

Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International Advanced Level In Statistics S1 Paper WST01/01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

EDEXCEL IAL MATHEMATICS General Instructions for Marking

- 1. The total number of marks for the paper is 75.
- 2. The Edexcel Mathematics mark schemes use the following types of marks:
- M marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
- A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
- **B** marks are unconditional accuracy marks (independent of M marks)
- Marks should not be subdivided.
- 3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod benefit of doubt
- ft follow through
- the symbol $\sqrt{}$ will be used for correct ft
- cao correct answer only
- cso correct solution only. There must be no errors in this part of the question to obtain this mark
- isw ignore subsequent working
- awrt answers which round to
- SC: special case
- oe or equivalent (and appropriate)
- dep dependent
- indep independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper
- The second mark is dependent on gaining the first mark
- 4. All A marks are 'correct answer only' (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.
- 5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.
- 6. Where a candidate has made multiple responses <u>and indicates which response they</u> <u>wish to submit</u>, examiners should mark this response.

 If there are several attempts at a question <u>which have not been crossed out</u>, examiners should mark the final answer that is the most complete.
- 7. Ignore wrong working or incorrect statements following a correct answer

_	stion nber	Scheme	Marks
1.	(a)	First Counter Red Red Plue Red Red Red Pellow Red Plue Red Plue Pellow Yellow Yellow	B1 B1
	(b)	$P(Y) = \frac{7}{12} \times \frac{2}{11} + \frac{3}{12} \times \frac{2}{11} + \frac{2}{12} = \left\{ \frac{42}{132} \text{ or } \frac{7}{22} \right\} \underline{\text{or}}$ $P(\text{Yellow and two counters}) = \frac{7}{12} \times \frac{2}{11} + \frac{3}{12} \times \frac{2}{11} = \left\{ \frac{20}{132} \text{ or } \frac{5}{33} \right\}$	(2) M1
		$\frac{P([Y \cap R] \cup [Y \cap B])}{P(Y)} = \frac{\frac{20}{132}}{\frac{42}{132}}$	M1
		$=\frac{20}{42} \text{or} \frac{10}{21} \text{oe}$	(3) [5 marks]
		Notes	
	(a)	1 st B1 for the remaining probs on first set of branches and at least one on 2 nd B1 for a fully correct tree diagram with all the correct probabilities	set
	(b)	1 st M1 for a correct ft expression for P(Y) or P(Yellow and two counters)ft the diagram $eg \ 1 - \frac{7}{12} \times \frac{6+3}{11} - \frac{3}{12} \times \frac{7+2}{11}$ NB: The method is implied by the numbers in curly brackets but we dissee them to award the mark. 2 nd M1 for a correct ratio formula (symbols or words) and at least one correct	lo not need to
		fully correct ft ratio. Do not follow through probabilities > 1 or < 0 A1 for $\frac{10}{21}$ or exact equivalent. (Allow $0.\dot{4}7619\dot{0}$) NB if an exact correct fraction is not given and an awrt 0.476 is given get M1M1A0 if from correct working Generally if the answer is correct then award full marks (unless from incorrect working) or notes indicate otherwise	ven it would

Question Number		Scheme	Marks	
2. (a)		B and C	B1	
	(b)	A and C independent airces	(1)	
	(b)	A and C independent gives: $P(C) \times 0.65 = 0.13$ or $0.65 \times (r+0.13) = 0.13$ or $0.65 \times (0.48-s) = 0.13$	M1	
		P(C) = 0.2 or $r + 0.13 = 0.2$ or $0.48 - s = 0.2$	Al	
		$r = \{0.2 - 0.13\} = \underline{0.07} \text{ or } s = \{0.48 - 0.2\} = \underline{0.28}$	A1	
		P(A) + r + s = 1 or $0.65 + "0.07" + s = 1$ or $0.65 + "0.28" + r = 1$	M1	
		s = 1 - 0.72 = 0.28 and r = 1 - 0.93 = 0.07	A1 (5)	
	(c)	$P[(B \cup C)] = "0.2" + q \text{ or } 0.13 + "0.07" + q$	B1ft	
		$P(A \cap C') = p + q \{= 0.52\}$	B1	
		$\left\{ P\left[(A \cap C') \cap (B \cup C) \right] = q \Rightarrow \right\} "(p+q)" \times "(0.2+q)" = q \text{ or}$		
		$ (p+q)"\times"(0.13+"0.07"+q)" = q \text{ or } "(p+q)"\times"(1-s-p)" = 0.52-p $	M1	
) / () / (
		[Using $p + q = 0.52$] $0.52 \times "(0.2 + q)" = q \text{ or } 0.52(0.72 - p) = 0.52 - p$	M1	
		$q = \frac{13}{60}$	A1	
		$\frac{-}{}_{n-}$ 91	A 1	
		$p = {300}$	A1	
		Notes	(6) [12 marks]	
	(a)	B1 B and C seen. If they include A then B0	[12 marks]	
	(b)	1^{st} M1 for a correct equation for P(C) using independence.		
	()	1 st A1 for $P(C) = 0.2$ correct linear equation for r or s		
		2^{nd} A1 for either $r = 0.07$ or $s = 0.28$		
		2^{nd} M1 for using $\sum p = 1$ Allow letter r and s or their values for r and s provide	ed they are	
		probabilities.	•	
		3^{rd} A1 for both $s = 0.28$ and $r = 0.07$		
	()	NB: The quotations around the 0.07 ("0.07") imply that we ft their values	ie	
	(c)	1 st B1ft for an expression (in q) for $P(B \cup C)$ ft their value of r or their "0.2"		
		eg 0.13 + "their r " + q Implied by 1^{st} or 2^{nd} M1 below. 2^{nd} B1 for a correct expression for $P(A \cap C')$ in terms of p and q or 0.52		
		Implied by 1^{st} or 2^{nd} M1below		
		1 st M1 for a correct use of independence (ft their probabilities), values or letter	rs.	
		Implied by 2^{nd} M1 2^{nd} M1 $using n + a = 0.52 \text{ to gain a linear equation in one variable}$		
		using $p+q=0.52$ to gain a linear equation in one variable		
		$1^{\text{st}} \text{ A}1$ for a correct fraction for q $2^{\text{nd}} \text{ A}1$ for a correct fraction for p	$\overline{}_{c}$	
		SC: If both p and q are given as equivalent $\begin{bmatrix} B & \frac{3}{300} \\ \frac{13}{60} \end{bmatrix} \begin{pmatrix} B & \frac{3}{300} \\ 0.13 \end{pmatrix}$	0.07	
		recurring decimals award A0A1 eg 0.216 and 0.303	0.28	

3 (a) Width = $\frac{2.5 \text{ (cm)}}{\text{So } n^2 \text{ for freq of } 5 \text{ so } 6 \times 1.5 - 9 \text{ cm}^2 \text{ for freq of } 30 \text{ or } \text{ fd} = \frac{5}{4} \text{ w} \times k - 9$ So $k - 9 + 2.5$ or $6 \div \frac{3}{4} - \frac{3.6 \text{ (cm)}}{3.6 \text{ (cm)}}$ A1 (b) $Q_3 = [12] + \frac{16}{25} \times 3$ allow use of $(n + 1)$ giving $[12] + \frac{16.5}{25} \times 3$ M1 $= 13.92 = \text{awrt} \frac{13.9}{13.9}$ (c) $(6)(0)$ $\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452$ $x = 14.52 = \text{awrt} \frac{14.5}{14.5}$ M1 A1 (2) (a) $\int fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 A1 (b) $\int fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 A1 (c) $\int fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 A1 (d) $\int \frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25% or 0.8025 awrt $\frac{16.803}{100}$ A1 (e) Profit = $2.2 \times 0.8025^{10} + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times 0.6 \times \frac{0.75 \times 11}{100}$ Notes (a) B1 for width -2.5 (cm) A1 for sight of 9 cm^2 or $w \times h = 9$ or $fd = \frac{5}{2}$ (o.e.) A1 for for height $= 3.6$ (cm) (b) M1 for $\frac{1}{2} \times 3 \text{ or } \frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving $13.98 = \text{awrt } 14.0$) (c) (i) M1 for attempt at Σfx with at least 3 correct terms or $900 \times \Sigma fx \times 1800$ for info $\Sigma fx^2 = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only 22) (ii) 1^{14} M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt $1.4.5$ (correct answer only $3/3$) (c) M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt $1.4.5$ (correct expression including $1.4.5$ (correct answer only $3/3$) for attempt at a correct expression (allow 1 error	Question Number	Scheme	Marks	
1.5 cm² for freq of 5 so 6×1.5 = 9 cm² for freq of 30 or fd = $\frac{3}{3}$ w × h = 9 So h = 9 ÷ 2.5 or 6÷ $\frac{1}{3}$ = $\frac{3.6 \text{ (cm)}}{3.6 \text{ (cm)}}$ (b) $Q_2 = [12] + \frac{16}{25} \times 3$ allow use of $(n + 1)$ giving $[12] + \frac{16.5}{25} \times 3$ M1 $-13.92 - \text{ awrt } \frac{13.9}{3.9}$ (c) $(\frac{1}{3}) = \frac{16.5}{25} \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452}{\pi = 14.52} = \text{awrt } \frac{14.5}{41}$ (ii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 (iii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 (a) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25 % or 0.8025 awrt $\frac{0.803}{100}$ A1 (b) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25 % or 0.8025 awrt $\frac{0.803}{100}$ A1 (c) Profit = $2.2 \times 0.8025^{10} + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times 0.000000000000000000000000000000000$		Width = 2.5 (cm)	B1	
(b) $Q_2 = [12] + \frac{16}{25} \times 3$ allow use of $(n+1)$ giving $[12] + \frac{16.5}{25} \times 3$ M1 A_1 (2) $E_1 = [1.5] \times 3$ M1 $E_2 = [1.5] \times 3$ M1 $E_3 = [1.5] \times 3$ M1 $E_4 = [1.5] \times 3$ M1 $E_5 = [1.5] \times$			M1	
(b) $Q_2 = [12] + \frac{16}{25} \times 3$ allow use of $(n+1)$ giving $[12] + \frac{16.5}{25} \times 3$ M1 $A1$ (2) $= 13.92 = \text{awrt} \frac{13.9}{13.9}$ (c) (1) $\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452 \\ \overline{x} = 14.52 = \text{awrt} \frac{14.5}{14.5}$ M1 $A1$ (2) $\overline{x} = 14.52 = \text{awrt} \frac{14.5}{14.5}$ M1 $A1$ (2) $\overline{x} = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23.280$ M1 $\overline{x} = 4.687 = \text{awrt} \frac{4.69}{100}$ M1 $\overline{x} = 4.687 = \text{awrt} \frac{4.69}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.6935 = \text{awrt} \frac{1.7 \times 10}{100}$ M1 $\overline{x} = 1.255 \times 10$ M1 $\overline{x} = 1.255 $			A1	
(c)(i) $\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452 \\ \overline{x} = 14.52 = \text{awrt } \frac{14.5}{14.5} $ (ii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280 \\ \sigma_x = \sqrt{\frac{^{\circ}23280^{\circ}}{100}} - ("14.52")^2 \text{ or } \sqrt{21.9696} \\ \sigma_x = 4.687 = \text{awrt } \frac{4.69}{4.69} \\ \text{A1}$ (3) $\int \frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{100} \\ \text{(2)}$ (e) $ \text{Profit} = 2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times " \left(1 - \left[0.8025 + \frac{0.75 \times 11}{100} \right] \right) " \\ \text{M1}$ $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100} \\ \text{A1}$ (2) $ \text{Notes} $ (14 marks) (a) $ \text{B1} \text{for width } = 2.5 \text{ (cm)} \\ \text{M1} \text{for sight of } 9 \text{ cm}^2 \text{ or } w \times h = 9 \text{ or } \text{fd} = \frac{2}{3} \text{ (o.e.)} \\ \text{A1} \text{for height } = 3.6 \text{ (cm)} \\ \text{M1} \text{for a avrt } 13.9 \text{ (use of } (n+1) \text{ giving } 13.98 = \text{awrt } 14.0) \\ \text{(e)(i)} \text{M1} \text{for attempt at } \Sigma fx \text{ with at least 3 correct terms } 900 \times \Sigma fx < 1800 \\ \text{for info } \Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264 \\ \text{A1} \text{for attempt at } \Sigma fx \text{ with at least 3 correct terms } 900 \times \Sigma fx < 26000 \\ \text{for info } \Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336 \\ 2^{\text{ad}} \text{ M1} \text{for a attempt at } \Sigma fx^2 \text{ with at least 3 correct terms } 0.2000 \times \Sigma fx^2 < 26000 \\ \text{for info } \Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336 \\ 2^{\text{ad}} \text{ M1} \text{for a correct expression including } \sqrt{\text{ (ftheir } \Sigma fx^2 \text{ if clear it is } \Sigma fx^2 \text{) Do not allow}} \\ \text{(c)fi)} \text{M1} \text{for attempt at } 25 x^2 \text{ with at least 3 correct terms } 0.2000 \times \Sigma fx^2 < 26000 \\ \text{for info } \Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336 \\ 2^{\text{ad}} \text{ M1} \text{for a correct expression including } \sqrt{\text{ (ftheir } \Sigma fx^2 \text{ if clear it is } \Sigma fx^2 \text{) Do not allow}} \\ \text{(c)} \text{M1} \text{for attempt at } 25 x^2 \text{ with at } 1.2 x \times 12 x \times 12$		<u> </u>	(3)	
(c)(i) $\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452 \\ \bar{x} = 14.52 = \text{awrt } \frac{14.5}{4.5} $ (ii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280 \\ \sigma_x = \sqrt{\frac{"23280"}{100}} - ("14.52")^2 \text{or } \sqrt{21.9696} $ (d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (1) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{4} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{4} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8025 \text{ awrt } \frac{0.803}{4.6} $ (2) $\frac{1}{4} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8035 \text{ awrt } \frac{1.7 \text{ (p)}}{1.00} $ (2) $\frac{1}{4} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{So proportion is } 80.25 \% \text{ or } 0.8035 \text{ or } 0.803 $ (2) $\frac{1}{4} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \\ \text{M1} \text{ for attempt at } 2.5 \times 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10$	(b)	$Q_2 = [12] + \frac{16}{25} \times 3$ allow use of $(n+1)$ giving $[12] + \frac{16.5}{25} \times 3$	M1	
(c)(i) $\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452}{\bar{x} = 14.52 = \text{awrt }} \frac{14.5}{\text{Al}}$ (ii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280}{\text{M1}}$ $\sigma_x = \sqrt{\frac{"23280"}{100}} - (\text{"}14.52")^2 \text{or} \sqrt{21.9696}$ (d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11}{\text{So proportion is }} \frac{\text{M1}}{80.25} \times \text{or } 0.8025 \text{ awrt } \frac{\textbf{4.69}}{100}$ (e) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11}{\text{So proportion is }} \frac{\text{M1}}{80.25} \times \text{or } 0.8025 \text{ awrt } \frac{\textbf{0.803}}{100}$ (1) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11}{\text{So proportion is }} \frac{\text{M1}}{80.25} \times \text{or } 0.8025 \text{ awrt } \frac{\textbf{0.803}}{100}$ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11}{\text{So proportion is }} \frac{\textbf{M1}}{100} \times 1.2 \times " \left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)" \text{M1}$ $= 1.6935 \text{awrt } \frac{\textbf{1.7 (p)}}{100}$ M1 $= 1.6935 \text{awrt } \frac{\textbf{1.7 (p)}}{100}$ A1 $= 1.6935 \text{awrt } \frac{\textbf{1.7 (p)}}{1.9 \text{ awrt }} \frac{\textbf{1.7 (p)}}{100}$ A1 $= 1.6935 \text{awrt } \frac{\textbf{1.7 (p)}}{100}$ A1		$= 13.92 = \text{awrt } \underline{13.9}$		
(ii) $\sum fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280 \qquad \text{M1}$ $\sigma_x = \sqrt{\frac{"23280"}{100}} - (\text{"}14.52")^2 \text{or} \sqrt{21.9696} \qquad \text{M1}$ $\sigma_x = \sqrt{\frac{"23280"}{100}} - (\text{"}14.52")^2 \text{or} \sqrt{21.9696} \qquad \text{M1}$ $\sigma_y = 4.687 = \text{awrt} 4.69 \qquad \text{A1}$ (3) $\sigma_y = 4.687 = \text{awrt} 4.69 \qquad \text{A1}$ (4) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad \text{M1}$ So proportion is $80.25\% \text{ or } 0.8025 \text{ awrt} 0.803 \qquad \text{A1}$ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad \text{M1}$ So proportion is $80.25\% \text{ or } 0.8025 \text{ awrt} 0.803 \qquad \text{M1}$ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad \text{M1}$ So proportion is $80.25\% \text{ or } 0.8025 \text{ awrt} 0.803 \qquad \text{M1}$ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad \text{M1}$ So proportion is $80.25\% \text{ or } 0.8025 \text{ awrt} 0.803 \qquad \text{M1}$ (2) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad \text{M1}$ So proportion is $80.25\% \text{ or } 0.8025 \text{ awrt} 0.803 \qquad \text{M1}$ (2) $\frac{1}{4} \times 10 + 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$	(c)(i)	$\sum fx = 5 \times 6.5 + 13 \times 9 + 16 \times 11 + 25 \times 13.5 + 30 \times 17.5 + 11 \times 24 = 1452$		
(ii) $\sum f x^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280 \qquad M1$ $\sigma_x = \sqrt{\frac{"23280"}{100}} - ("14.52")^2 \qquad \text{or} \qquad \sqrt{21.9696} \qquad M1$ $\sigma_x = 4.687 = \text{awrt} \qquad 4.69 \qquad A1$ (d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11 \qquad M1$ So proportion is 80.25% or 0.8025 awrt 0.803 A1 (2) (e) $\text{Profit} = 2.2 \times \frac{"0.8025"}{ \cdot \cdot$			A1	
$\sigma_x = \sqrt{\frac{"23280"}{100}} - ("14.52")^2 \text{or} \sqrt{21.9696}$ $\sigma_x = 4.687 = \text{awrt} \underline{4.69} \text{A1}$ σ	400			
(d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25% or 0.8025 awrt $\frac{4.69}{0.803}$ A1 (e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ M1 $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100} \text{ A1 (2)}$ Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm^2 or $w \times h = 9$ or $10 \text{ fo} = \frac{5}{3} \text{ (o.e.)}$ A1 for height = 3.6 (cm) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving $13.98 = \text{awrt } 14.0$) (c)(i) M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $900 \times \Sigma f \times 1800$ for info $\Sigma f \times 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{18} M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $2000 \times \Sigma f \times 1800$ for info $\Sigma f \times 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{18} M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $\Sigma f \times w$ or $\Sigma f \times w$ 1800 $\Sigma f \times w \times$	(ii)	$\int fx^2 = 6.5^2 \times 5 + 9^2 \times 13 + 11^2 \times 16 + 13.5^2 \times 25 + 17.5^2 \times 30 + 24^2 \times 11 = 23280$	M1	
(d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25% or 0.8025 awrt $\frac{4.69}{0.803}$ A1 (e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ M1 $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100} \text{ A1 (2)}$ Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm^2 or $w \times h = 9$ or $10 \text{ fo} = \frac{5}{3} \text{ (o.e.)}$ A1 for height = 3.6 (cm) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving $13.98 = \text{awrt } 14.0$) (c)(i) M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $900 \times \Sigma f \times 1800$ for info $\Sigma f \times 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{18} M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $2000 \times \Sigma f \times 1800$ for info $\Sigma f \times 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{18} M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms or $\Sigma f \times w$ or $\Sigma f \times w$ 1800 $\Sigma f \times w \times$		$\sigma = \frac{"23280"}{"(14.52")^2} \text{ or } \sqrt{21.9696}$	M1	
(d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25% or 0.8025 awrt $\frac{0.803}{0.803}$ (2) (e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ M1 $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100}$ M1 $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100}$ M1 Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm^2 or $w \times h = 9$ or $1 = \frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) (b) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{xx} M1 for attempt at Σfx^2 with at least 3 correct terms or $0 \times 1000 < \Sigma fx^2 < 0 \times 1000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ $0 \times 1000 < 0 \times 1000 <$		V 100		
(d) $\frac{1}{2} \times 13 + 16 + 25 + 30 + \frac{1}{4} \times 11$ So proportion is 80.25% or 0.8025 awrt $\frac{0.803}{100}$ A1 (2) (e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ M1 $= 1.6935 \text{ awrt } \frac{1.7 \text{ (p)}}{100}$ A1 (2) Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm² or $w \times h = 9$ or fd = $\frac{5}{3}$ (o.c.) A1 for height = 3.6 (cm) (b) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at Σfx with at least 3 correct terms or $900 \times \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) 1^{st} M1 for attempt at Σfx^2 with at least 3 correct terms or $\Sigma fx = 20.000 \times \Sigma fx^2 < 26.000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ $\Sigma fx = 30.35 + 117 + 176 + 337.5 + 336 + 4556.25 + 9187.5 + 6336$ A1 for a correct expression including $\sqrt{(ft \text{ their } \Sigma fx^2)}$ if clear it is Σfx^2) Do not allow $(\Sigma fx)^2 fx = \Sigma fx^2$ A1 for a correct expression including $\sqrt{(ft \text{ their } \Sigma fx^2)}$ if clear it is $\Sigma fx^2 = 10.000$ for a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (d) M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$		$\sigma_{\rm r} = 4.687 = \text{awrt } \underline{4.69}$		
So proportion is 80.25% or 0.8025 awrt 0.803 A1 (2) (e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ A1 (2) Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm² or $w \times h = 9$ or fd = $\frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) (b) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for attempt at Σfx with at least 3 correct terms or $900 \times \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) I^{st} M1 for attempt at Σfx^2 with at least 3 correct terms or $20000 \times \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ I^{st} M1 for a correct expression including $\sqrt{f^{st}}$ (ft their Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only $3/3$) (d) M1 A1 for a correct expression ft their 0.8025 o.e. eg $[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5] \div 100$ Condone $[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)] \div 100$	(4)	1×12+16+25+20+1×11		
(e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ $= 1.6935 \text{ awrt } \underline{1.7 \text{ (p)}} \qquad \text{A1} \qquad (2)$ Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm² or $w \times h = 9$ or fd = $\frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) (b) M1 for average of $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) (ii) Ist M1 for attempt at Σfx with at least 3 correct terms or $20000 < \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ $2^{\text{nd}} M1$ for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) (d) M1 for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (e) M1 for avrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg $\begin{bmatrix} 2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5 \end{bmatrix} \div 100$ $Condone \begin{bmatrix} 2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12) \end{bmatrix} \div 100$	(u)	·		
(e) Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times " \left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$ $= 1.6935 \text{awrt } \frac{1.7 \text{ (p)}}{100} \qquad \text{A1} \qquad (2)$ Notes [14 marks] (a) B1 for width = 2.5 (cm) M1 for sight of 9 cm^2 or $w \times h = 9$ or $6 \text{ d} = \frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) (b) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at $\Sigma f \times w$ ith at least 3 correct terms of $S \times w$ or $S \times w$ or info $S \times w$ = $S \times w$ or $S \times w$ or $S \times w$ for awrt 14.5 (correct answer only $S \times w$) (ii) $S \times w$ for a termpt at $S \times w$ ith at least 3 correct terms of $S \times w$ or $S \times w$ for a correct expression including $S \times w$ (ft their $S \times w$) Do not allow $S \times w$ for a correct expression including $S \times w$ (ft their $S \times w$) Do not allow $S \times w$ for a correct expression (allow 1 error or omission) eg $S \times w$ Do not allow of a correct expression fit their 0.8025 o.e. eg [2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times (1.2)] \div 100 Condone [2.2 \times "0.8 \times 0.1 \times (1.2)] \div 100		30 proportion is 60.23 70 or 0.6023 awrt <u>0.603</u>		
Notes [14 marks]	(e)	Profit = $2.2 \times "0.8025" + 0.8 \times \frac{0.75 \times 11}{100} - 1.2 \times "\left(1 - \left[0.8025 + \frac{0.75 \times 11}{100}\right]\right)"$	M1	
(a) B1 for width = 2.5 (cm) M1 for sight of 9 cm² or $w \times h = 9$ or fd = $\frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at Σfx with at least 3 correct terms or 900 < Σfx < 1800 for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only 2/2) (ii) $\int_{0}^{15} \int_{0}^{15} \int_{0}^{15$		= 1.6935 awrt <u>1.7 (p)</u>	A1 (2)	
(b) M1 for sight of 9 cm² or $w \times h = 9$ or fd = $\frac{5}{3}$ (o.e.) A1 for height = 3.6 (cm) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) 1st M1 for attempt at Σfx^2 with at least 3 correct terms or $20000 < \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ 2nd M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) (d) M1 for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ A1 for awrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$			[14 marks]	
(b) M1 for height = 3.6 (cm) for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only $2/2$) 1st M1 for attempt at Σfx^2 with at least 3 correct terms or $20000 < \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ 2nd M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) (d) M1 for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ A1 for awrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$	(a)			
(b) M1 for $\frac{16}{25} \times 3$ or $\frac{9}{25} \times 3$ or $\frac{m-12}{15-m} = \frac{16}{9}$ For any correct equation leading to Q_2 or correct fraction as part of Q_2 A1 for awrt 13.9 (use of $(n+1)$ giving 13.98 = awrt 14.0) (c)(i) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only 2/2) (ii) 1^{st} M1 for attempt at Σfx^2 with at least 3 correct terms or $\Sigma fx^2 = 2000 < \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ A1 for a correct expression including $\Sigma fx^2 = 211.25 + 1053 + 1936 + 1056.25 + 105$				
For any correct equation leading to Q_2 or correct fraction as part of Q_2 for awrt 13.9 (use of $(n + 1)$ giving 13.98 = awrt 14.0) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only 2/2) 1st M1 for attempt at Σfx^2 with at least 3 correct terms or $\Sigma fx^2 = 20.000 < \Sigma fx^2 < 26.000 < \Sigma fx^2 < 26.000 < 0.000 < 0.000 1st M1 for a correct expression including \Sigma fx^2 = 20.000 < \Sigma fx^2 < 26.000 < 0.000 < 0.000 < 0.000 1st M1 for a correct expression including \Sigma fx^2 = 20.000 < \Sigma fx^2 < 26.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0.000 < 0$	(b)			
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(c)(i) M1 for awrt 13.9 (use of $(n + 1)$ giving $13.98 = \text{awrt } 14.0$) M1 for attempt at Σfx with at least 3 correct terms or $900 < \Sigma fx < 1800$ for info $\Sigma fx = 32.5 + 117 + 176 + 337.5 + 525 + 264$ A1 for awrt 14.5 (correct answer only 2/2) (ii) 1^{st} M1 for attempt at Σfx^2 with at least 3 correct terms or $20000 < \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ 2^{nd} M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) M1 for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ A1 for awrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$		25 25 10		
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(ii) 1^{st} M1 for awrt 14.5 (correct answer only 2/2) for attempt at Σfx^2 with at least 3 correct terms or 20 000 $< \Sigma fx^2 < 26000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ 2^{nd} M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (e) A1 for awrt 80.3% or 0.803 for a correct expression ft their 0.8025 o.e. eg $[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5] \div 100$ Condone $[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)] \div 100$	(c)(i)	<u> </u>		
(ii) 1^{st} M1 for attempt at Σfx^2 with at least 3 correct terms or $20\ 000 < \Sigma fx^2 < 26\ 000$ for info $\Sigma fx^2 = 211.25 + 1053 + 1936 + 4556.25 + 9187.5 + 6336$ 2^{nd} M1 for a correct expression including $$ (ft their Σfx^2 if clear it is Σfx^2) Do not allow $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) M1 for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (e) M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$				
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$2^{\text{nd}} \text{ M1} \text{for a correct expression including } \sqrt{\text{ (ft their } \Sigma fx^2 \text{ if clear it is } \Sigma fx^2 \text{) Do not allow}} $ $(\Sigma fx)^2 \text{ for } \Sigma fx^2$ A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) $M1 \text{for attempt at a correct expression (allow 1 error or omission) eg } 100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ $A1 \text{for awrt } 80.3\% \text{ or } 0.803$ $M1 \text{for a correct expression ft their } 0.8025 \text{ o.e. eg}} $ $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ $Condone \left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$	(11)		500	
(a) $(\Sigma fx)^2$ for Σfx^2 A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (e) A1 for awrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ $Condone\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$			not allow	
(d) A1 for awrt 4.69 (allow $s = 4.7107$ awrt 4.71) (correct answer only 3/3) for attempt at a correct expression (allow 1 error or omission) eg $100 - \left(5 + \frac{13}{2}\right) - \frac{33}{4}$ (e) A1 for awrt 80.3% or 0.803 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ $Condone\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$			not anow	
(e) A1 for awrt 80.3% or 0.803 M1 for a correct expression ft their 0.8025 o.e. eg			3)	
(e) M1 for a correct expression ft their 0.8025 o.e. eg $\left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5\right] \div 100$ Condone $\left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)\right] \div 100$	(d)	for attempt at a correct expression (allow 1 error or omission) eg 100 –	$\left(5 + \frac{13}{2}\right) - \frac{33}{4}$	
$ \left[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5 \right] \div 100 $ $ \text{Condone} \left[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12) \right] \div 100 $		A1 for awrt 80.3% or 0.803	, ,	
Condone $[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)] \div 100$	(e)			
		$[2.2 \times (100 - 11.5 - 8.25) + 0.8 \times 8.25 - 1.2 \times 11.5] \div 100$		
		Condone $[2.2 \times "80" + 0.8 \times (8) - 1.2 \times (12)] \div 100$		
AT 101 awrt 1./ AHOW & U.VI / (tills must have units)		A1 for awrt 1.7 Allow £0.017 (this must have units)		

Question Number	Scheme		
4. (a)	$P(W < 120) = P\left(Z < \frac{120 - 165}{35}\right)$	M1	
	$= P(Z < -1.2857) = 1 - 0.9015 \text{ or } 1 - 0.9007285$ $= 0.09927 = \text{awrt } \mathbf{0.0985 \sim 0.0994}$	M1 A1 (3)	
(b)	e.g. $P(W > x) = \frac{1}{3}$ gives $\frac{x - 165}{35} = \pm 0.43$ (calculator 0.430727)	M1B1	
	Limits 149.9245 to 180.0754 awrt <u>150</u> to <u>180</u>	A1, A1 (4)	
(c)	$P(W < 200 \mid W > "180") \underline{\text{or}} \frac{P("180" < W < 200)}{P(W > "180") \text{or} \frac{1}{3}}$	M1	
	$=\frac{0.8413(44739)-\frac{2}{3}}{\frac{1}{3}}$	A1 (num)	
	= 0.52403 (0.523~0.5264)	A1 (3)	
(d)	$\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times 3!$ $= \frac{2}{9}$	M1;M1	
	$=\frac{2}{9}$	A1	
		(3) [13 marks]	
	Notes		
(a)	1^{st} M1 for standardising with 120 (allow 210), 165 and 35. Accept \pm 2^{nd} M1 for attempting $1-p$ [where $0.85] A1 for awrt 0.0985 \sim 0.0994 (Correct ans only 3/3)$		
(b)	M1 for standardising with x (o.e.) 165 and 35 and setting equal to a z value, $(Accept \frac{165 - x}{35} = \pm z \text{ where } 0.4 < z < 0.5)$	0.4 < z < 0.5	
	B1 for use of $z = 0.43$ or better We must see 0.43 or better. 1 st A1 for lower limit of awrt 150 2 nd A1 for upper limit of awrt 180		
SC	A0A1 for two limits symmetrically placed about 165 provided M1 scored NB: correct answers with no working can score M1B0A1A1		
(c)	M1 for a correct probability statement (either form) ft their 180 or a correct 1st A1 for a correct numerator (awrt 0.175) 2nd A1 for an answer in the range awrt 0.523~0.5264 (use of 180 gives 0.5263)		
(d)	$1^{\text{st}} M1$ for $\left(\frac{1}{3}\right)^3$ (or equivalent)		
	2^{nd} M1 for $p \times 3!$ (or equivalent) where 0		
	A1 for $\frac{2}{9}$ or any exact equivalent		

Question Number		Scheme	Marks	
5. (a)	$\{\mathrm{E}(X)=\}$	$-2a-b+0\times c+b+4a$ or $2a$ { $2a = 0.5 \text{ so }$ } $a = 0.25$	M1 A1 (2)	
(b)		$\{E(X^{2}) = \}(-2)^{2} \times a + (-1)^{2} \times b + 0 + 1^{2} \times b + 4^{2} \times a \text{ or } 20a + 2b \text{ (o.e.)}$ $\{Var(X) = \} "20a + 2b" - 0.5^{2}$		
	,	2b - 0.25 = 5.01 (o.e.) e.g. "4.75" + $2b = 5.01{ 2b = 0.26 so } b = 0.13$	M1 A1 A1	
	{Use o	of sum of probs = 1 to calculate a 2^{nd} value $\underline{c} = 0.24$	A1ft (5)	
(c)(i)	$\{\mathrm{E}(Y)=$	$=5-8\times0.5$ } = <u>1</u>	B1	
(ii)	{Var(}	$(-8)^2 \times 5.01$	M1	
, ,		= 320.64 awrt <u>321</u>	A1	
			(3)	
(d)	$4X^{2} >$	5-8X	M1	
		$(2X-1)(2X+5) > 0 \implies X > 0.5$	M1A1	
	So need 2	X = 1 or 4 or probability of $a + b$	M1	
		= 0.38	A1	
			(5)	
			[15 marks]	
		Notes		
(a)	M1 A1	for any correct expression for $E(X)$ in terms of a (or a , b , c) for $a = 0.25$		
(b)	1 st M1 for attempt at an expression for $E(X^2)$ with at least 3 correct non-zero terms 2 nd M1 for a correct expression for $Var(X)$ eg"18 $a - c + 1$ " – 0.5 ² Allow with their value of a substituted			
	1 st A1	for a correct equation for b (or possibly c) eg" $18a - c + 1$ " $-0.5^2 = 3$ with their value of a substituted	5.01 Allow	
	2 nd A1	for either $b = 0.13$ or $c = 0.24$ for using $a = 1$, 2×0.25 , 2×0.13 , or $b = (1, 2) \times 0.25$, 0.24	1) · 2 to gain	
	3 rd A1ft	for using $c = 1 - 2 \times "0.25" - 2 \times "0.13"$ or $b = (1 - 2 \times "0.25" - "0.24")$ the correct ft answer for their 2^{nd} value) + 2 to gain	
(c)	B1 M1	for $\{E(Y) = \} 1$ for correct use of $Var(aX + b) = a^2 Var(X)$		
	A1	for awrt 321		
(d)	1 st M1 for correct quadratic inequality (may be inside prob statement) or table of values 2 nd M1 for an attempt to solve or identifying correct X values			
	1 st A1 3 rd M1 2 nd A1	for $X > 0.5$ [may also have $X < -2.5$] for realising need $X = 1$ and 4 only or answer of their $(a + b)$ for 0.38 (or exact equivalent) only (correct ans only 5/5)		

Question Number	er Scneme		
6. (a)	$\left\{S_{yy} = \right\} 42.63 - \frac{23.7^2}{16} = [7.524375]$		
(b)	Use of $\overline{y} = 3.684 - 0.3242\overline{x}$; so $\sum x = 16 \times \left(\frac{3.684 - \frac{23.7}{16}}{0.3242}\right) = 108.71067$		
	$\{S_{xx} = \}756.81 - \frac{("108.71")^2}{16}; = 18.18435 \text{ awrt } \underline{18.2}$	M1; A1 (4)	
(c)	$b = \frac{S_{xy}}{S_{xx}} \Rightarrow S_{xy} = "18.1843" \times (-0.3242)[= -5.8953]; r = \frac{"-5.89536"}{\sqrt{"18.184" \times 7.524375}}$ $= -0.50399 = -0.49 \sim -0.51$	M1; M1	
(d)	Sub $x = 2$ in the regression line gives $y = 3.0356$	(3) B1 (1)	
(e)	St.dev = $\sqrt{\frac{S_{xx}}{n}} = \sqrt{\frac{"18.184"}{16}} = 1.066$	M1	
(4)	So limits are: $\frac{"108.71"}{16} \pm 3 \times "1.066" = 3.5965 \sim 9.9929 = awrt 3.6 \sim 10$ The probability of $x = 2$ being in the range is very small;	M1, A1 (3) B1ft;	
(f)	so Behrouz's estimate is <u>unreliable</u>	dB1ft (2)	
(g)	Should use regression of x on y to estimate unemployment or equivalent So Andi's suggestion is not suitable or not to be recommended		
	Notes	[16 marks]	
(a)	B1 Value given so must see sight of a correct expression – allow 561.69 for	or 23.7 ²	
(b)	1 st M1 for clear use of regression line with \overline{y} or $\sum y$		
	$1^{\text{st}} \text{ A1} \text{for } \sum x = \text{awrt } 109$		
	2^{nd} M1 for a correct expression for S_{xx} ft their Σx		
	2 nd A1 for awrt 18.2		
(c)	1 st M1 for use of gradient to find S_{xy}		
	2 nd M1 for a correct expression for r ft their S_{xy} and S_{xx} A1 for an answer in the range $-0.49 \sim -0.51$		
(d)	B1 for sight of $y = 3.03$ or better. Allow 3.04		
(e)	1 st M1 for a correct attempt at st. dev. ft their S_{xx} or $\sqrt{\frac{756.81}{16} - \left(\frac{"108.71"}{16}\right)}$	ft their Σx	
	2 nd M1 for one correct calcft their values		
(f)	A1 for a range awrt 3.6~10 1st B1ft for a correct reason ft their range in part (e) eg $x = 2$ is outside the range		
	extrapolation 2 nd dB1ft dep on 1 st B1 for stating a correct conclusion for their range		
(g)	for a suitable reason based on reg line, eg regression line $(y \text{ on } x)$ can only be to estimate wages. Allow x instead of unemployment and y instead of wages		
	2 nd dB1 dep on 1 st B1 for suggesting not suitable (or equivalent)		