

Mark Scheme (Results)

Summer 2022

Pearson Edexcel International Advanced Level In Statistics S1 (WST01) Paper 01

Question		Scheme	Mai	rks
Number	0		D1	
1(a)	w = 8		B1	
	x = 19		B1 B1	
	y = 37		DI	(2)
(h)	"37" 1	×("37"-"19") [= 55]	M1	(3)
(b)			M1	
	59 and 6	4	A1ft	(2)
(c)		x x 10 20 30 40 50 60 Hours	M1 A1ft A1ft	(3)
(d)	("37"-	26) – (26 – "19") 37" – "19")	M1	(3)
		= 0.22 (to 2 sf)	A1	
(2)	D ~ 'Th	11 4h - data?	D1	(2)
(e)	E.g. 1n	e mean uses all the data'	B1	(1)
			Tote	al 11
		Notes	100	41 11
(a)	B1B1B1	Cao May be seen in table before part (a). $w = 28$ is first B0.		
(b)	M1	Calculation for the outliers using their lower quartile and upper quartile. Allow "their upper quartile" + "their IQR" for this mark i.e. 37 + 18		
	A1ft	For identifying 59 and 64 as outliers from correct working. Ft the identification of outlier(s) (if any) from "their 55" from their shown calculation Answer only is M0A0.		
(c)	M1	For a box with at least one whisker drawn		
	A1ft	14 for lowest whisker, 26 for median, "19" and "37" plotted for quartiles ft their value quartiles	es for	
	A1ft	Upper whisker at 51 or "their 51" plus "their outliers" plotted but there must be at lea for this mark. Condone upper whisker at "their 55". NB award A0 if there is more than one whisker at either end	st one or	ıtlier
(d)	M1	For substituting their values into the formula		
	A1	Allow awrt 0.22 (allow $\frac{2}{9}$ or $0.\dot{2}$)		
(e)	B1	A correct reason which supports <i>Landacre</i> 's use of the mean or rejects their use of the Allow comment relating to (slight) positive skew so mean > median so <i>Landacre</i> will larger average they will have to pay. Comments about skewness/symmetry on their own score B0. Mean includes the outliers is B1. Condone Median is not affected by the outliers for B1. Mean is more accurate is B0.		

	Question Number		Scheme	Ma	rks	
	2(a)	$S_{gg} = 3624.41 - \frac{144.84^2}{9} [= 1293.4516]$				
		r = -	40.25 \[\sqrt{1293.4516"\times 1.29} \]	M1		
(b) As the population/t increases, GDP/g increases oe B1 (c) $b = \frac{40.25}{1.29} \left[= 31.20155 \right]$ $a = \frac{144.84}{9} - "31.20155" × \frac{7.87}{9} \left[= -11.19068 \right]$ $g =31.20155t$ $g = -11.2 + 31.2t$ (d) The GDP/g increases by (an average of) "31.2" billion [dollars] when the population/t increases by one million. (e)(i) "-11.2"+"31.2"×7 M1 $= 207.2$ $= 207$				A1		
(b) As the population/r increases, GDP/g increases oe $b = \frac{40.25}{1.29} \left[= 31.20155 \right]$ $a = \frac{144.84}{9} - "31.20155" \times \frac{7.87}{9} \left[= -11.19068 \right]$ $g =31.20155t$ $g = -11.2 + 31.2t$ Al (d) The GDP/g increases by (an average of) "31.2" billion [dollars] when the population/t increases by one million. (e)(i) "-11.2"+"31.2"×7 $= 207.2$ awrt 207 Al (ii) Unreliable as 7 000 000 is much greater than the mean population/ \overline{t} for the 9 years. B1 (f) $0.1 = "31.2"x$ M1 $x = 0.003205$ million people awrt 0.0032 Notes Notes Total 14 (a) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) M1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 awrt 0.985 (correct answer only scores MIMIM1) (b) B1 A correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct method for finding S_{vx} (implied by awrt 1290 to 3sf) A1 Correct					(3)	
(c) $b = \frac{40.25}{1.29} [= 31.20155]$ $a = \frac{144.84}{9} - "31.20155" \times \frac{7.87}{9} [= -11.19068]]$ $g =31.20155t$ $g = -11.2 + 31.2t$ (d) $The GDP/g \text{ increases by (an average of) "31.2" billion [dollars] when the population/t increases by one million. (e)(i) T-11.2" + "31.2" \times 7 = 207.2 (ii) Unreliable as 7 000 000 is much greater than the mean population/\bar{t} for the 9 years. (b) T = \frac{1}{2} + \frac{1}{2}$	(b)	As th	e population/t increases, GDP/g increases oe	B1	` ′	
$a = \frac{144.84}{9} - "31.20155" \times \frac{7.87}{9} \left[= -11.19068 \right] $ $g =31.20155t $ $g = -11.2+31.2t $ (4) The GDP/g increases by (an average of) "31.2" billion [dollars] when the population/t increases by one million. (e)(i)					(1)	
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(e)(i)	(d)	1		B1		
					(1)	
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Or substituting two values for g with a difference of 0.1 in their equation leading to a value of x						
	(f)	M1		ie of r		
A1 awrt 0.0032 (million) Allow awrt 3200 (to 2sf) Do not allow fractions.		A1		01 //		

Signature Sig	Qu. No.		Scheme	Marks
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	3(a)	Width = 2.5 (cm)		
(a) Median = $[20] + \frac{25}{35} \times 5$ allow $[20] + \frac{25.5}{35} \times 5$ M1 $= 23.57 \text{ allow } 23.64 \text{ awrt } 23.6 \text{ A1}$ (b) $P(4 \log \sin) = \left(\frac{62}{88}\right) \times \left(\frac{60}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922 \text{ awrt } 0.239 \text{ A1}$ (c) $P(4 \log \sin) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922 \text{ awrt } 0.239 \text{ A1}$ (c) $P(4 \log \sin) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922 \text{ awrt } 0.239 \text{ A1}$ (c) $P(4 \log \sin) = \left(\frac{924}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{85}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922 \text{ awrt } 0.239 \text{ A1}$ (2) M1 $= -531 \text{ A1}$ (3) M1 $= -531 \text{ A1}$ (3) M1 $= -531 \text{ A2}$ (3) Wariance of $y = \frac{12862}{88} \times \left(\frac{(10.5)^n}{2}\right)^2 = 35.909]$ M1 $= -143.636 \text{ awrt } 144 \text{ A1}$ (3) A1 $= -143.636 awrt$		Heigh	ht = $\left(\frac{35}{15} \times 6\right)$ ÷ "2.5" or $\frac{4}{5} \times 7$ or 6 cm ² = 15 (logs) or 14 cm ² = 35 (logs) oe	M1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			= 5.6 (cm)	A1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				(3)
(c) $19+35+8 = 62^{\circ}$) or $88-3-15-8 = 62^{\circ}$) Blcso* (d) $P(4 \log fit) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922$ awrt 0.239 A1 (e)(i) $\frac{1}{10} = \frac{924}{88} = 10.5$ M1 $= 0.3392$	(b)	Medi	an = $[20] + \frac{25}{35} \times 5$ allow $[20] + \frac{25.5}{35} \times 5$	M1
(c) $19 + 35 + 8 (= 62^*)$ or $88 - 3 - 15 - 8 (= 62^*)$ (1) $P(4 \log s \text{ fit}) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$ M1 $= 0.23922$ awrt 0.239 A1 (e)(i) $mean of y = \frac{924}{88} [= 10.5]$ M1 $mean of w = ("10.5" + 255) \times 2$ M1 $= 531$ A1 (ii) $variance of y = \frac{12862}{88} - ("10.5")^2 [= 35.909]$ M1 $variance of w = "35.909" \times 4 \text{ or "} 35.909" \times 0.5^2$ M1 $= 143.636$ awrt 144 A1 (a) $\frac{B1}{A1}$ Correct method to relate area to number of logs (may be implied by "their w " × "their h " = 14) A1 5.6 oe (b) M1 For a correct fraction multiplied by 5. Allow working downwards e.g. $[25] - \frac{10}{35} \times 5$ A1 Correct answer from correct working. Allow exact fraction. (c) $\frac{1}{8}$ A correct calculation seen. Allow $\frac{1}{2}$ (16) for 8. Allow equivalent methods $\frac{4-54}{30-54} = \frac{26-25}{37-25}$ Minimum working required $54 + 8$ or $70 - 8$ or $\frac{44-70}{30}$ NB: $26 + x = 88 \rightarrow x = 62$ is B0. (d) M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 0.5) or for equation $0.5 \sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of y (implied by awrt 35.9) or $0.25 \sum w^2 + 255^2 \times 88 - 255 \sum w = 12862$			= 23.57 allow 23.64 awrt 23.6	i
$ (d) \qquad P(4 \log \operatorname{fit}) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right) \qquad \qquad M1 $ $ = 0.23922 \qquad \operatorname{awrt} 0.239 \qquad A1 $ $ (e)(i) \qquad \operatorname{mean of } y = \frac{924}{88} [= 10.5] \qquad \qquad M1 $ $ = 10.23922 \qquad \operatorname{man of } y = \frac{924}{88} [= 10.5] \qquad \qquad M1 $ $ = 10.5 + 255 \times 2 \qquad \qquad M1 $	(c)	19 +	35 + 8 (-62*) or $88 - 3 - 15 - 8 (-62*)$	
(d) $ \begin{array}{c} P(4 \log s \mathrm{fit}) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right) & \mathrm{MI} \\ = 0.23922 & \mathrm{awrt} 0.239 & \mathrm{AI} \\ \hline \\ (e)(i) & \mathrm{mean} \mathrm{of} y = \frac{924}{88} [= 10.5] & \mathrm{MI} \\ \hline \\ \mathrm{mean} \mathrm{of} w = \left("10.5" + 255\right) \times 2 & \mathrm{MI} \\ \hline \\ = 531 & \mathrm{AI} & (3) \\ \hline \\ (ii) & \mathrm{variance} \mathrm{of} y = \frac{12862}{88} - \left("10.5"\right)^2 [= 35.909] & \mathrm{MI} \\ \hline \\ \mathrm{variance} \mathrm{of} w = \frac{135.909 \times 4 \mathrm{or} "35.909" + 0.5^2}{-143.636} & \mathrm{awrt} 144 & \mathrm{AI} \\ \hline \\ (a) & \mathrm{MI} & \mathrm{Correct} \mathrm{method} \mathrm{to} \mathrm{relate} \mathrm{area} \mathrm{to} \mathrm{number} \mathrm{of} \mathrm{logs} (\mathrm{may} \mathrm{be} \mathrm{implied} \mathrm{by} "\mathrm{their} w" \times "\mathrm{their} h" = 14) \\ \hline \\ (b) & \mathrm{MI} & \mathrm{Correct} \mathrm{method} \mathrm{to} \mathrm{relate} \mathrm{area} \mathrm{to} \mathrm{number} \mathrm{of} \mathrm{logs} (\mathrm{may} \mathrm{be} \mathrm{implied} \mathrm{by} "\mathrm{their} w" \times "\mathrm{their} h" = 14) \\ \hline \\ (c) & \mathrm{AI} & \mathrm{S.6} \mathrm{ce} \\ \hline \\ \mathrm{MI} & \mathrm{Correct} \mathrm{answer} \mathrm{from} \mathrm{correct} \mathrm{downwards} \mathrm{c.g.} \left[25 \right] - \frac{10}{35} \times 5 \\ \hline \\ \mathrm{AI} & \mathrm{Correct} \mathrm{answer} \mathrm{from} \mathrm{correct} \mathrm{working} \mathrm{allow} \mathrm{working} \mathrm{downwards} \mathrm{c.g.} \left[25 \right] - \frac{10}{35} \times 5 \\ \hline \\ \mathrm{AI} & \mathrm{Correct} \mathrm{calculation} \mathrm{seen} \mathrm{.Allow} \frac{1}{2} (\mathrm{16}) \mathrm{for} \mathrm{8.} \mathrm{Allow} \mathrm{equivalent} \mathrm{methods} \frac{4.54}{3045} = \frac{2025}{3055} \\ \hline \\ \mathrm{Minimum} \mathrm{working} \mathrm{required} 54 + 8 \mathrm{or} 70 - 8 \mathrm{or} \frac{41.70}{20.00} \mathrm{NB} 26 + x = 88 \to x = 62 \mathrm{is} \mathrm{B0}. \\ \hline \\ \mathrm{(d)} & \mathrm{MI} & \mathrm{For} \left(\frac{n}{88}\right) \times \left(\frac{n-2}{87}\right) \times \left(\frac{n-3}{86}\right) \times \left(\frac{n-3}{85}\right) \mathrm{(allow} \mathrm{ann} n < 88) \\ \hline \\ \mathrm{AI} \mathrm{awrt} 0.239 \mathrm{sc} \\ \mathrm{(e)(i)} & \mathrm{MI} & \mathrm{Correct} \mathrm{method} \mathrm{for} \mathrm{finding} \mathrm{mean} \mathrm{of} y (\mathrm{implied} \mathrm{by} \mathrm{awrt} 35.9) \\ \mathrm{or} 0.25 \sum w^2 + 255^2 \times 88 - 255 \sum w + 258^2 \times 88 - 255 \sum w + 262 \mathrm{s} \mathrm{Mander} \mathrm{awrt} 35.9) \\ \mathrm{or} 0.25 \sum w^2 + 255^2 \times 88 - 255 \sum w + 258^2 \times 88 - 255 \sum w + 2862 \mathrm{s} \mathrm{mean} \mathrm{awrt} 35.9 \\ \mathrm{or} 0.25 \sum w^2 + 255^2 \times 88 - 2$	(6)	17 1	33 + 0 (= 02)	
(e)(i) $\begin{array}{ c c c c c } \hline \\ mean of $y = \frac{924}{88}[=10.5]$ & M1 \\ \hline \\ mean of $w = ("10.5"+255)\times 2$ & M1 \\ \hline \\ & & & & & & & & & & & & & & & & &$	(d)	(d) $P(4 \log \text{ fit}) = \left(\frac{62}{88}\right) \times \left(\frac{61}{87}\right) \times \left(\frac{60}{86}\right) \times \left(\frac{59}{85}\right)$		M1
(e)(i) $ \begin{array}{c} \text{mean of } y = \frac{924}{88} \Big[= 10.5 \Big] \\ \text{mean of } w = ("10.5" + 255) \times 2 \\ \text{mean of } w = ("10.5" + 255) \times 2 \\ \text{mean of } w = ("10.5" + 255) \times 2 \\ \text{mean of } w = ("10.5")^2 \Big[= 35.909 \Big] \\ \text{M1} \\ \text{variance of } w = "35.909" \times 4 \text{ or } "35.909" \div 0.5^2 \\ \text{may consider of } w = "35.909" \times 4 \text{ or } "35.909" \div 0.5^2 \\ \text{mode of } w = "35.909" \times 4 \text{ or } "35.909" \div 0.5^2 \\ \text{mode of } w = 143.636 \\ \text{mode of } w = 143.636 \\ \text{Notes} \\ \text{M1} \\ \text{Correct method to relate area to number of logs (may be implied by "their w" × "their h" = 14)} \\ \text{M1} \\ \text{Correct method to relate area to number of logs (may be implied by "their w" × "their h" = 14)} \\ \text{M1} \\ \text{Correct answer from correct working. Allow exact fraction.} \\ \text{(c)} \\ \text{M1} \\ \text{Correct answer from correct working. Allow exact fraction.} \\ \text{(d)} \\ \text{M2} \\ \text{M3} \\ \text{M3} \\ \text{M4} \\ \text{M5} \\ \text{M5} \\ \text{M6} \\ \text{M6} \\ \text{M6} \\ \text{M6} \\ \text{M7} \\ \text{M7} \\ \text{M7} \\ \text{M7} \\ \text{M7} \\ \text{M8} \\ \text{M8} \\ \text{M7} \\ \text{M8} \\ \text{M8} \\ \text{M9} \\ \text{Correct method for finding mean of } w \\ \text{M9} \\ \text{M1} \\ \text{Correct method for finding mean of } w \\ \text{M1} \\ \text{Correct method for finding mean of } w \\ \text{M2} \\ \text{M3} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M1} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M2} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M3} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M3} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M6} \\ \text{M1} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M1} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M1} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M1} \\ \text{Correct method for finding variance of } y \\ \text{(implied by awrt 35.9)} \\ \text{M3} \\ \text{M4} \\ \text{M5} \\ \text{M5} \\ \text{M5} \\ \text{M6} \\ $			= 0.23922 awrt 0.239	
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(ii) variance of $y = \frac{12862}{88} - ("10.5")^2 [= 35.909]$ Variance of $w = "35.909" \times 4$ or "35.909" $\div 0.5^2$ $= 143.636$ Notes Notes Notes Notes Notes Total 14 (a) B1 2.5 oe M1 Correct method to relate area to number of logs (may be implied by "their w " \times "their h " $= 14$) A1 5.6 oe (b) M1 For a correct fraction multiplied by 5. Allow working downwards e.g. $[25] - \frac{10}{35} \times 5$ A1 Correct answer from correct working. Allow exact fraction. (c) B1 A correct calculation seen. Allow $\frac{1}{2}(16)$ for 8. Allow equivalent methods $\frac{x-54}{70-54} = \frac{26-25}{27-25}$ Minimum working required $54 + 8$ or $70 - 8$ or $\frac{54+70}{2}$ NB: $26 + x = 88 \rightarrow x = 62$ is B0. (d) M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5 \sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of y (implied by awrt 35.9) or $0.25 \sum w^2 + 255^2 \times 88 - 255 \sum w = 12862$		mea	n of $w = ("10.5" + 255) \times 2$	M1
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(c) B1 A correct calculation seen. Allow $\frac{1}{2}(16)$ for 8. Allow equivalent methods $\frac{x-54}{70-54} = \frac{26-25}{27-25}$ Minimum working required 54 + 8 or $70 - 8$ or $\frac{54+70}{2}$ NB: $26 + x = 88 \rightarrow x = 62$ is B0. (d) M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao (ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$	(b)	M1	For a correct fraction multiplied by 5. Allow working downwards e.g. $[25] - \frac{10}{35} \times 5$	
Minimum working required $54 + 8$ or $70 - 8$ or $\frac{54+70}{2}$ NB: $26 + x = 88 \rightarrow x = 62$ is B0. M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		A ₁	-	
Minimum working required $54 + 8$ or $70 - 8$ or $\frac{34+10}{2}$ NB: $26 + x = 88 \rightarrow x = 62$ is B0. M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao (ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$	(c)	D1	A correct calculation seen. Allow $\frac{1}{2}(16)$ for 8. Allow equivalent methods $\frac{x-54}{70-54} = \frac{26-25}{27-25}$	
(d) M1 For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$) A1 awrt 0.239 SC With replacement awrt 0.246 scores M1A0 (e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao (ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		DI	Minimum working required $54 + 8$ or $70 - 8$ or $\frac{54+70}{2}$ NB: $26 + x = 88 \rightarrow x = 62$	is B0.
(e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao (ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$	(d)	M1	For $\left(\frac{n}{88}\right) \times \left(\frac{n-1}{87}\right) \times \left(\frac{n-2}{86}\right) \times \left(\frac{n-3}{85}\right)$ (allow any $n < 88$)	
(e)(i) M1 Correct method for finding mean of y (implied by 10.5) or for equation $0.5\sum w - 88 \times 255 = 924$ M1 Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao (ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		A1	awrt 0.239	
(ii) Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$ A1 Cao Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		SC		
(ii) A1 Cao Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$	(e)(i)	M1	Correct method for finding mean of y (implied by 10.5) or for equation $0.5 \sum w - 88 \times 2$	255 = 924
(ii) Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		M1	Correct method for finding mean of w or $\sum w = 46728$ and $\frac{46728}{88}$	
M1 or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$		A ₁		
	(ii)	M1	Correct method for finding variance of y (implied by awrt 35.9) or $0.25\sum w^2 + 255^2 \times 88 - 255\sum w = 12862$	
	•	—		

	A1 av	vrt 144		
Question Number		Scheme		Marks
4(a)	· ·	$W) = P(H) + P(W) - P(H \cap W)$	$P(H' \cap W) = P(H \cup W) - P(H)$	M1
	$P(H \cap$	$W) = \frac{3}{8} \times P(W)$	$P(H' \cap W) = P(H') \times P(W)$	M1
	$\frac{3}{4} = \frac{3}{8} +$	$P(W) - \frac{3}{8}P(W)$	$\frac{3}{8} = \frac{5}{8} P(W)$ $P(W) = \frac{3}{5} *$	A1
	P(W) =	$\frac{3}{5}$ *	$P(W) = \frac{3}{5} *$	A1cso*
				(4)
(b)	P(N' A)	$H = \frac{\frac{3}{8} - \frac{1}{15}}{\frac{3}{8}} \text{ or } \frac{\frac{9}{40} + \frac{1}{12}}{\frac{3}{8}} \text{ or } 1 - \frac{\frac{1}{15}}{\frac{3}{8}}$ $= \frac{37}{45} = \text{awrt } 0.822$		M1
		$=\frac{37}{45}$ = awrt 0.822		A1
				(2)
(c)		$ \begin{array}{c c} H \\ \hline \frac{1}{12} \\ N \\ \hline \frac{1}{15} \end{array} $ $ \begin{array}{c} \frac{9}{40} \\ \hline \frac{3}{8} \end{array} $ $ \begin{array}{c} \frac{1}{4} \end{array} $	$\begin{array}{ c c c c c }\hline & & & & & & & & & & & & & & & & & & &$	B1 M1 M1 M1 A1
		Notes		Total 11
(a)	M1		$)-P(H \cap W)$ (with at least one value correctly	
	M1	for use of $P(H \cap W) = P(H \cup W) - P(H) \times P(W)$	P(H) (with at least one value correctly substitution or use of $P(H' \cap W) = P(H') \times P(H')$	
	A1	a correct equation in $P(W)$ (allow W or		1 (**)
	A1cso*		with no wrong working seen. Dep. on all previo	us marks.
	NB	A method which uses $\frac{3}{5}$ or $\frac{3}{5} \times \frac{3}{8} =$	$\frac{9}{40}$ can score maximum M1M1A0A0.	
(b)	M1	For $\frac{p}{\frac{3}{8}}$ where $0 use of inde$		
	A1	awrt 0.822		
(c)	B1	3 circles labelled. Either <i>N</i> inside <i>H</i> o not allow blank space to be considere Allow all 3 circles overlapping with a	· · · · · · · · · · · · · · · · · · ·	= 0 , but do
	M1	For $P(H \cap W) = \frac{3}{2} \times \frac{3}{5} = \frac{9}{40}$ seen	or correctly placed in Venn diagram.	
	M1	For their $\frac{3}{5} - \frac{9}{40} = \frac{3}{8}$ (may be i	mplied by the regions in their $P(W)$ adding to 0.0	6)
	M1	For their $\frac{3}{8}$ - " $\frac{9}{40}$ " - $\frac{1}{15}$ = " $\frac{1}{12}$ "		
	A1	Fully correct diagram with 1/4 and box	and correct probabilities (allow exact decimal e	quivalents)

Question Number	Scheme			rks
5(a)	E(x)	$R^{2} = 2^{2} \times 0.25 + 3^{2} \times 0.3 + 4^{2} \times 0.15 + 5^{2} \times 0.1 + 6^{2} \times 0.2 $ (= 15.8*)	B1cso)*
				(1)
(b)	$[sd(R)=]\sqrt{15.8-3.7^2}$			
		$=\sqrt{2.11}$		
	Stand	dard deviation = 1.4525 awrt 1.45	A1	
				(2)
(c)	d = 1	1	B1	
				(1)
(d)		-0.2 + 0.1 + a + b = 1 oe	M1	
		$0.1 + 3 \times 0.2 + 4 \times 0.1 + 5a + 6b = 4.55$ oe	M1	
	5(0.	$(6-b)+6b=3.35$ or $5a+6(0.6-a)=3.35 \implies a=0.25$ or $b=0.35$	M1	
	c =	0.4 + 0.25 or $c = 1 - 0.35$	M1	
	c =	0.65 oe	A1	
				(5)
(e)	0.9×	<0.75×0.1	M1	
	= 0.0675			
				(2)
(f)	For identifying that if Jessie scores 2, Pabel has no spin oe may be implied		M1	
	$[0.10 \times 0 +] 0.2 \times 0.3 + 0.1 \times 0.15 + "0.25" \times 0.1 + "0.35" \times 0.2$			
	= 0.17			
				(3)
(-)	D1	Notes	Total	14
(a)	B1	Correct calculation with all products seen (allow $1 + 2.7 + 2.4 + 2.5 + 7.2$) Figures may be seen in table before part (a). Condone missing addition signs if products s	oon in	ahla
(b)	M1	Use of formula including the square root	cen m	aoic.
(0)	A1	awrt 1.45 (correct answer with no working scores M1A1)		
(c)	B1	For 1		
(d)	M1	Allow equivalents eg $a+b=0.6$		
	M1	Allow equivalents eg $5a + 6b = 3.35$		
		Correct method to eliminate a or b (implied by a correct value for a or b)		
	M1	This mark can still be scored even if the method leads to a value of a or b which is not a p	robabil	ity.
		May see $a = c - 0.4$ to eliminate a or $b = 1 - c$ used to eliminate b		
	M1	A complete method for finding the value of c (condone using any value of a and b for t	his mai	k)
()	A1	0.65 oe		
(e)	M1	For the product of 3 probabilities		
	A1	0.0675 or exact equivalent fraction eg $\frac{27}{400}$		
(f)	M1	Identifying that if Jessie scores 2, there is only one spin or the 4 correct possibilities or		
	M1	At least 3 correct non-zero probability products ft their a and b (an answer of 0.195 scores	s MOM	1A0)
	A1	0.17		

Question Number		Scheme	Marks
6(a)	P(V	$P(V > 104.9) = P(Z > \frac{104.9 - 100}{2.5})$	
		=1-0.975	M1
		= 0.0250 0.025 or awrt 0.0250	A1
			(3)
(b)	Expe	ected number = $150 \times "0.025"$	M1
		= 3.75 awrt 3.75	A1
		FD(11 1010)]	(2)
(c)	[P(V	$V > v V < 104.9) = $ $ \frac{[P(v < V < 104.9)]}{P(V < 104.9)} = 0.2801 $	M1
		< V < 104.9) = (1 - "0.025") - P(V < v)	M1
	,	$([=0.7019] oe$	dM1
	$\frac{v-1}{2}$	$\frac{00}{5} = 0.53$	M1A1
		01.325 awrt 101.32 or awrt 101.33	A1
			(6)
		Notes	Total 11
(a)	M1	Standardising with 104.9, 100 and 2.5 (allow ±) implied by 1.96 seen	
	M1	For use of $1-p$ with $0.9 condone answer of 0.0249 for this mark$	
	A1	Allow 0.025 or awrt 0.0250 (NB calculator answer is 0.02499) (answer only scores M	/1M1A1)
(b)	M1	For $150 \times$ " their part (a)"	
	A1	awrt 3.75 isw after answer of 3.75 seen. If 3.75 not seen, allow 4 if the method mark is a	
(c)	M1	For writing or using a ratio of probabilities with denominator $P(V < 104.9)$ oe and equating	ig to 0.2801
		$\frac{p}{P(V < 104.9)} = 0.2801$ implied by awrt 0.273	
		Use of independence is MO as $x \times P(V < 104.9)$	
		Use of independence is M0 e.g. $\frac{x \times P(V < 104.9)}{P(V < 104.9)} = 0.2801$	
	M1	For writing or using $P(V > v \cap V < 104.9) = P(V < 104.9) - P(V < v) [= (1 - "0.025") - P(V < v)]$	<v)]< td=""></v)]<>
	ALT	For first two M marks $\frac{P(V < v)}{P(V < 104.9)} = 1 - 0.2801$ scores M1M1, then follow scheme.	
		(dep M1) Dependent on previous M1 for rearranging to find $P(V < v)$	
	dM1	Allow equivalent oe $(1-"\text{their}(a)")(1-0.2801)$	
		NB: $[P(V < v) =]$ awrt 0.702 implies M1M1M1 or $[P(V > v) =]$ awrt 0.298 implies M1M	/1M1
-	M1	Standardising with 100, 2.5 and equating to a z-value, $\frac{v-100}{2.5} = z$ 0.4 < $ z $ < 0.6 Watch out for $\frac{v-100}{2.5} = \text{probability which is M0}$	VIIIVII
<u> </u>		-10	
	A1	Correct equation with compatible signs	
	A1	awrt 101.33 (allow awrt 101.32 from use of calculator)	