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Mark Scheme (Results)

October 2025

International Advanced Level in Statistics S1

WST01/01A

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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.

General Instructions for Marking

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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 $\surd$ 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. If a candidate makes more than one attempt at any question:
   - If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   - If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

7. Ignore wrong working or incorrect statements following a correct answer

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Question Number	Scheme	Marks
1(a)	$S_{yy} = 39418 - \frac{560^2}{8}$	M1
	= 218	A1
		(2)
(b)	$[r =] \frac{-710}{\sqrt{"218" \times 2587.5}}$	M1
	= –0.945344... awrt –0.945	A1
		(2)
(c)	As **age increases**, **volume/blood** [pumped] **decreases** (o.e.)	B1
		(1)
(d)	**Yes** as r is close to **–** 1 (if $r <$ **–** 0.5) or **Yes** as r is close to 1 (if $r >$ 0.5) [If **–** 0.5 $\leq r \leq$ 0.5 allow "**no** since r is close to 0"]	B1ft
		(1)
(e)	$b = \frac{-710}{2587.5} = -0.27439...$ $\left(\text{allow } \frac{-284}{1035}\right)$ awrt –0.27	M1A1
	$a = \frac{560}{8} - "b" \times \frac{370}{8} [= 82.690...]$	M1
	$y = 82.7 - 0.274x$	A1
		(4)
(f)(i)	[$y = 82.7 - 0.274 \times 40$ =] 71.74.. awrt 72	B1ft
(ii)	Should be reliable since interpolation (o.e.)	B1
		(2)
	Notes	**Total 12**

(a)	**M1**	For a correct expression for S_{yy} May be implied by 218
	A1	218 (Condone 218.0)
(b)	**M1**	for attempt at correct formula. Must have their S_{yy} and given S_{xx} , S_{xy} in the correct places. Condone missing – sign awrt – 0.945 scores M1A1 but award M1A0 for awrt –0.95 with no expression seen
	A1	Awrt –0.945
(c)	**B1**	Must mention "age" and "volume/blood" No ft
(d)	**B1ft**	A correct statement with a correct reason ft their r (provided that $\lvert r \rvert < 1$) Allow 'my value / it's' to imply r. 'points lie close to a line' is B0 since there is no evidence of this
(e)	**M1**	For a correct expression for b Condone missing – sign May be implied by awrt –0.27 or an exact fraction
	A1	Awrt –0.27 Allow an exact fraction
	M1	For a correct method to find a Ft their value of b May be implied by awrt 82.7
	A1	For a correct equation for y and x with a = awrt 82.7 and b = awrt –0.274 No fractions. Both values must be 3 sf or better
(f)(i)	**B1ft**	Awrt 72 ft their regression line
(ii)	**B1**	For a comment that suggests that it is reliable since 40 is within the range of the data or interpolation e.g. Reliable since 40 is close to $\bar{x}$ / 46.25 Do not allow Reliable since awrt 72 is within the range of the data oe Condone extra non-relevant comments

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Question Number	Scheme			Marks
2(a)	1			B1
				(1)
(b)	$a = 0.26 - 0.1$	$b = 0.26 + 0.28$ or 'a' + 0.38 or $0.76 -$ 'c'	$c = 0.76 -$ 'b' or $1 - (0.62 +$ 'a')	M1
	$a = 0.16$	$b = 0.54$	$c = 0.22$	A1A1
				(3)
(c)	0.24			B1
				(1)
(d)	P(X is an odd number) = 0.1 + 0.28 + 0.24= 0.62			
	P(X_1 and X_2 are both odd) = 0.62^2 or $0.1^2 + 0.28^2 + 0.24^2 + 2\times0.1\times0.28 + 2\times0.1\times0.24 + 2\times0.24\times0.28$			M1
	= 0.3844	awrt 0.384		A1
				(2)
(e)	[P($X_1 + X_2 = 6$ | both are odd) =] $\frac{P(X_1 + X_2 = 6 \cap X_1 \text{ and } X_2 \text{ are odd})}{P(X_1 \text{ and } X_2 \text{ are odd})}$			M1
	$= \frac{0.1\times0.24 + 0.28\times0.28 + 0.24\times0.1}{'d'} = \frac{0.1264}{'d'}$			A1ft
	= 0.32882….	awrt 0.329		A1
				(3)

	Notes		Total 10
(a)	**B1**	Cao	
(b)	**M1**	For any correct calculation (may be implied by one correct answer) ft their values for a, b or c provided these result in a probability	
	A1	For one correct value	
	A1	For all 3 correct answers	
(c)	**B1**	Cao	
(d)	**M1**	For a complete correct expression ft their values for a and c e.g. $(1 - ('a' + 'c'))^2$ May be implied by awrt 0.384 or $\frac{961}{2500}$	
	A1	Awrt 0.384 or $\frac{961}{2500}$	
(e)	**M1**	For a correct conditional probability expression may be implied by a correct numerator awrt 0.126 or $\frac{79}{625}$ and a denominator ft part d. May be stated in words e.g. $\frac{P(\text{sum} = 6 \cap \text{odd})}{P(\text{odd})}$ oe Do not allow P($X_1 + X_2 = 6$ | both are odd) on its own	
	A1ft	For a correct numerator (may be implied by awrt 0.126 or $\frac{79}{625}$) and denominator ft their part d	
	A1	Awrt 0.329 or $\frac{316}{961}$	

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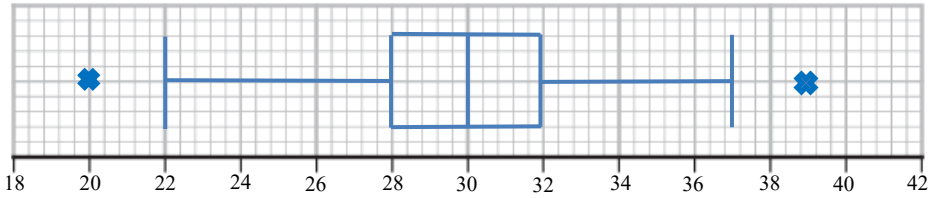
Question Number	Scheme	Marks
3(a)	29	B1
		(1)
(b)	Median = 30	B1
	IQR = 32 – 28	M1
	= 4	A1
		(3)
(c)	'32' + 1.5('4') = '38' and '28' – 1.5('4') = '22'	M1
		B1 B1ft A1
		(4)
(d)	***Westyou***: $[Q_2 - Q_1 = 3,\ Q_3 - Q_2 = 1 \text{ or } (Q_2 - Q_1) > (Q_3 - Q_2)] \Rightarrow$ -ve [skew]	B1B1ft
	Eastyou: $[Q_2 - Q_1 = 2,\ Q_3 - Q_2 = 2 \text{ or } (Q_2 - Q_1) = (Q_3 - Q_2)] \Rightarrow$ No skew	B1ft
		(3)

	Notes	**Total 11**
(a)	**B1**	Allow 28.9
(b)	**B1**	Cao (Condone no label, but incorrect label is B0) Must be seen in part b
	M1	For UQ – LQ (at least one correct)
	A1	Cao (Must be in part (b)) Allow 4 with no working shown, but do not allow 4 from incorrect working
(c)	**M1**	Sight of $"32"+1.5("4")$ or "38" or $"28"-1.5("4")$ or "22" ft their UQ and LQ. May be implied by a fully correct box plot with both outliers plotted
	B1	Box with 2 whiskers (Must be one either side of the box)
	B1ft	Lower whisker plotted at 22 (allow their 22 or the next biggest number if more than 1 outlier identified or allow 20 if no outlier identified), LQ plotted at their 28, Median plotted at their 30, UQ plotted at their 32 and Upper whisker plotted at 37 (allow their 38 or their next smallest value if more than 1 outlier identified or allow 39 if no outlier identified) **NB** We only ft their 28 and their 32 if stated/shown in part b
	A1	2 outliers plotted at 20 and 39 and no extras
		NB If no scale given then the maximum this may score is M1B1B0A0
(d)	**B1**	***Westyou*** negative [skew] Must be clear indication that it is associated with *Westyou* e.g W
	B1ft	***Eastyou*** no skew/zero skew oe Condone symmetrical/symmetric. Must be clear indication that it is associated with *Eastyou* e.g. E Do not allow even skew or normal/normally distributed etc ft their box plot
	B1ft	Justification for both of the given statements or use of the box plot in their explanation This mark is independent of the given statements ft their box plot Do not allow contradictory justifications
		NB SC if only one comment is made then assume it is about *Eastyou* and B0B1B0 is possible

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Question Number	Scheme	Marks
4(a)	[Let J = the length of a jump] P(J < 2.5) = $\mathrm{P}\left(Z < \frac{2.5-3.3}{0.6}\right)$	M1
	[= P(Z < – 1.333…) = 1 – 0.9082] = 0.0912 to 0.0918	A1
		(2)
(b)	$[\mathrm{P}(J > d) = 0.4 \Rightarrow]$ $\frac{d-3.3}{0.6} = 0.2533$ or $\frac{3.3-d}{0.6} = -0.2533$	M1A1
	d = 3.45198 awrt 3.452	A1
		(3)
(c)	$[\mathrm{P}(J > m \mid J > d) \Rightarrow]$ $\frac{\mathrm{P}(J > m)}{0.4} = 0.5$ or P(J > m) = 0.2	M1
	$\frac{m-3.3}{0.6} = 0.8416$ or $\frac{3.3-m}{0.6} = -0.8416$	M1
	m = 3.80496 (calc 3.80497…) awrt 3.8[0]	A1
		(3)
(d)	P(J > 4.1) = 0.0918 (same as (a))	B1ft
	So P(certificate) = $0.4 \times$ "(a)"	M1
	= 0.036 to 0.037	A1
		(3)

	Notes	Total 11
(a)	**M1**	For standardising with 2.5, 3.3 and 0.6 Allow ± and ignore inequality Must show the standardisation
	A1	For an answer in the range 0.0912 to 0.0918 **NB** calc gives 0.09121128…
(b)	**M1**	For standardising with d (allow any letter for d), 3.3 and 0.6 and setting equal to z where 0.2 < |z| < 0.3 Must show the standardisation
	A1	For a correct equation with z = ± 0.25 or better (allow any letter for d) z value must be compatible with their standardisation
	A1	For awrt 3.452 (calc gives 3.45200… use of 0.2533 gives 3.4519…)
(c)	**M1**	For a correct probability statement involving J and m (median) only Allow any letter for J and m May be implied by awrt 3.8[0]/3.81 or 2nd M mark
	M1	For $\frac{m-3.3}{0.6} = z$ where 0.84 ≤ z < 0.85 or $\frac{3.3-m}{0.6} = z$ where –0.85 < z ≤ –0.84 May be implied by awrt 3.8[0]/3.81 Allow any letter for m
	A1	Awrt 3.8[0] (accept 3.805)
(d)	**B1ft**	For an answer in the range 0.0912 to 0.0918 or same as part (a) for P(J > 4.1) Allow any letter for J
	M1	For 0.4 × their P(J > 4.1)
	A1	For answer in the range 0.036 to 0.037 **NB** 0.4 × 0.0918 = 0.036712 and 0.4 × 0.0912 = 0.03648

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Question Number	Scheme	Marks
5(a)	[P(Both blue) $= 0.05 \times 0.05 =$]0.0025 oe	B1
		(1)
(b)	P(Exactly 1 red)$=2 \times 0.05 \times 0.95$	M1
	$=0.095$	A1
		(2)
(c)	P(2 yellow and 1 green)$=3 \times \frac{4}{9} \times \frac{5}{8} \times \frac{4}{7}$	B1M1
	$= \frac{10}{21}$	A1
		(3)
(d)	[P(All beads are yellow)] = $\frac{5}{9} \times \frac{4}{8} \times \frac{3}{7} \times \frac{2}{6}$	M1
	[P(At least 1 bead is green)$=1 -$ P(all beads are yellow)$=] 1 - \frac{5}{9} \times \frac{4}{8} \times \frac{3}{7} \times \frac{2}{6}$	M1
	$= \frac{121}{126}$	A1
		(3)
	Notes	**Total 9**

(a)	**B1**	oe e.g. $\frac{1}{400}$
(b)	**M1**	oe e.g. $\frac{1}{20} \times \frac{19}{20} + \frac{19}{20} \times \frac{1}{20}$
	A1	oe e.g. $\frac{19}{200}$
(c)	**B1**	For 3 × … or the sum of exactly 3 identical products. Allow equivalent expressions for 3 × … e.g. ${}^3C_2$
	M1	For $\frac{4}{9} \times \frac{5}{8} \times \frac{4}{7}$ oe e.g. $\frac{5 \times 4 \times 4}{9 \times 8 \times 7}$ May be implied by $\frac{10}{63}$
	A1	For $\frac{10}{21}$ oe (allow awrt 0.476 from correct working)
(d)	**M1**	For $\frac{5}{9} \times \frac{4}{8} \times \frac{3}{7} \times \frac{2}{6}$ oe e.g. $\frac{5 \times 4 \times 3 \times 2}{9 \times 8 \times 7 \times 6}$ It must be on its own or clear that they are finding P(All beads are yellow) and not embedded in a list of possible outcomes or a list of all 15 outcomes May be implied by 2nd M1 (YYYG)×4 [(YYGY), (YGYY), (GYYY)] May be implied by $4 \times \frac{5 \times 4 \times 3 \times 4}{9 \times 8 \times 7 \times 6}$ oe (YYGG)×6 [(YGYG), (YGGY), (GYYG), (GYGY), (GGYY)] May be implied by $6 \times \frac{5 \times 4 \times 4 \times 3}{9 \times 8 \times 7 \times 6}$ oe (YGGG) ×4 [(GGGY), (GGYG), (GYGG)] May be implied by $4 \times \frac{5 \times 4 \times 3 \times 2}{9 \times 8 \times 7 \times 6}$ oe (GGGG) May be implied by $\frac{4 \times 3 \times 2 \times 1}{9 \times 8 \times 7 \times 6}$ oe
	M1	Use of $1 - p$ (where p is a product of 4 probabilities) or the sum of all 15 correct probabilities
	A1	$\frac{121}{126}$ oe (allow awrt 0.96 – must be from correct working)
		SC If M0M0A0 then award M1M0A0 for 15 probabilities with no extras listed with at least 3 correct products

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Question Number	Scheme	Marks
6(a)	$\mathrm{E}(X) = -4a + (-3b) + a + 2b + 5\times 0.2 [= -3a - b + 1]$	B1
		(1)
(b)(i)	$[\mathrm{E}(X) =] 0$	B1
(ii)	$a + b + a + b + 0.2 = 1$	B1
	$\left.\begin{array}{l} 2a + 2b = 0.8 \\ 3a + b = 1 \end{array}\right\} \Rightarrow$ e.g. $4a = 1.2$ or $4b = 0.4$	M1
	Solving simultaneously to give $a = 0.3$ $b = 0.1$	A1A1
		(5)
(c)	$\mathrm{Var}(1-3X) = 9\mathrm{Var}(X)$ $\quad$ y : 13 10 −2 −5 −14	M1
	$\mathrm{E}(X^2) = (-4)^2 a + (-3)^2 b + a + (2^2)b + 25\times 0.2 [= 11.4]$ $\quad$ $\mathrm{Var}(1-3X) = \left.\begin{array}{l} 13^2\times 0.3 + 10^2\times 0.1 + \\ (-2)^2\times 0.3 + (-5)^2\times 0.1 \\ +(-14)^2\times 0.2 \end{array}\right) - 1^2$	M1
	$\mathrm{Var}(1-3X) = 102.6$ $\quad$ awrt 103	A1
		(3)
(d)(i)	$[\mathrm{P}(Y<0) = \mathrm{P}(1-X<0) =]$ $\mathrm{P}(X>1) = "0.1" + 0.2 = 0.3$ $\quad$ [y : 5 4 0 −1 −4] $\mathrm{P}(Y<0) = "0.1" + 0.2 = 0.3$	M1A1ft
(ii)	$[\mathrm{P}(Y<k) = \mathrm{P}(1-X<k) =] \mathrm{P}(X>(1-k)) = 0.2$ or $1-k=2$ $\quad$ $\mathrm{P}(Y<-1) = 0.2$	M1
	$k = -1$	A1
		(4)
	Notes	**Total 13**
(a)	**B1**	For a correct expression for E(X) need not be simplified. May be seen in part (b) Do not ISW e.g. $\frac{-4a + (-3b) + a + 2b + 5\times 0.2}{5}$ oe
Mark (i) and (ii) together as one part		
(b)(i)	**B1**	For 0 Condone E(X)^2 = 0
(ii)	**B1**	For using sum of probabilities = 1 to form an equation in a and b May be seen in (i)
	M1	For eliminating one variable only ft their 2 equations if working is shown. May be implied by a = 0.3 or b = 0.1
	A1	For a = 0.3 or b = 0.1
	A1	For both a = 0.3 and b = 0.1
(c)	**M1**	For 3^2Var(X) or 3^2E(X^2) or for all 5 correct y values seen or used
	M1	For a correct algebraic expression for E(X^2) or Var(X) e.g. $17a + 13b + 5$ or a correct numerical expression ft their a and their b May be seen in part (b) or a fully correct expression for Var(1 − 3X) including the -1^2
	A1	Awrt 103 Allow $\frac{513}{5}$
(d)(i)	**M1**	For P(X > 1) or for X = 2 and X= 5 only or for Y = −1 and Y = −4 or "b" + 0.2 Allow b + 0.2 if no b value stated in part b
	A1ft	Ft their b provided b and b + 0.2 are probabilities
(ii)	**M1**	For P(X > (1 − k)) = 0.2 or 1 − k = 2 or P(Y < −1)=0.2 May be implied by k = −1
	A1	Cao

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Question Number	Scheme	Marks
7(a)	$[\mu \text{ or } \bar{x} =]\frac{8360}{10} = 836$	B1
	$(\sigma =)\sqrt{\frac{\sum(x-\bar{x})^2}{10}} = \sqrt{\frac{63840}{10}}$ | $(s =)\sqrt{\frac{\sum(x-\bar{x})^2}{9}} = \sqrt{\frac{63840}{9}}$	M1
	= 79.89993... awrt 79.9 | = 84.22192... awrt 84.2	A1
		(3)
(b)	Mean > Median	B1
	So positive skew	dB1
		(2)
(c)	$\frac{776+896}{2} = 836$ which is the same as $\bar{x}$ **or** one is 60 above $\bar{x}$, one 60 below	B1
	So no change in the mean	dB1
		(2)
(d)	$896-836 = 836-776 = 60 < 79.9/84.2$ or $(896-836)^2 = (776-836)^2 = 60^2 = 3600 < 6384$ or $\left[\frac{\sum(x-\bar{x})^2}{12} \rightarrow\right] \frac{63840+2\times60^2}{12} = \frac{71040}{12} = 5920 < \frac{63840}{10}$ or $\sqrt{5920} = 76.9 < 79.9/84.2$	B1
	So standard deviation will reduce	dB1
		(2)

	Notes	**Total 9**
(a)	**B1**	Cao Allow a correct fraction
	M1	for a correct expression for σ or σ^2 or s or s^2 (ignore labels). NB $\sum x^2 = 7052800$ but must see at least $\sigma^2 = \frac{7052800}{10} - (\text{"836"})^2$ for M1
	A1	Awrt 79.9 or awrt 84.2 if s is calculated cao scores M1A1 Do not allow $4\sqrt{399}$
(b)	**B1**	For a correct comparison of mean and median (allow 836 > 815 or 815 < 836) May see $\frac{k(\text{mean}-\text{median})}{\sigma \text{ or } \sigma^2}$ (o.e.) if so just check sign of answer (provided denom > 0)
	dB1	Dependent on 1st B1 for positive skew. Positive correlation is B0 **SC** If their mean is < 815 award B0B1 for the comparison **and** statement of negative skew
(c)	**B1**	For a suitable calculation to show mean of these two rabbits (or all 12) is the same e.g. new $\sum x = 8360+776+896 = 10032$, so mean = $\frac{10032}{12} = 836$ **NB We must see a calculation**

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	dB1	Dependent on a suitable calculation or reason for stating no change oe
(d)	**B1**	For a suitable calculation showing 60 and comparing with 79.9/84.2 or a suitable calculation showing 3600 and comparing with 6384 or calculation of new variance 5920 and comparing with 6384 or calculation of new standard deviation 76.9 and comparing with 79.9/84.2
	dB1	Dependent on 1st B1 for stating standard deviation reduces oe