 - 130x + 156 = 0$ $x^2 - 5x + 6 = 0$ $(x - 2)(x - 3) = 0$ <p>Thus <math>x = 2</math> and <math>x = 3</math>  giving <math>y = -3</math> and <math>y = 2</math></p> <p>[Hence Pts (3, 2) and (2, -3)]</p> <p style="text-align: center;"><u>or</u></p> <p>Trial and Error Method where both points are tested in both equations</p>	<p><b>Scale 15D (0, 5, 8, 12, 15)</b></p> <p><b>Four steps involved in solution.</b></p> <ol style="list-style-type: none"> <li>1. Express one variable in terms of the other</li> <li>2. Substitutes into the quadratic</li> <li>3. Find values of one variable</li> <li>4. Find values of second variable</li> </ol> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Some work of merit</li> </ul> <p>e.g. Work in isolating one variable  e.g. One point tested in one equation</p> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Two steps correct</li> </ul> <p>e.g. One point tested in both equations</p> <p style="text-align: center;"><u>or</u></p> <p>e.g. Two points tested in one equation</p> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Three steps correct</li> </ul> <p>e.g. One point tested in both equations</p> <p style="text-align: center;"><u>and</u></p> <p>Other point tested in one equation only</p>

3	Model Solution – 30 Marks	Marking Notes
(a) (i)	$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040 \text{ ways}$ <p style="text-align: center;"><u>or</u></p> $7! = 5040$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Some correct terms multiplied</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• All terms listed but not multiplied</li> <li>• One error in substitution but finishes correctly</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(a) (ii)	$1 \times 5 \times 4 \times 3 \times 2 \times 1 \times 4 = 480 \text{ ways}$ <p style="text-align: center;"><u>or</u></p> $5! \times 4 = 480$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Indicates <math>\times 4</math> for vowels</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Terms listed but not multiplied</li> <li>• One error in substitution but finishes correctly</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(a) (iii)	$\binom{7}{P}{3} = 210$ <p style="text-align: center;"><u>or</u></p> $(7)(6)(5) = 210$	<p><b>Scale 5B (0, 3, 5)</b></p> <p><i>Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. 7 or 6 or 5 identified</li> <li>• Lists at least one 3 letter arrangement</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>

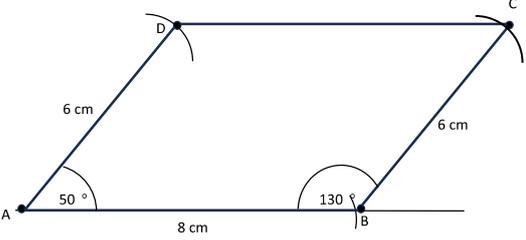
3	Model Solution – 30 Marks	Marking Notes										
	<table border="1"> <tr> <td data-bbox="336 217 676 271">Correlation coefficient</td> <td data-bbox="676 217 871 271">0.95</td> <td data-bbox="871 217 1066 271">0.6</td> <td data-bbox="1066 217 1260 271">–0.95</td> </tr> <tr> <td data-bbox="336 271 676 356">Scatterplot (A, B, or C)</td> <td data-bbox="676 271 871 356">B</td> <td data-bbox="871 271 1066 356">C</td> <td data-bbox="1066 271 1260 356">A</td> </tr> </table>	Correlation coefficient	0.95	0.6	–0.95	Scatterplot (A, B, or C)	B	C	A			
Correlation coefficient	0.95	0.6	–0.95									
Scatterplot (A, B, or C)	B	C	A									
<b>(b)</b> <b>(i)</b> <b>&amp;</b> <b>(ii)</b>	<p><b>(i)</b> Table above</p> <p><b>(ii)</b> Strong positive linear correlation so as <math>x</math> goes up <math>y</math> goes up.</p> <p style="text-align: center;"><u>or</u></p> <p><b>(ii)</b> Points all lie close to a positive straight line</p>	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <u>or</u> (ii) e.g. one correct correlation coefficient identified in (i)</li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <u>and</u> (ii)</li> <li>• One part correct</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One part correct and work of merit in the other</li> </ul>										

4	Model Solution – 30 Marks	Marking Notes
(a) (i)	$S.S.S = (0.7)(0.7)(0.7)$ $= 0.343 \text{ or } \frac{343}{1000} \text{ or } 34.3\%$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. <math>0.7</math> or <math>\frac{7}{10}</math> written</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct layout with full substitution e.g. <math>0.7^3</math> or <math>\left(\frac{7}{10}\right)^3</math></li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answers without supporting work</li> </ul> <p><i>Zero Credit:</i></p> <ul style="list-style-type: none"> <li>• Probability greater than 1</li> </ul>
(a) (ii)	$S.S.F = (0.7)(0.7)(0.3)$ $= 0.147$ <p>Three arrangements</p> $0.147 \times 3 = 0.441 \left(\frac{441}{1000}\right)$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. indicates three arrangements</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct layout with correct substitution</li> <li>• Answer as <math>0.147</math> or <math>\frac{147}{1000}</math></li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answers without supporting work</li> </ul> <p><i>Zero Credit:</i></p> <p>Probability greater than 1</p>
(a) (iii)	<p>Previous performance levels may affect future performance.</p>	<p><b>Scale 5B (0, 3, 5)</b></p> <p><i>Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Partial explanation</li> </ul>

4	Model Solution – 30 Marks	Marking Notes
(b)	$\mu = \frac{\sum fx}{\sum f}$ $= \frac{4(0)+5(6)+4(8)+2(10)+3(12)+1(16)}{4+5+4+2+3+1}$ $= \frac{0 + 30 + 32 + 20 + 36 + 16}{19}$ $= \frac{134}{19} = 7.05263$ <p>= 7.05 points scored</p>	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Some addition of numerator or denominator terms</li> <li>• 134 and/or 19 without work</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• One error and finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>

5	Model Solution – 30 Marks	Marking Notes
(a) & (b)	<p>(a) 6 cm</p> <p>(b)</p> $\begin{aligned} \text{Area} &= \pi r^2 \\ &= \pi(6)^2 \\ &= 36\pi \\ &= 113 \cdot 097 \\ &= 113 \cdot 10 \text{ cm}^2 \end{aligned}$	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (a) <u>or</u> (b) e.g. work on diagram for (a)</li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One part correct</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One part correct and work of merit in the other part</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> <li>• Incorrect or omitted units</li> <li>• Leaves answer in terms of <math>\pi</math></li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answers without supporting work</li> </ul>
(c)	$\begin{aligned} \frac{\text{Area circle}}{\text{Area square}} &= \frac{113 \cdot 10}{12 \times 12} \\ &= 0 \cdot 7854 \times 100 \\ &= 78 \cdot 54[\%] \\ &= 79[\%] \end{aligned}$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Finds Area of square</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• <math>\frac{113 \cdot 10}{12 \times 12} \times 100</math> or <math>0 \cdot 7854</math></li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>

5	Model Solution – 30 Marks	Marking Notes
(d)	$x^2 = 12^2 + 12^2$ $x^2 = 288$ $x = \sqrt{288}$ $x = 16.9705$ $\text{Radius} = \frac{16 \cdot 9705}{2}$ $= 8 \cdot 4853$ $= 8 \cdot 49$ <p style="text-align: center;"><b><u>or</u></b></p> $x^2 = 6^2 + 6^2$ $x^2 = 72$ $x = \sqrt{72}$ $x = 8 \cdot 4853$ $x = 8 \cdot 49$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Pythagoras Theorem formula written as <math>c^2 = a^2 + b^2</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• <math>x = \frac{\sqrt{288}}{2}</math> or <math>\sqrt{72}</math> with work</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><i>Zero Credit:</i></p> <ul style="list-style-type: none"> <li>• No correct substitution and no formula</li> </ul>
(e)	$\text{Circumference} = 2\pi r$ $= 2\pi(8 \cdot 49)$ $= 53 \cdot 344$ $= 53 \cdot 34 \text{ cm}$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> <li>• Incorrect or omitted units</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul> <p><i>Zero Credit:</i></p> <ul style="list-style-type: none"> <li>• <math>53 \cdot 3</math> without work</li> </ul>

6	Model Solution – 30 Marks	Marking Notes
(a)		<p><b>Scale 15D (0, 5, 8, 12, 15)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. <u>ONE</u> correct element</li> <li>• Work on diagram</li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Any <u>TWO</u> elements correct towards constructing a parallelogram</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• <u>THREE</u> or more elements correct</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• If [AD] is on the horizontal and the construction is correct</li> </ul>
(b)	$2x - 30 = 100$ $2x = 130$ $x = 65$ $x + 3y = 80$ $65 + 3y = 80$ $3y = 80 - 65$ $3y = 15$ $y = 5$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. sets up equation, indicates knowledge of opposite angles in a parallelogram being equal or adjacent angles summing to <math>180^\circ</math></li> <li>• Work on diagram</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Value of <math>x</math> found</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Answer without supporting work that gives <math>y = 65, \quad x = 5</math></li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answers without supporting work</li> </ul>

6	Model Solution – 30 Marks	Marking Notes
(c)	<p style="text-align: center;">Statement ..... True</p> <p><b>Justification:</b>  Opposite sides are parallel and equal in length.</p> <p style="text-align: center;"><u>or</u></p> <p>Any other valid reason</p>	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Correct box (True) ticked but no work of merit in Justification</li> <li>• Incorrect box (False) ticked but some correct knowledge of the properties of a parallelogram or square indicated</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct box ticked and work of merit in Justification</li> </ul>

Section B		
Q7	Model Solution – 50 Marks	Marking Notes
(a) (i)	$\text{Gradient} = \frac{24}{135} \times 100$ $= 17.7\%$ $= 18[\%]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. formula with some substitution</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(a) (ii)	$\frac{12}{100} = \frac{16}{x}$ $12x = 1600$ $x = \frac{1600}{12} = 133.33 \text{ m}$ $ AC  = 133 \text{ [m]}$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Gradient formula with some substitution</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>•  AC  isolated correctly</li> <li>• One error in substitution and finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>

Section B		
Q7	Model Solution – 50 Marks	Marking Notes
(a) (iii)	$x^2 + 27^2 = 105^2$ $x^2 + 729 = 11025$ $x^2 = 11025 - 729 = 10296$ $x = \sqrt{10296}$ $x = 101.469$ $x = 101 \text{ m}$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Correct relevant formula</li> <li>• Formula with some substitution</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• Correct answer without supporting work</li> <li>• <math>x^2 = 11025 - 729</math></li> <li>• One error in substitution but finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> <li>• Incorrect or omitted units</li> </ul>
(a) (iv)	$\tan A = \frac{9}{100}$ $A = \tan^{-1} \frac{9}{100}$ $A = 5.1427$ $A = 5[^\circ]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• <math>A = \tan^{-1} \left( \frac{9}{100} \right)</math></li> <li>• Correct answer without supporting work</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p><b>Note:</b> Incorrect Calculator Mode (Apply once in paper)</p> <p style="text-align: right;">Rad: = 0.08975 Grad = 5.714</p>

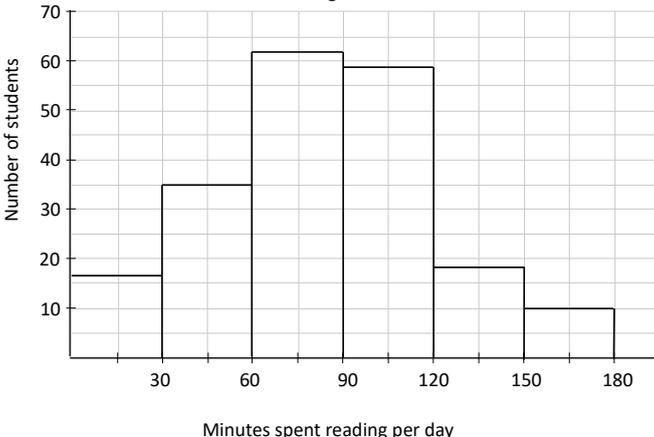
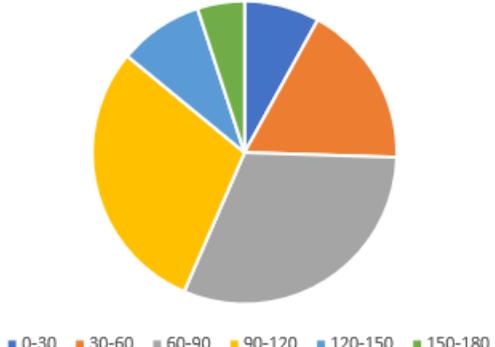
Section B		
Q7	Model Solution – 50 Marks	Marking Notes
(b)	$180 - [88 + 87] = 5$ $\frac{x}{\sin 87} = \frac{20}{\sin 5}$ $x = \frac{20 \sin 87}{\sin 5}$ $x = 229.15977 \text{ m}$ <p> OR  = 229 [m]</p>	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Sine Rule written</li> <li>• Identifies <math>5^\circ</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p>Rad: = <math>17 \cdot 14</math> Grad: = <math>249 \cdot 61</math></p>
(c)	$550^2 = 700^2 + 800^2 - 2(700)(800)\cos X$ $\cos X = \frac{700^2 + 800^2 - 550^2}{2(700)(800)}$ $\cos X = \frac{490000 + 640000 - 302500}{2(700)(800)}$ $\cos X = \left(\frac{827500}{1120000}\right)$ $\angle X = \cos^{-1}\left(\frac{331}{448}\right)$ $\angle X = \cos^{-1} 0.738839$ $\angle X = 42.4^{[o]}$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Some correct substitution into Cosine formula</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul> <p>Rad: = <math>0.73945</math> Grad: = <math>47.07485</math></p>

Q8	Model Solution – 50 Marks	Marking Notes
(a)	$V = \pi r^2 h$ $V = \pi(1 \cdot 2)^2(0 \cdot 75)$ $= 3 \cdot 3929$ $= 3 \cdot 39[\text{m}^3]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> <li>• Identifies <math>r</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• One error in substitution but finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> <li>• Leaves answer in terms of <math>\pi</math></li> </ul>
(b) (i)	$V = l \times w \times h$ $= (0 \cdot 5)(0 \cdot 5)(0 \cdot 5)$ $= 0 \cdot 125 \times 3$ $= 0 \cdot 375 [\text{m}^3]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Length of One side of cube labelled correctly</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul>
(b) (ii)	<p>Volume of raised cylinder = <math>0 \cdot 375</math></p> $\pi r^2 h = 0 \cdot 375$ $\pi(1 \cdot 2)^2 h = 0 \cdot 375$ $h = \frac{0 \cdot 375}{\pi(1 \cdot 2)^2}$ $= 0 \cdot 0828$ $= 0 \cdot 08[\text{m}]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Writes <math>0 \cdot 375</math></li> <li>• Identifies <math>r</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul>

Q8	Model Solution – 50 Marks	Marking Notes
(c) (i)	$l^2 = 0 \cdot 8^2 + 1 \cdot 3^2$ $l^2 = 2 \cdot 33$ $l = \sqrt{2 \cdot 33}$ $l = 1.5264 \dots$ $l = 1.53 \text{ [m]}$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p>e.g. Identifies right angled triangle in diagram or correct relevant formula</p> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• One error in substitution and finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul>
(c) (ii)	$C.S.A. = \pi r l$ $= \pi(1 \cdot 3)(1 \cdot 53)$ $= 6 \cdot 2486$ $= 6 \cdot 25 \text{ m}^2$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit</li> </ul> <p>e.g. Identifies <math>r</math> or <math>l</math></p> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> </ul> <p><i>Full Credit :</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> <li>• Incorrect or omitted units</li> </ul>

Q8	Model Solution – 50 Marks	Marking Notes
(c) (iii)	<p><math>x = 1.53 \text{ m}</math></p> <p>Area of Sector = C.S.A. of Cone</p> $\frac{\angle A}{360} \times \pi r^2 = 6.25$ $\angle A = \frac{6.25(360)}{\pi(1.53)^2}$ $\angle A = 305.949 \dots$ $\angle A = 306^{[o]}$ <p style="text-align: center;"><b>or</b></p> <p><math>x = 1.53 \text{ m}</math></p> <p>Length of Sector = Length of Circular Base</p> $\frac{\angle A}{360} \times 2\pi(1.53) = 2\pi(1.3)$ $\angle A = \frac{8.168(360)}{2\pi(1.53)}$ $\angle A = 305.88.$ $\angle A = 306^{[o]}$ <p style="text-align: center;"><b>or</b></p> <p><math>x = 1.53 \text{ m}</math></p> $\frac{2\pi r}{2\pi l} = \frac{\angle A}{360}$ $\frac{2\pi(1.3)}{2\pi(1.53)} = \frac{\angle A}{360}$ $\frac{1.3}{1.53} = \frac{\angle A}{360}$ $\angle A = \frac{1.3(360)}{1.53}$ $\angle A = 306^{[o]}$	<p><b>Scale 10D (0, 4, 6, 8, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Identifies <math>r</math> Use of Ans (c)(i) <b>or</b> (c)(ii)</li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct <math>x</math> value</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted</li> <li>• One error in substitution but finishes correctly</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Incorrect rounding</li> </ul>

Q9	Model Solution – 50 Marks	Marking Notes
<p>(a) (i) &amp; (iii)</p>	<p>(i) Answer: <math>59 + 18 + 10 = 87</math></p> <p>(iii) Might be local students getting there first or students arriving together by school buses</p> <p style="text-align: center;"><u>or</u></p> <p>Might not be representative</p> <p style="text-align: center;"><u>or</u></p> <p>Leaves out students who arrive later to school</p>	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in either (i) <u>or</u> (iii)</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit in (i) <u>and</u> (iii)</li> <li>• One part correct</li> </ul>
<p>(a) (ii)</p>	<p>Writes any value of median in the range</p> $60 \leq \text{median} < 90$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Gives answer as 90</li> </ul> <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> <li>• [60 – 90] interval indicated</li> </ul> <p><i>Zero Credit</i></p> <ul style="list-style-type: none"> <li>• Mean = <math>83 \cdot 7</math></li> </ul>

Q9	Model Solution – 50 Marks	Marking Notes
(a) (iv)	<p style="text-align: center;"><b>Histogram</b></p>  <p style="text-align: center;"><b>or</b></p> <p style="text-align: center;">No. of students</p>  <p style="text-align: center;"><b>or</b></p> <p>Other acceptable graph / chart</p>	<p><b>Scale 15C (0, 5, 10, 15)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Partly drawn graph / chart</li> <li>• Identifies axes or sectors</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Four intervals drawn correct</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• No labels.( once only)</li> </ul>
(b) (i)	$\hat{p} = \frac{61}{500}$ $= 0 \cdot 122 \times 100$ $= 12 \cdot 2\%$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. <math>\hat{p} = \frac{61}{500}</math> or <math>\times 100</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• <math>\hat{p} = \frac{61}{500} \times 100</math> or <math>0 \cdot 122</math></li> </ul>

Q9	Model Solution – 50 Marks	Marking Notes
(b) (ii)	$\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{500}}$ $= 0.044721359$ $= 4.5\%$	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula written e.g. <math>n = 500</math> or <math>\sqrt{500}</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct formula fully substituted e.g. <math>\frac{1}{\sqrt{500}}</math></li> </ul>
(b) (iii)	$12.2 - 4.5 \leq \hat{p} \leq 12.2 + 4.5$ $7.7 \leq \hat{p} \leq 16.7$ <p><b>Conclusion:</b></p> <p>No difference between Cork and population proportion</p> <p><b>Reason:</b></p> <p>10% is inside the range found. Within the CI.</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 e.g. Writes answer from (b)(i) or (b)(ii) in this part</li> <li>• <math>\hat{p} \pm \frac{1}{\sqrt{n}}</math></li> <li>• <math>\hat{p} \pm 1.96 \sqrt{\frac{p(1-p)}{n}}</math></li> </ul> <p><i>Mid Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• One boundary formed <math>12.2 - 4.5</math> <b>or</b> <math>12.2 + 4.5</math></li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Both boundaries formed <math>12.2 - 4.5</math> <b>and</b> <math>12.2 + 4.5</math> but no conclusion <b>and</b> reason</li> </ul> <p><i>Full Credit (-1):</i></p> <p>Either conclusion <b>or</b> reason missing</p>

Q10	Model Solution – 50 Marks	Marking Notes
(a)	$\frac{180 - 72}{2} = 54$ $ \angle ABC  = 54 \times 2 = 108[^\circ]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Any correct geometrical interpretation worked or indicated diagram</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Calculates <math>54^\circ</math> and stops</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(b)	$\text{Area } \Delta = \frac{1}{2}(6)(6)\text{Sin}72$ $= 17 \cdot 119$ $= 17 \cdot 1 [\text{cm}^2]$ <p>Area of Pentagon</p> $17 \cdot 119 \times 5 = 85 \cdot 59 \dots$ $= 85 \cdot 6 [\text{cm}^2]$	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Any correct work with area of triangle formula.</li> <li>• Correct formula for area of triangle fully substituted</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Finds area of triangle</li> </ul> <p>Rad: Triangle = <math>4 \cdot 56</math>, Pentagon = <math>22 \cdot 84</math></p> <p>Grad: Triangle = <math>16 \cdot 28</math>, Pentagon = <math>81 \cdot 43</math></p>

Q10	Model Solution – 50 Marks	Marking Notes																																				
(c) (i)	<table border="1" data-bbox="261 264 754 602"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <th>1</th> <td>(1,1)</td> <td>(1,2)</td> <td>(1,3)</td> <td>(1,4)</td> <td>(1,5)</td> </tr> <tr> <th>2</th> <td>(2,1)</td> <td>(2,2)</td> <td>(2,3)</td> <td>(2,4)</td> <td>(2,5)</td> </tr> <tr> <th>3</th> <td>(3,1)</td> <td>(3,2)</td> <td>(3,3)</td> <td>(3,4)</td> <td>(3,5)</td> </tr> <tr> <th>4</th> <td>(4,1)</td> <td>(4,2)</td> <td>(4,3)</td> <td>(4,4)</td> <td>(4,5)</td> </tr> <tr> <th>5</th> <td>(5,1)</td> <td>(5,2)</td> <td>(5,3)</td> <td>(5,4)</td> <td>(5,5)</td> </tr> </tbody> </table> <p style="text-align: center;"><u>or</u></p> <p>Tree diagram</p> <p style="text-align: center;"><u>or</u></p> <p>Some other acceptable list of outcomes</p>		1	2	3	4	5	1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	<p><b>Scale 10C (0, 4, 6, 10)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. one element correct in table <u>or</u> effort at tree diagram</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• 15 elements correct in table</li> <li>• Scores added in table</li> </ul>
	1	2	3	4	5																																	
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)																																	
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)																																	
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)																																	
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)																																	
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)																																	
(c) (ii)	<p>Maximum = 10</p> <p>Minimum = 2</p>	<p><b>Scale 5C (0, 3, 4, 5)</b></p> <p><i>Low Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Work of merit e.g. Effort at finding totals</li> </ul> <p><i>High Partial Credit:</i></p> <ul style="list-style-type: none"> <li>• Calculates maximum or minimum</li> </ul> <p><i>Full Credit (-1):</i></p> <ul style="list-style-type: none"> <li>• Answer as Maximum = 2, Minimum = 10</li> </ul> <p><i>Full Credit:</i></p> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>																																				

Q10	Model Solution – 50 Marks	Marking Notes
(c) (iii)	Probability (4 or 5): $P(4 \text{ or } 5) = \frac{3}{25} + \frac{4}{25}$ $= \frac{7}{25} \text{ or } 0.28 \text{ or } 28\%$	<b>Scale 5C (0, 3, 4, 5)</b>  <i>Low Partial Credit:</i> <ul style="list-style-type: none"> <li>• Work of merit e.g. Indicates correct numerator <b>or</b> denominator</li> <li>• Some correct work in (c)(i)</li> </ul> <i>High Partial Credit:</i> <ul style="list-style-type: none"> <li>• Calculates: <math>P(4) = \frac{3}{25}</math> <b>and</b> <math>P(5) = \frac{4}{25}</math></li> </ul> <i>Full Credit:</i> <ul style="list-style-type: none"> <li>• Correct answer without supporting work</li> </ul>
(d)	<p><b>Working out</b></p> $E(x) = \sum x P(x)$ $E(x) = 1(0.3) + (0.5)(0.2) + 0(0.4) + 5(0.1)$ $E(x) = \text{€}0.90$ <p><b>Fair game?</b></p> <p>Not a fair game as costs €1 to play</p> <p><b>Why</b></p> <p>Expected outcome €0.90 is less than the amount paid to play</p> <p style="text-align: center;"><b>or</b></p> <p>Expected value not equal to Zero</p>	<b>Scale 10C (0, 4, 6, 10)</b>  <i>Low Partial Credit:</i> <ul style="list-style-type: none"> <li>• Work of merit</li> <li>• One correct term <b>or</b> operation indicated e.g. <math>1(0.3)</math></li> <li>• Indicates not a fair game with no justification</li> </ul> <i>High Partial Credit:</i> <ul style="list-style-type: none"> <li>• Two correct terms indicated</li> <li>• Expected value correct, but no conclusion <b>and</b> explanation</li> </ul> <i>Full Credit (-1):</i> <ul style="list-style-type: none"> <li>• Either conclusion <b>or</b> explanation missing.</li> </ul>









