

# Y1S6 XMQs and MS

(Total: 75 marks)

1. P3\_2018 Q1 . 5 marks - Y1S1 Data collection
2. P3\_2018 Q3 . 11 marks - Y1S6 Statistical distributions
3. P31(AS)\_2018 Q5 . 8 marks - Y1S6 Statistical distributions
4. P31(AS)\_2019 Q3 . 6 marks - Y1S6 Statistical distributions
5. P31(AS)\_2020 Q3 . 6 marks - Y1S6 Statistical distributions
6. P31(AS)\_2020 Q5 . 8 marks - Y1S6 Statistical distributions
7. P31(AS)\_2022 Q5 . 8 marks - Y1S6 Statistical distributions
8. P31\_2019 Q4 . 9 marks - Y1S6 Statistical distributions
9. P31\_2021 Q6 . 7 marks - Y1S6 Statistical distributions
10. P31\_2022 Q3 . 7 marks - Y1S2 Measures of location and spread



**Section A: STATISTICS**

Qu 1	Scheme										Marks	AO	
(a)	$c$	0	1	2	3	4	5	6	7	8		B1	1.2
	$P(C = c)$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$		B1ft	1.2
(b)	$P(C < 4) = \frac{4}{9}$ (accept 0.444 or better)											(2)	
(c)	Probability lower than expected suggests model is <u>not</u> good											B1	3.4
(d)	e.g. Cloud cover will vary from month to month and place to place So e.g. use a non-uniform distribution											(1)	
												B1ft	3.5a
												(1)	3.5c
												<b>( 5 marks)</b>	
<b>Notes</b>													
(a)	<p>1<sup>st</sup> B1 for a correct set of values for <math>c</math>. Allow <math>\{\frac{1}{8}, \frac{2}{8}, \dots, \frac{8}{8}\}</math>                  2<sup>nd</sup> B1ft for correct probs from their values for <math>c</math>, consistent with discrete uniform distrib'n                  Maybe as a prob. function. Allow <math>P(X = x) = \frac{1}{9}</math> for <math>0 \leq x \leq 8</math> provided <math>x = \{0, 1, 2, \dots, 8\}</math> is clearly defined somewhere.</p>												
(b)	B1 for using correct model to get $\frac{4}{9}$ (o.e.)												
<b>SC</b>	<b>Sample space {1, ..., 8}</b> If scored B0B1 in (a) for this allow $P(C < 4) = \frac{3}{8}$ to score B1 in (b)												
(c)	<p>B1ft for comment that states that the model proposed is or is not a good one based on their model in part (a) and their probability in (b)  <b> (b) – 0.315  &gt; 0.05</b> Allow e.g. “it is not suitable”; “it is not accurate” etc  <b> (b) – 0.315  ≤ 0.05</b> Allow a comment that suggests it <u>is</u> suitable  <b>No prob in (b)</b> Allow a comparison that mentions 50% or 0.5 and rejects the model  <b>No prob in (b) and no 50% or 0.5 or (b) &gt; 1</b> scores B0                  Ignore any comments about location or weather patterns.</p>												
(d)	<p>B1 for a sensible refinement considering variations in month or location                  Just saying “not uniform” is B0  <b>Context &amp; “non-uniform”</b> Allow mention of different locations, months <u>and</u> non-uniform <u>or</u> use more locations to form a new distribution with probabilities based on frequencies  <b>Context &amp; “binomial”</b> Allow mention of different locations, months <u>and</u> binomial  <b>Just refined model</b> Model must be outlined and discrete and non-uniform                  e.g. higher probabilities for more cloud cover <u>or</u> lower probabilities for less cloud cover  <b>Continuous model</b> Any model that is based on a continuous distribution. e.g. normal is B0</p>												



Qu 3	Scheme	Marks	AO										
(a)	The <u>probability</u> of a dart hitting the target is <u>constant</u> (from child to child and for each throw by each child) (o.e.)	B1	1.2										
	The <u>throws</u> of each of the darts are <u>independent</u> (o.e.)	B1	1.2										
(b)	$[P(H \geq 4) = 1 - P(H \leq 3) = 1 - 0.9872 = 0.012795.. =]$ awrt <b><u>0.0128</u></b>	B1 (2)	1.1b										
(c)	$P(F = 5) = 0.9^4 \times 0.1, = 0.06561$ = awrt <b><u>0.0656</u></b>	M1, A1 (2)	3.4 1.1b										
(d)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>n</math></td> <td>1</td> <td>2</td> <td>...</td> <td>10</td> </tr> <tr> <td><math>P(F = n)</math></td> <td>0.01</td> <td><math>0.01 + \alpha</math></td> <td>...</td> <td><math>0.01 + 9\alpha</math></td> </tr> </table>	$n$	1	2	...	10	$P(F = n)$	0.01	$0.01 + \alpha$	...	$0.01 + 9\alpha$	M1	3.1b
	$n$	1	2	...	10								
$P(F = n)$	0.01	$0.01 + \alpha$	...	$0.01 + 9\alpha$									
	Sum of probs = 1 $\Rightarrow \frac{10}{2}[2 \times 0.01 + 9\alpha] = 1$ [i.e. $5(0.02 + 9\alpha) = 1$ or $0.1 + 45\alpha = 1$ ] so $\alpha = \mathbf{0.02}$	M1A1 A1 (4)	3.1a 1.1b 1.1b										
(e)	$P(F = 5   \text{Thomas' model}) = \mathbf{0.09}$	B1ft (1)	3.4										
(f)	<u>Peta's</u> model assumes the <u>probability</u> of hitting target is <u>constant</u> (o.e.) <b>and</b> <u>Thomas'</u> model assumes this <u>probability increases</u> with each attempt(o.e.)	B1 (1)	3.5a										
		<b>(11 marks)</b>											
<b>Notes</b>													
(a)	1 <sup>st</sup> B1 for stating that the <u>probability</u> (or possibility or chance) is <u>constant</u> (or fixed or same) 2 <sup>nd</sup> B1 for stating that <u>throws</u> are <u>independent</u> ["trials" are independent is B0]												
(b)	B1 for awrt 0.0128 (found on calculator)												
(c)	M1 for a probability expression of the form $(1-p)^4 \times p$ where $0 < p < 1$ A1 for awrt 0.0656 <b>SC</b> Allow M1A0 for answer only of 0.066												
(d)	1 <sup>st</sup> M1 for setting up the distribution of $F$ with at least 3 correct values of $n$ and $P(F = n)$ in terms of $\alpha$ . (Can be implied by 2 <sup>nd</sup> M1 or 1 <sup>st</sup> A1) 2 <sup>nd</sup> M1 for use of sum of probs = 1 <b>and</b> clear summation or use of arithmetic series formula (allow 1 error or missing term). (Can be implied by 1 <sup>st</sup> A1) 1 <sup>st</sup> A1 for a correct equation for $\alpha$ 2 <sup>nd</sup> A1 for $\alpha = 0.02$ (must be exact and come from correct working)												
(e)	B1ft for value resulting from $0.01 + 4 \times$ "their $\alpha$ " (provided $\alpha$ and the answer are probs) <b>Beware</b> If their answer is the same as their (c) (or a rounded version of their (c)) score B0												
(f)	B1 for a suitable comment about the <u>probability</u> of hitting the target <b>ALT</b> Allow idea that Peta's model suggests the dart may never hit the target but Thomas' says that it will hit at least once (in the first 10 throws).												



Qu	Scheme	Marks	AO										
5(a)	$P(X=4) = P(X=2)$ so $P(X=4) = 0.35$ $P(X=1) = P(X=3)$ and $P(X=1) + P(X=3) = 1 - 0.7$ So	M1	2.1										
	<table border="1"> <tr> <td><math>x</math></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td><math>P(X=x)</math></td> <td>0.15</td> <td>0.35</td> <td>0.15</td> <td>[0.35]</td> </tr> </table>	$x$	1	2	3	4	$P(X=x)$	0.15	0.35	0.15	[0.35]	A1	1.1b
	$x$	1	2	3	4								
	$P(X=x)$	0.15	0.35	0.15	[0.35]								
	(b) Let $A$ = number of spins that land on 4 $A \sim B(60, "0.35")$	(2)											
	$[P(A > 30) = ] 1 - P(A \leq 30)$	B1ft	3.3										
	$= 1 - 0.99411\dots = \text{awrt } 0.00589$	M1	3.4										
		A1	1.1b										
	(c) $Y - X \leq 4 \Rightarrow \frac{12}{X} - X \leq 4$ or $12 - X^2 \leq 4X$ (since $X > 0$ ) o.e.	(3)											
	i.e. $0 \leq X^2 + 4X - 12 \Rightarrow 0 \leq (X+6)(X-2)$ so $X \geq 2$	M1	3.1a										
$P(Y - X \leq 4) = P(X \geq 2) = 0.35 + 0.15 + 0.35 = \underline{0.85}$	M1	1.1b											
	A1	3.2a											
	(3)												
		<b>(8 marks)</b>											
<b>Notes</b>													
(a)	M1 for using the given information to obtain $P(X=4)$ Award for statement $P(X=4) = P(X=2)$ or writing $P(X=4) = 0.35$ A1 for getting fully correct distribution (any form that clearly identifies probs) e.g. can be list $P(X=1) = 0.15, P(X=3) = \dots$ etc or as a probability function $P(X=x) = \begin{cases} 0.15 & x=1,3 \\ 0.35 & x=2,4 \end{cases}$ [Condone missing $P(X=2)$ as this is given in QP]												
(b)	B1 for selecting a suitable model, sight of $B(60, \text{their } 0.35)$ o.e. in words f.t. their $P(X=4)$ from part (a). Can be implied by $P(A \leq 30) = \text{awrt } 0.9941$ or final answer = awrt 0.00589 M1 for using their model and interpreting "more than half" Need to see $1 - P(A \leq 30)$ . Can be implied by awrt 0.00589 Can ignore incorrect LHS such as $P(A \geq 30)$ A1 for awrt 0.00589												
(c)	1 <sup>st</sup> M1 for translating the prob. problem into a <u>correct</u> mathematical inequality Just an inequality in 1 variable. May be inside a probability statement.												
ALT	Table of values: <table border="1"> <tr> <td><math>X</math></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td><math>Y</math></td> <td>12</td> <td>6</td> <td>4</td> <td>3</td> </tr> </table> or values of $Y - X = 11, 4, 1, -1$	$X$	1	2	3	4	$Y$	12	6	4	3		
$X$	1	2	3	4									
$Y$	12	6	4	3									
	2 <sup>nd</sup> M1 for solving the inequality leading to a range of values, allow 1 or 2 slips May be a quadratic or cubic but must lead to a set of values of $X$ or $Y - X$												
ALT	Table or values: They must state clearly which values are required <b>Both Ms can be implied by a correct answer (or correct ft of their distb'n)</b>												
	A1 for interpreting the inequality and solving the problem i.e. 0.85 cao												



Question	Scheme	Marks	AOs
<b>3(a)</b>	(Discrete) uniform (distribution)	B1	1.2
		<b>(1)</b>	
<b>(b)</b>	B(28, 0.2)	B1	3.3
<b>(i)</b>	$P(X \geq 7) = 1 - P(X \leq 6)$ [= 1 - 0.6784...]	M1	3.4
	awrt <b>0.322</b>	A1	1.1b
<b>(ii)</b>	$P(4 \leq X < 8) = P(X \leq 7) - P(X \leq 3)$ [= 0.818... - 0.160...]	M1	3.1b
	awrt <b>0.658</b>	A1	1.1b
		<b>(5)</b>	
<b>(6 marks)</b>			
<b>Notes</b>			
<b>(a)</b>	Continuous uniform is B0		
<b>(b)</b>	<b>B1:</b> for identifying correct model, B(28, 0.2) allow B, bin or binomial may be implied by one correct answer or sight one correct probability i.e. awrt 0.678, awrt 0.818 or awrt 0.160 B(0.2, 28) is B0 unless it is used correctly		
<b>(i)</b>	<b>M1:</b> Writing or using $1 - P(X \leq 6)$ or $1 - P(X < 7)$ <b>A1:</b> awrt 0.322 (correct answer only scores M1A1)		
<b>(ii)</b>	<b>M1:</b> Writing or using $P(X \leq 7) - P(X \leq 3)$ or $P(X < 8) - P(X < 4)$ or $P(X = 4) + P(X = 5) + P(X = 6) + P(X = 7)$ Condone P(4) as P(X = 4), etc. <b>A1:</b> awrt 0.658 (correct answer only scores M1A1)		



Question	Scheme	Marks	AOs
3	Overall method	M1	2.1
	$a + b = 2c + 0.5$ oe or $a + b = 2(1 - a - b)$	B1	2.2a
	$a + b + c = 0.75$ oe	B1	1.1b
	$3c = 0.25$ $\left[ c = 0.0833\dots \text{ or } \frac{1}{12} \right]$	M1	1.1b
	$P(\text{scoring } 2,4 \text{ or } 4,2 \text{ or } 3,3) = 2 \times \frac{1}{12} \times 0.15 + 0.1^2$	M1	3.1b
	$= 0.035$ oe	A1cso	1.1b

(6)

**(6 marks)****Notes**

3	<b>M1:</b>	A fully correct method with all the required steps. For gaining 2 correct equations with at least one correct (allow if unsimplified). Attempting to solve to find a value of $c$ followed by <b>correct method</b> to find the probability
	<b>B1:</b>	Forming a correct equation from the information given in the question
	<b>B1:</b>	A correct equation using the sum of the probabilities equals 1
	<b>M1:</b>	Correct method for solving 2 equations to find $c$ Implied by $c = \frac{1}{12}$
	<b>M1:</b>	Recognising the ways to get a total of 6. Condone missing arrangements or repeats. Do not ignore extras written unless ignored in the calculation. May be implied by $m \times \frac{1}{12} \times 0.15 + n \times 0.1^2$ where $m$ and $n$ are positive integers
	<b>A1cso:</b>	Cao 0.035, $\frac{7}{200}$ oe



Question	Scheme		Marks	AOs
5(a)	Let $C$ = the number of successful calls. $C \sim B\left(9, \frac{1}{6}\right)$		M1	3.3
	$P(C \geq 3) = 1 - P(C \leq 2) = 0.1782\dots$ awrt <b>0.178</b>		A1	1.1b
			(2)	
(b)	Let $X$ = the number of occasions when at least 3 calls are successful. $P(X = 1) = 5 \times ("0.1782\dots") \times ("0.8217\dots")^4$		M1	1.1b
	$= 0.4061\dots$ awrt <b>0.406</b>		A1	1.1b
			(2)	
(c)	$H_0 : p = \frac{1}{6}$ $H_1 : p > \frac{1}{6}$		B1	2.5
	Let $R$ = the number of successful calls $R \sim B\left(35, \frac{1}{6}\right)$		M1	3.3
	$P(R \geq 11) = 1 - P(R \leq 10) = 0.02\dots$		A1	3.4
	There is sufficient evidence to support that <b>Rowan</b> has more successful sales calls than Afrika.		A1	2.2b
			(4)	
<b>(8 marks)</b>				
<b>Notes</b>				
5(a)	<b>M1:</b>	For selecting the right model		
	<b>A1:</b>	awrt 0.178		
(b)	<b>M1:</b>	For $5 \times ("their(a)") \times ("1 - their(a)")^4$		
	<b>A1:</b>	awrt 0.406		
(c)	<b>B1:</b>	for correctly stating both hypotheses in terms of $p$ or $\pi$ Accept $p = 0.1\dot{6}$		
	<b>M1:</b>	For selecting a suitable model. May be implied by a correct probability or CR		
	<b>A1:</b>	Correct probability statement and answer of 0.02 or better (0.02318...) (CR $R \geq 11$ and either $P(R \leq 9) = 0.9450$ or $P(R \leq 10) = 0.9768$ or $1 - P(R \leq 10) = 0.0232$ )		
	<b>A1:</b>	Dependent on M1A1 but can ignore hypotheses. For conclusion in context supporting <b>Rowan's</b> belief / <b>Rowan</b> is a better sales person		
		Do not accept Rowan can reject $H_0$		



Qu	Scheme	Mark	AO
5. (a)(i)	Require $R = 3$ and $G = 4$ so probability is $\frac{3}{4} \times \frac{1}{3}$	M1	2.1
	$= \frac{1}{4}$ or <b>0.25</b>	A1	1.1b
(ii)	[ $R$ must be 2 and $G = 1$ so $\frac{1}{4} \times \frac{2}{3}$ ] = $\frac{1}{6}$	A1	1.1b
(b)	$P(X = 50) = 0.25$ must mean $R = 3$ and $G = 4$	M1	3.1a
	so $3m + 4n = 50$	A1	1.1b
	$P(X = 20) = \frac{1}{6} \Rightarrow R = 2, G = 1$ so $2m + n = 20$	A1	2.1
	Solving: $3m + 4(20 - 2m) = 50$ (o.e.)	M1	1.1b
	<b><math>m = 6</math> and <math>n = 8</math></b>	A1	3.2a
		(5)	
		(8 marks)	
<b>Notes</b>			
(a)(i)	M1 for sight of $\frac{3}{4} \times \frac{1}{3}$ or $\frac{1}{4} \times \frac{2}{3}$ as a single product BUT allow e.g. $\frac{3}{4} \times \frac{1}{3} + \frac{1}{3} \times \frac{3}{4}$ to score M1 However if the products are later added e.g. $\frac{3}{4} \times \frac{1}{3} + \frac{1}{4} \times \frac{2}{3}$ it is M0 May be implied by one correct answer to (i) or (ii)		
	A1 for $\frac{1}{4}$ or 0.25 or exact equivalent (allow 25%)		
(ii)	A1 for $\frac{1}{6}$ or exact equivalent		
(b)	<b>For the 1<sup>st</sup> 4 marks condone incorrect labelling e.g. <math>R</math> for <math>m</math> or <math>G</math> for <math>n</math> if intention is clear</b> 1 <sup>st</sup> M1 for identifying either set of cases ( $R = 2, G = 1, X = 20$ ) or ( $R = 3, G = 4, X = 50$ ) Allow 1 <sup>st</sup> M1 for $P(X = 20) = \frac{1}{4} \times \frac{2}{3}$ or $P(X = 50) = \frac{3}{4} \times \frac{1}{3}$ NOT just $P(X = 20) = \frac{1}{6}$ etc or $\frac{1}{4}m + \frac{2}{3}n = 20$ or $\frac{3}{4}m + \frac{1}{3}n = 50$ and might score 2 <sup>nd</sup> M1 (answer is $m = 64, n = 6$ ) or $\frac{1}{4}m + \frac{2}{3}n = \frac{1}{6}$ or $\frac{3}{4}m + \frac{1}{3}n = \frac{1}{4}$ and might score 2 <sup>nd</sup> M1 (answer is $m = \frac{4}{15}, n = \frac{3}{20}$ ) or $2m + n = \frac{1}{6}$ or $3m + 4n = \frac{1}{4}$ and might score 2 <sup>nd</sup> M1 (answer is $m = \frac{1}{12}, n = 0$ ) or $2m + n = 50$ and $3m + 4n = 20$ and might score 2 <sup>nd</sup> M1 (answer is $m = 36, n = -22$ )		
	1 <sup>st</sup> A1 for one correct equation		
	2 <sup>nd</sup> A1 for <b>both</b> correct equations and no incorrect equations, unless they attempt to solve the correct 2 equations only		
	2 <sup>nd</sup> M1 for attempt to solve <u>their</u> two linear equations in $m$ and $n$ (reduce to an equation in one variable, condone one sign error). May be implied by $m = 6$ and $n = 8$ .		
Calc	If they use one of the 4 sets of equations for 1 <sup>st</sup> M1 and use a calculator to write down the answer, we will allow this mark for sight of the correct answers to those equations as given above.		
	3 <sup>rd</sup> A1 $m = 6$ and $n = 8$ only (no incorrect labelling here) Correct answer by trial can score 5/5 if no incorrect working seen.		

4. Magali is studying the mean total cloud cover, in oktas, for Leuchars in 1987 using data from the large data set. The daily mean total cloud cover for all 184 days from the large data set is summarised in the table below.

<b>Daily mean total cloud cover (oktas)</b>	0	1	2	3	4	5	6	7	8
<b>Frequency (number of days)</b>	0	1	4	7	10	30	52	52	28

One of the 184 days is selected at random.

- (a) Find the probability that it has a daily mean total cloud cover of 6 or greater. (1)

Magali is investigating whether the daily mean total cloud cover can be modelled using a binomial distribution.

She uses the random variable  $X$  to denote the daily mean total cloud cover and believes that  $X \sim B(8, 0.76)$

Using Magali's model,

- (b) (i) find  $P(X \geq 6)$  (2)

- (ii) find, to 1 decimal place, the expected number of days in a sample of 184 days with a daily mean total cloud cover of 7 (2)

- (c) Explain whether or not your answers to part (b) support the use of Magali's model. (1)

There were 28 days that had a daily mean total cloud cover of 8

For these 28 days the daily mean total cloud cover for the **following** day is shown in the table below.

<b>Daily mean total cloud cover (oktas)</b>	0	1	2	3	4	5	6	7	8
<b>Frequency (number of days)</b>	0	0	1	1	2	1	5	9	9

- (d) Find the proportion of these days when the daily mean total cloud cover was 6 or greater. (1)
- (e) Comment on Magali's model in light of your answer to part (d). (2)

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Question	Scheme	Marks	AOs
4 (a)	$\frac{132}{184} = 0.71739\dots$ awrt <b><u>0.717</u></b>	B1	1.1b
		(1)	
(b)(i)	$P(X \geq 6) = 1 - P(X \leq 5)$ or $P([X =]6) + P([X =]7) + P([X =]8)$	M1	3.4
	$= 1 - 0.296722\dots$ awrt <b><u>0.703</u></b>	A1	1.1b
(b)(ii)	$184 \times P(X = 7)$ [= $184 \times 0.2811\dots$ ]	M1	1.1b
	$= 51.7385\dots$ awrt <b><u>51.7</u></b>	A1	1.1b
(c)	Part (a) and part (b)(i) are similar <b>and</b> the expected number of 7s (51.7 or 0.281) matches with the number of 7s found in the data set (52 or 0.283) so Magali's model is supported.	B1ft	3.5a
		(1)	
(d)	$\frac{23}{28} = 0.82142\dots$ awrt <b><u>0.821</u></b>	B1	1.1b
		(1)	
(e)	Any one of... <ul style="list-style-type: none"> <li>Part (d)/'0.821' differs from part (a)/(b)(i)/(0.7...)</li> <li>there is a <b>greater/different probability of high cloud cover/more likely to have high cloud cover</b> if the previous day had high cloud cover</li> <li><b>independence(o.e.)</b> does not hold</li> </ul>	B1	2.4
	...therefore Magali's (binomial) model may not be suitable.	dB1	3.5a
		(2)	
<b>(9 marks)</b>			
<b>Notes</b>			
<b>Allow fractions, decimals or percentages throughout this question.</b>			
(a)	Allow equivalent fraction, e.g. $\frac{33}{46}$		
(b)(i)	<b>M1:</b> for writing or using $1 - P(X \leq 5)$ or $P(X = 6) + P(X = 7) + P(X = 8)$ <b>A1:</b> awrt 0.703 (correct answer scores 2 out of 2)		
(b)(ii)	<b>M1:</b> for $184 \times P(X = 7)$ o.e. e.g., $184 \times [P(X \leq 7) - P(X \leq 6)]$ <b>A1:</b> awrt 51.7		
(c)	<b>B1ft:</b> comparing '0.717' with '0.703' and '51.7' or '0.281' with 52 or 0.283 <b>and</b> concluding that Magali's model <b>is supported</b> (must be comparing prob. with prob. <u>and</u> days with days). Allow not supported or mixed conclusions if consistent with their f.t. answers in (a) and (b)		
(e)	<b>B1:</b> Any bullet point <b>dB1:</b> (dep on previous B1) for Magali's model may not be suitable (o.e.) Condone not accurate for not suitable  <b>SC:</b> part (d) is similar to part (a)/(b)(i) <b>and</b> a compatible conclusion (i.e. Magali's model is supported) to score B1B1.		



Qu 6	Scheme	Marks	AO
(a)	[Sum of probs = 1 implies] $\log_{36} a + \log_{36} b + \log_{36} c = 1$ $\Rightarrow \log_{36}(abc) = 1$ so $abc = 36$ All probabilities greater than 0 implies each of $a, b$ and $c > 1$ $36 = 2^2 \times 3^2$ (or 3 numbers that multiply to give 36 e.g. 2, 2, 9 etc ) Since $a, b$ and $c$ are distinct must be <b><u>2, 3, 6</u></b> ( <b><u><math>a = 2, b = 3, c = 6</math></u></b> )	M1 A1 B1 dM1 A1	3.1a 3.4 2.2a 2.1 3.2a
	(b)	$(\log_{36} a)^2 + (\log_{36} b)^2 + (\log_{36} c)^2$ $[= 0.0374137\dots + 0.09398737\dots + 0.25]$ $= 0.38140\dots$ awrt <b><u>0.381</u></b>	M1 A1
		<b>(7 marks)</b>	
<b>Notes</b>			
(a)	1 <sup>st</sup> M1 for a start to the problem using sum of probabilities leading to eq'n in $a, b$ and $c$ 1 <sup>st</sup> A1 for reducing to the equation $abc = 36$ [Must follow from their equation.]		
<b>NB</b>	Can go straight from $abc = 36$ to the answer for full marks for part (a).		
	B1 for deducing that each value $> 1$ (may be implied by 3 integers all $> 1$ in the next line)		
	2 <sup>nd</sup> dM1 (dep on M1A1) for writing 36 as a product of prime factors <u>or</u> 3 values with product = 36 and none = 1		
	2 <sup>nd</sup> A1 for 2, 3 and 6 as a list or $a = 2, b = 3$ and $c = 6$		
<b>SC</b> Ans only	<b>M0M0</b> If no method marks scored but a correct answer given score: M0A0B1M0A1 (2/5) This gets the SC score of 2/5 [Question says show your working clearly]		
(b)	M1 for a correct expression in terms of $a, b$ and $c$ or values; ft their integers $a, b$ and $c$ Condone invisible brackets if the answer implies they are used. A1 for awrt 0.381		



Question	Scheme		Marks	AOs
<b>3(a)</b>	tr		B1	1.2
			(1)	
<b>(b)(i)</b>	$\mu = \frac{174.9}{31} = 5.6419\dots$	awrt 5.64	B1	1.1b
<b>(ii)</b>	$\sigma_r = \sqrt{\frac{3523.283}{31} - \mu^2}$		M1	1.1b
	= 9.04559...	awrt 9.05	A1	1.1b
			(3)	
<b>(c)</b>	Leuchars is in the North and Camborne is in the South		M1	2.4
	The mean is smaller for Leuchars than Camborne therefore there is no evidence that Dian's belief is true		A1ft	2.2b
			(2)	
<b>(d)</b>	eg $p = 0.27$ is unlikely to be constant.		B1	2.4
			(1)	
<b>(7 marks)</b>				
<b>Notes:</b>				
<b>(a)</b>	<b>B1</b>	Allow Tr or trace or Trace		
<b>(b)(i)</b>	<b>B1</b>	For a correct mean awrt 5.64		
<b>(ii)</b>	<b>M1</b>	For a correct expression for sd including the $\sqrt{\quad}$ Ft their mean		
	<b>A1</b>	awrt 9.05 (Allow $s = 9.1932\dots$ awrt 9.19) NB awrt to 9.05 or 9.19 with no working is M1 A1		
<b>(c)</b>	<b>M1</b>	For stating Leuchars is North of Camborne oe eg Camborne is further south		
	<b>A1ft</b>	M1 must be awarded. A correct conclusion <b>and</b> correct comment about the means ft their mean in (b) Allow No		
	<b>SC</b>	for No <b>and</b> there are only 2 places used so there is insufficient data. Mark as M0A1 on open		
<b>(d)</b>	<b>B1</b>	A correct reason referring to <ul style="list-style-type: none"> <li>• independence (needs context as to what is independent) eg consecutive 14 days unlikely to be independent.</li> <li>• probability [of rain] not being constant.</li> <li>• Allow a comment that conveys the idea that the proportion of days with no rain will be different over the year.</li> </ul>		