



# Mark Scheme (Results)

June 2015

Pearson Edexcel International A Level  
in Statistics 2 (WST02/01)

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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.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

## PEARSON 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  $\surd$  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)
  - d... or dep – dependent
  - indep – independent
  - dp decimal places
  - sf significant figures
  - \* The answer is printed on the paper or ag- answer given
  - $\square$  or d... 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.

June 2015 WMST02/01  
 Statistics 2 Mark Scheme

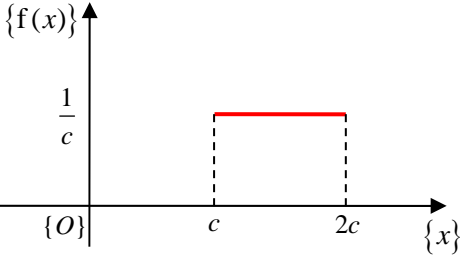
Question Number	Scheme	Marks
1. (a)	$\{P(X > 4) =\} 1 - F(4)$	1 - F(4) seen or used
	$\left\{ = 1 - \frac{3}{5} \right\} = \frac{2}{5}$	$\frac{2}{5}$ or 0.4
		[2]
(b)	$P(3 < X < a) = 0.642$	
	$F(a) - F(3) = 0.642$	$F(a) - F(3) = 0.642$
	$F(a) - \frac{1}{20}(3^2 - 4) = 0.642 \Rightarrow F(a) = 0.892$	Correct equation
	$\frac{1}{5}(2a - 5) - \frac{1}{20}(3^2 - 4) = 0.642 \Rightarrow a = \dots$	Solving this equation o.e., leading to $a = \dots$ (or $x = \dots$ ).
	$\left\{ \frac{1}{5}(2a - 5) = 0.892 \Rightarrow \right\} a = 4.73$	$a = 4.73$ (or $x = 4.73$ )
		[4]
(b)	<b>Alternative Method for Part (b)</b>	
	$\int_3^4 \left( \frac{1}{10}x \right) \{dx\}$	Correct expression for finding the probability between $x = 3$ and $x = 4$
	$\left\{ = \left[ \frac{x^2}{20} \right]_3^4 \right\} = \frac{4^2}{20} - \frac{3^2}{20} \left\{ = \frac{7}{20} \right\}$	Correct $\frac{4^2}{20} - \frac{3^2}{20}$ , simplified or un-simplified.
	$\int_3^4 \left( \frac{1}{10}x \right) \{dx\} + \int_4^a \left( \frac{2}{5} \right) \{dx\} = 0.642 \Rightarrow a = \dots$	Writes a correct equation and attempts to solve leading to $a = \dots$ (or $x = \dots$ )
	$\left\{ \frac{7}{20} + \frac{2}{5}a - \frac{8}{5} = 0.642 \Rightarrow \right\} a = 4.73$	$a = 4.73$ (or $x = 4.73$ )
		[4]
(c)	$f(x) = \frac{d}{dx} \left( \frac{1}{20}(x^2 - 4) \right) = \frac{1}{10}x$	Attempt at differentiation. See notes.
	$f(x) = \frac{d}{dx} \left( \frac{1}{5}(2x - 5) \right) = \frac{2}{5}$	At least one of $\frac{1}{10}x$ or $\frac{2}{5}$
		Both $\frac{1}{10}x$ and $\frac{2}{5}$
	$f(x) = \begin{cases} \frac{1}{10}x, & 2 \leq x \leq 4 \\ \frac{2}{5}, & 4 < x \leq 5 \\ 0, & \text{otherwise} \end{cases}$	<b>This mark is dependent on M1</b> All three lines with limits correctly followed through from their $F'(x)$
		[4]
		10

		Question 1 Notes
1. (a)	<b>M1</b>	$1 - F(4)$ seen or used.
	<b>Note</b>	Can be implied by either $1 - \frac{3}{5}$ or $1 - \frac{1}{5}(2(4) - 5)$ or $1 - \frac{1}{20}(4^2 - 4)$ The probability statements $1 - P(X \leq 4)$ or $1 - P(X < 4)$ are not sufficient for M1
	<b>A1</b>	$\frac{2}{5}$ or 0.4
	<b>Note</b>	Give M1A1 for the correct answer from no working.
(b)	<b>NOTE</b>	In part (b), candidates are allowed to write <ul style="list-style-type: none"> <li>• <math>F(a)</math> as either <math>P(X &lt; a)</math> or <math>P(X \leq a)</math>. Also condone <math>F(a)</math> written as <math>F(x)</math></li> <li>• <math>F(3)</math> as either <math>P(X &lt; 3)</math> or <math>P(X \leq 3)</math></li> </ul>
	<b>M1</b>	For writing $F(a) - F(3) = 0.642$ or equivalent (see NOTE above)
	<b>A1</b>	For an un-simplified $F(a) - \frac{1}{20}(3^2 - 4) = 0.642$ or equivalent (see NOTE above)
	<b>Note</b>	Give 1 <sup>st</sup> M1 1 <sup>st</sup> A1 for $F(a) = 0.892$ or $P(X \geq a) = 0.108$
	<b>SC</b>	Allow SC 1 <sup>st</sup> M1 1 <sup>st</sup> A1 for $\frac{1}{20}(a^2 - 4) - \frac{1}{20}(3^2 - 4) = 0.642$
	<b>Note</b>	Give 1 <sup>st</sup> M0 for $F(a - 1) - F(3) = 0.642$ o.e. without a correct acceptable statement
	<b>dM1</b>	<b>dependent on the FIRST method mark being awarded.</b> Attempts to solve $\frac{1}{5}(2a - 5) - \text{"their } F(3)\text{"} = 0.642$ leading to $a = \dots$ (or $x = \dots$ )
	<b>Note</b>	dM1 can be given for either $\frac{1}{5}(2a - 5) = 0.892$ or $1 - \frac{1}{5}(2a - 5) = 0.108$ leading to $a = \dots$ (or $x = \dots$ )
	<b>A1</b>	$a = 4.73$ (or $x = 4.73$ ) <b>cao</b>
	<b>Note</b>	Give M0A0M0A0 for $F(a) - (1 - F(3)) = 0.642 \Rightarrow F(a) = 1.392$
	<b>Note</b>	Give M0A0M0A0 for $\int_3^a \left(\frac{1}{10}x\right) dx = 0.642$ (this solves to give awrt 4.67)
	(c)	<b>M1</b> At least one of either $\frac{1}{20}(x^2 - 4) \rightarrow \pm \alpha x \pm \beta$ , $\alpha \neq 0$ , $\beta$ can be 0 $\frac{1}{5}(2x - 5) \rightarrow \pm \delta$ , $\delta \neq 0$
	<b>1<sup>st</sup> A1</b>	At least one of $\frac{1}{10}x$ or $\frac{2}{5}$ . Can be simplified or un-simplified.
	<b>2<sup>nd</sup> A1</b>	Both $\frac{1}{10}x$ and $\frac{2}{5}$ . Can be simplified or un-simplified.
	<b>dB1ft</b>	<b>dependent on the FIRST method mark being awarded.</b> All three lines with limits correctly followed through from their $F'(x)$
	<b>Note</b>	Condone the use of $<$ rather than $\leq$ or vice versa.
	<b>Note</b>	0, otherwise is equivalent to $0, x < 2$ <b>and</b> $0, x > 5$
	<b>Note</b>	In part (c), accept $f$ being expressed consistently in another variable eg. $u$

Question Number	Scheme	Marks							
2. (a)	$X \sim \text{Po}(8)$								
	$\{P(X \neq 8)\} = 1 - P(X = 8)$ $= 0.860413\dots$ or 0.8605	$1 - P(X = 8)$ , can be implied 0.86 or awrt 0.860 or awrt 0.861	M1 A1 [2]						
(b)	$X \sim \text{Po}(8)$								
	$\{P(X \geq 8)\} = 1 - 0.453$	$1 - 0.453$ or awrt 0.547	B1						
	$\{[P(X \geq 8)]^4\} = (1 - 0.453)^4 \{= (0.547)^4\}$ $= 0.089526\dots$	Applying $[ \text{their } P(X \geq 8) ]^4$ 0.09 or awrt 0.090	M1 A1 [3]						
(c)	$Y = \text{number of chocolate chips in the 9 biscuits}$								
	$\{Y \sim \text{Po}(72) \approx\} Y \sim N(72, 72)$	Normal or N (72, 72)	M1 A1						
	$\{P(Y > 75)\} \approx P(Y > 75.5)$	For either 74.5 or 75.5	M1						
	$= P\left(Z > \frac{75.5 - 72}{\sqrt{72}}\right)$	Standardising ( $\pm$ ) with their mean, their standard deviation and either 75.5 or 75 or 74.5	M1						
	$= P(Z > 0.41\dots) = 1 - 0.6591$								
	$= 0.3409$ (from calculator 0.339994...)	awrt 0.341 or awrt 0.340	A1 [5]						
(d)	$H_0 : \lambda = 1.5, H_1 : \lambda > 1.5$ or $H_0 : \lambda = 6, H_1 : \lambda > 6$	Both hypotheses are stated correctly	B1						
	{Under $H_0$ , for 4 hours} $X \sim \text{Po}(6)$								
	<table border="0"> <tr> <td><b>Probability Method</b></td> <td><b>Critical Region Method</b></td> </tr> <tr> <td><math>P(X \geq 11) = 1 - P(X \leq 10)</math></td> <td><math>P(X \leq 9) = 0.9161</math> or <math>P(X \geq 10) = 0.0839</math></td> </tr> <tr> <td><math>= 1 - 0.9574</math></td> <td><math>P(X \leq 10) = 0.9574</math> or <math>P(X \geq 11) = 0.0426</math></td> </tr> </table>	<b>Probability Method</b>	<b>Critical Region Method</b>	$P(X \geq 11) = 1 - P(X \leq 10)$	$P(X \leq 9) = 0.9161$ or $P(X \geq 10) = 0.0839$	$= 1 - 0.9574$	$P(X \leq 10) = 0.9574$ or $P(X \geq 11) = 0.0426$		M1
	<b>Probability Method</b>	<b>Critical Region Method</b>							
	$P(X \geq 11) = 1 - P(X \leq 10)$	$P(X \leq 9) = 0.9161$ or $P(X \geq 10) = 0.0839$							
	$= 1 - 0.9574$	$P(X \leq 10) = 0.9574$ or $P(X \geq 11) = 0.0426$							
<table border="0"> <tr> <td><math>P(X \geq 11) = 0.0426</math></td> <td>CR : <math>X \geq 11</math></td> <td>Either <math>P(X \geq 11) = 0.0426</math> or CR : <math>X \geq 11</math> or CR : <math>X &gt; 10</math></td> </tr> </table>	$P(X \geq 11) = 0.0426$	CR : $X \geq 11$	Either $P(X \geq 11) = 0.0426$ or CR : $X \geq 11$ or CR : $X > 10$		A1				
$P(X \geq 11) = 0.0426$	CR : $X \geq 11$	Either $P(X \geq 11) = 0.0426$ or CR : $X \geq 11$ or CR : $X > 10$							
Reject $H_0$ or significant or 11 lies in the CR	<b>dependent on previous M</b>	See notes	dM1						
Conclude either <ul style="list-style-type: none"> <li>The <b>rate of sales</b> of packets of biscuits has <b>increased</b>.</li> <li>The <b>mean</b> number of packets of biscuits <b>sold</b> has <b>increased</b>.</li> </ul>	Correct conclusion in context.	A1 cso							
		[5]							
		15							



		<b>Question 2 Notes</b>
2. (a)	<b>M1</b>	$1 - P(X = 8) \text{ or } P(X < 8) + P(X > 8) \text{ or } P(X \leq 7) + P(X \geq 9)$
	<b>Note</b>	Can be implied by either $1 - \frac{e^{-8}8^8}{8!}$ or $1 - (P(X \leq 8) - P(X \leq 7))$ or $1 - (0.5925 - 0.4530)$ or $1 - 0.1395$ or $P(X \leq 7) + 1 - P(X \leq 8)$
(b)	<b>A1</b>	0.86 or awrt 0.860 or awrt 0.861
	<b>B1</b>	$1 - 0.453$ or awrt 0.547 ( <b>Note:</b> calculator gives 0.5470391905...)
(c)	<b>M1</b>	Applying $[ \text{their } P(X \geq 8) ]^4$
	<b>A1</b>	0.09 or awrt 0.090 ( <b>Note:</b> calculator gives 0.08955168526...)
	<b>1<sup>st</sup> M1</b>	For writing N or for using a normal approximation.
	<b>1<sup>st</sup> A1</b>	For a correct mean of 72 and a correct variance of 72
	<b>Note</b>	1 <sup>st</sup> M1 and/or 1 <sup>st</sup> A1 may be implied in applying the standardisation formula
(d)	<b>2<sup>nd</sup> M1</b>	For either 74.5 or 75.5 (i.e. an attempt at a continuity correction)
	<b>3<sup>rd</sup> M1</b>	Standardising ( $\pm$ ) with their mean, their standard deviation and either 75.5 or 75 or 74.5
	<b>Note</b>	Award 2 <sup>nd</sup> M1 3 <sup>rd</sup> M0 for $\frac{75.5 - 72}{72}$ from a correct $Y \sim N(72, 72)$
	<b>Note</b>	You can recover the 1 <sup>st</sup> A1 in part (c) for $N(72, \sqrt{72}) \Rightarrow z = \frac{75.5 - 72}{\sqrt{72}}$
	<b>2<sup>nd</sup> A1</b>	awrt 0.341 or awrt 0.340. ( <b>Note:</b> calculator gives 0.339994...)
(d)	<b>B1</b>	$H_0 : \lambda = 1.5, H_1 : \lambda > 1.5$ correctly labelled or $H_0 : \lambda = 6, H_1 : \lambda > 6$ .
	<b>Note</b>	Allow $\mu$ used instead of $\lambda$
	<b>Note</b>	B0 for either $H_0 = 6, H_1 > 6$ or $H_0 : x = 6, H_1 : x > 6$ or $H_0 : p = 6, H_1 : p > 6$
	<b>1<sup>st</sup> M1</b>	For use of $X \sim \text{Po}(6)$ (may be implied by 0.9161, 0.9574, 0.9799, 0.0839, 0.0426 or 0.0201). Condone by $\frac{e^{-6}(6)^{11}}{11!}$ . Allow any value off the Po(6) tables.
	<b>1<sup>st</sup> A1</b>	For either $P(X \geq 11) = 0.0426$ or $\text{CR} : X \geq 11$ or $\text{CR} : X > 10$ Condone $\text{CR} \geq 11$
	<b>Note</b>	Award 1 <sup>st</sup> M1 1 <sup>st</sup> A1 for writing down $\text{CR} : X \geq 11$ or $\text{CR} : X > 10$ from no working.
	<b>Note</b>	Give A0 stating $\text{CR} : P(X \geq 11)$
	<b>2<sup>nd</sup> dM1</b>	<b>dependent on the FIRST method mark being awarded.</b> For a correct follow through comparison based on their probability or CR and their significance level compatible with their <i>stated</i> alternative hypothesis. Do not allow non-contextual conflicting statements. Eg. “significant” and “accept $H_0$ ”.
	<b>Note</b>	M1 can be implied by a correct contextual statement.
	<b>Note</b>	Give final M0A0 for $P(X = 11) = 0.9799 - 0.9574 = 0.0225 \Rightarrow \text{Reject } H_0$ , etc.
<b>Note</b>	Give final M0A0 for $P(X \leq 11) = 0.9799 \Rightarrow \text{Accept } H_0$ , etc	
<b>2<sup>nd</sup> A1</b>	Award for a correct solution only with all previous marks in part (d) being scored. Correct conclusion which is in context, using either the words <u>rate of sales and increased</u> or <u>mean sold and increased</u>	

Question Number	Scheme	Marks
3. (a)	 <p>A horizontal line drawn above the x-axis in the first quadrant</p> <p><b>dependent on the first B mark</b></p> <p>Labels of <math>c</math>, <math>2c</math> and <math>\frac{1}{c}</math>, marked on the graph. Ignore <math>\{O\}</math>, <math>\{x\}</math> and <math>\{f(x)\}</math></p>	B1 dB1
<b>[2]</b>		
(b)	<p><math>E(X) = \frac{3c}{2}</math></p> <p><math>E(X) = \frac{3c}{2}</math>, simplified or un-simplified.</p> <p><math>\{E(X^2) = \int_c^{2c} \left(\frac{1}{2c-c}x^2\right) \{dx\}</math></p> <p><math>\int_c^{2c} x^2 f(x) \{dx\}</math> where <math>f(x)</math> is equivalent to <math>\frac{1}{c}</math>. (Limits are required)</p> <p><math>= \left[ \frac{1}{c} \left( \frac{x^3}{3} \right) \right]_c^{2c}</math></p> <p><math>\pm Ag(c)x^2 \rightarrow \pm Bg(c)x^3</math>, <math>A \neq 0</math>, <math>B \neq 0</math> (Ignore limits for this mark)</p> <p><b>dependent on first M mark.</b> Applies limits of <math>2c</math> and <math>c</math> to an <i>integrated</i> function in <math>x</math> and subtracts the correct way round.</p> <p><math>= \left( \frac{(2c)^3}{3c} - \frac{c^3}{3c} \right) \left\{ = \frac{7c^2}{3} \right\}</math></p> <p><math>\text{Var}(X) = E(X^2) - (E(X))^2</math></p> <p><b>dependent on first M mark.</b> Applying the variance formula correctly with their <math>E(X)</math></p> <p><math>= \frac{7c^2}{3} - \left( \frac{3c}{2} \right)^2</math></p> <p><math>= \frac{c^2}{12}</math> *</p> <p>Correct proof</p>	B1 M1 M1 dM1 dM1 A1
<b>[6]</b>		
(c)	<p><math>X &gt; 2(2c - X)</math></p> <p>Correct un-simplified (or simplified) inequality statement.</p> <p><b>Can be implied by <math>X &gt; \frac{4c}{3}</math></b></p> <p><math>\Rightarrow X &gt; 4c - 2X \Rightarrow 3X &gt; 4c</math></p> <p><b>dependent on the first M mark.</b> Rearranges <math>X &gt; 2(2c - X)</math> to give <math>X &gt; \dots</math> or <math>X &lt; \dots</math></p> <p><b>See notes</b></p> <p><math>\left\{ P(X &gt; 2(2c - X)) = P\left(X &gt; \frac{4c}{3}\right) \right\} = \frac{2}{3}</math></p>	M1 dM1 A1
<b>[3]</b>		
<b>11</b>		
<p><b>Note:</b> In (c), give M2 for either <math>X &gt; \frac{4c}{3}</math> or <math>P\left(X &gt; \frac{4c}{3}\right)</math> or <math>1 - P\left(X &lt; \frac{4c}{3}\right)</math></p>		

Question 3 Notes		
3. (a)	<b>1<sup>st</sup> B1</b>	A horizontal line drawn above the $x$ -axis in the first quadrant
	<b>2<sup>nd</sup> dB1</b>	<b>dependent on the FIRST B mark being awarded.</b> Labels of $c$ , $2c$ and $\frac{1}{c}$ , marked on the graph.
	<b>Note</b>	Allow the label $\frac{1}{2c-c}$ as an alternative to $\frac{1}{c}$
	<b>Note</b>	Ignore $\{O\}$ , $\{x\}$ and $\{f(x)\}$
(b)	<b>B1</b>	$E(X) = \frac{3c}{2}$ , simplified or un-simplified. This mark can be implied.
	<b>Note</b>	B1 can be given for an un-simplified $\left(\frac{(2c)^2}{c}\right) - \left(\frac{c^2}{c}\right)$ or $\frac{3c^2}{2c}$ or $2c - \frac{c}{2}$ etc.
	<b>Note</b>	$\int_c^{2c} \frac{1}{c} x dx$ or $\left[\frac{x^2}{2c}\right]_c^{2c}$ are not sufficient for B1.
	<b>1<sup>st</sup> M1</b>	Correct $E(X^2)$ expression of $\int_c^{2c} x^2 f(x) \{dx\}$ where $f(x)$ is equivalent to $\frac{1}{c}$ .
	<b>Note</b>	Must have limits of $2c$ and $c$ . Note the $dx$ is not required for this mark.
	<b>2<sup>nd</sup> M1</b>	$\pm Ag(c)x^2 \rightarrow \pm Bg(c)x^3$ , $A \neq 0$ , $B \neq 0$ , where $g(c)$ is a function of $c$
	<b>Note</b>	Limits are not required for the second 2 <sup>nd</sup> M1 mark.
	<b>3<sup>rd</sup> dM1</b>	<b>dependent on the FIRST method mark being awarded.</b> Applies limits of $2c$ and $c$ to an integrated function in $x$ and subtracts the correct way round.
	<b>4<sup>th</sup> M1</b>	<b>dependent on the FIRST method mark being awarded.</b> Applying the variance formula correctly with their follow through $E(X)$ .
	<b>Note</b>	Allow 4 <sup>th</sup> M1 for $\left\{ \text{Var}(X) = \int_c^{2c} \left(\frac{1}{2c-c} x^2\right) \{dx\} - \left(\int_c^{2c} \left(\frac{1}{2c-c} x\right) \{dx\}\right)^2 \right\}$
(c)	<b>A1</b>	Correctly proves that $\text{Var}(X) = \frac{c^2}{12}$ . <b>Note:</b> Answer is given
	<b>1<sup>st</sup> M1</b>	For writing down a correctly un-simplified (or simplified) inequality statement. Eg: $X > 2(2c - X)$ or $P(X > 2(2c - X))$ ( <b>Note:</b> "P" is not required for this mark)
	<b>2<sup>nd</sup> dM1</b>	<b>dependent on the FIRST method mark being awarded.</b> Rearranges to give $P(X > \pm \alpha c)$ or $P(X < \pm \alpha c)$ or $X > \pm \alpha c$ or $X < \pm \alpha c$ , $\alpha \neq 0$
	<b>Note</b>	"P" is not required for these cases above
	<b>Note</b>	Also allow, with P, the statements $1 - P(X < \pm \alpha c)$ or $1 - P(X > \pm \alpha c)$ , $\alpha \neq 0$
	<b>NOTE</b>	Give M2 for either $X > \frac{4c}{3}$ or $P\left(X > \frac{4c}{3}\right)$ or $1 - P\left(X < \frac{4c}{3}\right)$
	<b>A1</b>	$\frac{2}{3}$ or $\frac{4}{6}$ or $0.\dot{6}$
	<b>Note</b>	Give M1M1A1 for a final answer of $\frac{2}{3}$ <b>from any</b> working.

Question Number	Scheme	Marks
<p><b>3.</b> (b)</p>	<p><b>Alternative Method 1 for Part (b)</b>  <math>\{\text{Var}(X) = \}</math>  <math display="block">\int_c^{2c} \left( \frac{1}{2c-c} \left( x - \frac{3}{2}c \right)^2 \right) \{dx\}</math> <math display="block">= \frac{1}{c} \left[ \frac{1}{3} \left( x - \frac{3c}{2} \right)^3 \right]_{\{c\}}^{\{2c\}}</math> <math display="block">= \frac{1}{3c} \left( \left( \frac{c}{2} \right)^3 - \left( -\frac{c}{2} \right)^3 \right)</math> <math display="block">= \frac{1}{3c} \left( \frac{c^3}{4} \right) = \frac{c^2}{12} *</math></p> <p>Implied <math>E(X) = \frac{3c}{2}</math>  <math>\int_c^{2c} x^2 f(x) \{dx\}</math> where <math>f(x)</math> is equivalent to <math>\frac{1}{c}</math>.                      (Limits are required)                      Applies <math>\int_c^{2c} f(x) \left( x - \frac{3c}{2} \right)^2 \{dx\}</math> where <math>f(x)</math> is a                      is equivalent to <math>\frac{1}{c}</math>. (Limits are required)</p> <p><math>\pm Ag(c)(x - \delta)^2 \rightarrow \pm Bg(c)(x - \delta)^3</math>,  <math>A, B, \delta \neq 0</math> (Ignore limits for this mark)</p> <p><b>dependent on first M mark.</b>                      Applies limits of <math>2c</math> and <math>c</math> to an                      integrated function in <math>x</math> and subtracts the                      correct way round.</p> <p>Correct proof</p>	<p><b>B1</b> <b>1<sup>st</sup> M1</b> <b>4<sup>th</sup> dM1</b> <b>2<sup>nd</sup> M1</b> <b>3<sup>rd</sup> dM1</b> <b>A1</b></p> <p>[6]</p>
<p>(b)</p>	<p><b>Alternative Method 2 for Part (b)</b>  <math>\{\text{Var}(X) = \}</math>  <math display="block">\int_c^{2c} \left( \frac{1}{2c-c} \left( x - \frac{3}{2}c \right)^2 \right) \{dx\}</math> <math display="block">= \frac{1}{c} \int_c^{2c} \left( x^2 - 3cx + \frac{9}{4}c^2 \right) \{dx\}</math> <math display="block">= \frac{1}{c} \left[ \frac{1}{3}x^3 - \frac{3}{2}cx^2 + \frac{9}{4}c^2x \right]_{\{c\}}^{\{2c\}}</math> <math display="block">= \frac{1}{c} \left( \left( \frac{1}{3}(2c)^3 - \frac{3}{2}c(2c)^2 + \frac{9}{4}c^2(2c) \right) - \left( \frac{1}{3}(c)^3 - \frac{3}{2}c(c)^2 + \frac{9}{4}c^2(c) \right) \right)</math> <math display="block">= \frac{1}{c} \left( \left( \frac{8}{3}c^3 - 6c^3 + \frac{9}{2}c^3 \right) - \left( \frac{1}{3}c^3 - \frac{3}{2}c^3 + \frac{9}{4}c^3 \right) \right)</math> <math display="block">= \frac{1}{c} \left( \left( \frac{7}{6}c^3 \right) - \left( \frac{13}{12}c^3 \right) \right) = \frac{1}{c} \left( \frac{c^3}{12} \right)</math> <math display="block">= \frac{c^2}{12} *</math></p> <p><b>Award as in Alt. Method 1</b></p> <p><math>\pm Ag(c)(x - \delta)^2 \rightarrow \pm Bg(c)(\pm \alpha x^3 \pm \beta x^2 \pm \delta x)^3</math>,  <math>A, B, \alpha, \beta, \delta \neq 0</math> (Ignore limits for this mark)</p> <p>As earlier</p> <p>Correct proof</p>	<p><b>B1</b> <b>1<sup>st</sup> M1</b> <b>4<sup>th</sup> M1</b> <b>2<sup>nd</sup> M1</b> <b>3<sup>rd</sup> dM1</b> <b>A1</b></p> <p>[6]</p>

Question Number	Scheme		Marks
4. (a)	$P(X = 0   k = 3) = 0.0498$ $P(X = 0   k = 4) = 0.0183$ $P(X = 0   k = 5) = 0.0067$ $\{e^{-k} < 0.025 \Rightarrow k >\} 3.688\dots$	At least one of these 9 probabilities <b>or</b> awrt 3.7 seen in their working.	B1
	$P(X \leq 8   k = 3) = 0.9962, P(X \geq 9   k = 3) = 0.0038$ $P(X \leq 8   k = 4) = 0.9786, P(X \geq 9   k = 4) = 0.0214$ $P(X \leq 8   k = 5) = 0.9319, P(X \geq 9   k = 5) = 0.0681$		<b>Both</b> $P(X = 0) = 0.0183$ <b>or</b> awrt 3.7 <b>and either</b> $P(X \geq 9) = 0.0214$ <b>or</b> $P(X \leq 8) = 0.9786$
	Both tails less than 2.5% when $k = 4$	Final answer given as $k = 4$	B1
	[3]		
(b)	Actual sig. level = $0.0214 + 0.0183$	See notes	M1
	= 0.0397	0.0397	A1 <b>cao</b>
	[2]		
<b>Question 4 Notes</b>			
4. (a)	<b>1<sup>st</sup> B1</b>	For any of 0.0498, 0.0183, 0.0067, 0.9962, 0.9786, 0.9319, 0.0038, 0.0214, 0.0681 or awrt 3.7 seen in their working.	
	<b>2<sup>nd</sup> B1</b>	For both $P(X = 0) = 0.0183$ <b>or</b> awrt 3.7 <b>and either</b> $P(X \geq 9) = 0.0214$ <b>or</b> $P(X \leq 8) = 0.9786$	
	<b>Note</b>	These must be written as probability statements.	
	<b>3<sup>rd</sup> B1</b>	Final answer given as $k = 4$ . Also allow $\lambda = 4$	
(b)	<b>Note</b>	<b>Do not recover working for part (a) in part (b)</b>	
	<b>M1</b>	For the addition of two probabilities for two tails, where each tail $< 0.05$	
	<b>A1</b>	0.0397 <b>cao</b>	

Question Number	Scheme				Marks			
5.	$Y = \frac{2X_1 + X_2}{3}$ where		$x$	6	9			
			$P(X = x)$	0.35	0.65			
	<b>Note: You can mark parts (a) and (b) together for this question.</b>							
	(a)	$\frac{2(6)+6}{3} = 6$	$\frac{2(9)+9}{3} = 9$	At least three correct values for y of either 6, 7, 8 or 9		B1		
		$\frac{2(6)+9}{3} = 7$	$\frac{2(9)+6}{3} = 8$	Correct values for y of 6, 7 8 and 9 only		B1		
						[2]		
	(b)	$\{(6, 6) \Rightarrow P(Y = 6)\} = (0.35)^2$		At least one of either $(0.35)^2$ , $(0.65)(0.35)$ , $(0.35)(0.65)$ or $(0.65)^2$		M1		
		$\{(6, 9) \Rightarrow P(Y = 7)\} = (0.65)(0.35)$						
		$\{(9, 6) \Rightarrow P(Y = 8)\} = (0.35)(0.65)$		At least two of either $(0.35)^2$ , $(0.65)(0.35)$ , $(0.35)(0.65)$ or $(0.65)^2$		M1		
		$\{(9, 9) \Rightarrow P(Y = 9)\} = (0.65)^2$						
		sample	(6, 6)	(6, 9)	(9, 6)	(9, 9)	See notes	A1
		y	6	7	8	9		
		$P(Y = y)$	0.1225	0.2275	0.2275	0.4225	At least 3 correct	A1
		or $P(Y = y)$	$\frac{49}{400}$	$\frac{91}{400}$	$\frac{91}{400}$	$\frac{169}{400}$	See notes	B1ft
					[5]			
(c)	$\{E(Y)\} = 6(0.1225) + 7(0.2275) + 8(0.2275) + 9(0.4225) = 7.95$ or $\frac{159}{20}$				M1;A1 cao			
					[2]			
					9			
(c)	<b>Alternative Method for Part (c)</b>							
$\left\{E(Y) = \frac{2}{3}E(X_1) + \frac{1}{3}E(X_2) = \frac{2}{3}E(X) + \frac{1}{3}E(X) = E(X)\right\}$								
$= 6(0.35) + 9(0.65); = 7.95$ or $\frac{159}{20}$					M1; A1 cao			
					[2]			

Question 5 Notes		
5. (a)	<b>Note</b>	<b>You can mark parts (a) and (b) together for this question.</b>
	<b>1<sup>st</sup> B1</b>	At least three correct values for y of either 6, 7, 8 or 9
(b)	<b>2<sup>nd</sup> B1</b>	Correct values for y of 6, 7 8 and 9 only. <b>Note:</b> Any extra value(s) given is 2 <sup>nd</sup> B0.
	<b>1<sup>st</sup> M1</b>	At least one of either $(0.35)^2$ , $(0.65)(0.35)$ , $(0.35)(0.65)$ or $(0.65)^2$ . <b>Can be implied.</b>
	<b>2<sup>nd</sup> M1</b>	At least two of either $(0.35)^2$ , $(0.65)(0.35)$ , $(0.35)(0.65)$ or $(0.65)^2$ . <b>Can be implied.</b>
	<b>1<sup>st</sup> A1</b>	At least two correct probabilities given which either must be linked to a correct sample $(x_1, x_2)$ or their followed through y-value.
	<b>2<sup>nd</sup> A1</b>	At least 3 correct probabilities corresponding to the correct value of y.
	<b>B1ft</b>	Either <ul style="list-style-type: none"> <li>• all 4 correct probabilities corresponding to the correct value of y</li> <li>• 6, 7, 8 and 9 with two correct probabilities, two other probabilities</li> </ul> and $\sum p(y) = 1$
	<b>Note</b>	B1ft is dependent on 1 <sup>st</sup> M1 2 <sup>nd</sup> M1 1 <sup>st</sup> A1.
<b>Note</b>	A table is not required but y-values must be linked with their probabilities for 2 <sup>nd</sup> A1 B1	
<b>Note</b>	Eg: (6, 6) by itself does not count as an acceptable value of y	
(c)	<b>M1</b>	A correct follow through expression for $E(Y)$ using their distribution
	<b>Note</b>	Also allow M1 for a correct expression for $E(X)$
	<b>A1</b>	7.95 <b>cao</b> Allow $\frac{159}{20}$

Question Number	Scheme	Marks
6. (a)	$X \sim B(30, 0.4)$	$X \sim B(30, 0.4)$ B1
		[1]
(b)	Eg: Any one of either <ul style="list-style-type: none"> <li>Constant probability of buying <u>insurance</u></li> <li>Customers buy <u>insurance</u> independently of each other</li> </ul>	Any one of these two assumptions in context which refers to insurance. B1
		[1]
(c)	$P(X < r) < 0.05$	
	$\{P(X \leq 8) = P(X < 9)\} = 0.0940$ $\{P(X \leq 7) = P(X < 8)\} = 0.0435$	For at least one of either 0.094(0) or 0.0435 seen in part (c) M1
	So $r = 8$	$r = 8$ A1
		[2]
(d)	$\{Y \sim B(100, 0.4) \approx Y \sim N(40, 24)\}$	Normal or N (40, 24) M1
	$\{P(Y \geq t)\} \approx P(Y > t - 0.5)$	For either $t - 0.5$ or $t + 0.5$ A1
	$\left\{ = P\left( Z > \frac{(t - 0.5) - 40}{\sqrt{24}} \right) = 0.938 \right\}$	M1
	$\frac{(t - 0.5) - 40}{\sqrt{24}} = -1.54$	Standardising ( $\pm$ ) with their mean and their standard deviation and either $t - 0.5$ or $t$ or $t + 0.5$ or $t - 1.5$ M1
		$-1.54$ or $1.54$ or awrt $-1.54$ or awrt $1.54$ B1
	So, $\{ \text{So, } t = 32.955571... \} \Rightarrow t = 33$	$t = 33$ A1 cao
		[6]
(e)	$H_0 : p = 0.4, H_1 : p < 0.4$	Both hypotheses are stated correctly B1
	$\{ \text{Under } H_0, X \sim B(25, 0.4) \}$	
	<b>Probability Method</b> $P(X \leq 6); = 0.0736$	<b>Critical Region Method</b> $P(X \leq 6); = 0.0736$ $\{P(X \leq 7) = 0.1536\}$ CR : $X \leq 6$
		$P(X \leq 6)$ M1
		Either 0.0736 or CR : $X \leq 6$ or CR : $X < 7$ A1
	$\{0.0736 < 0.10\}$	
	Reject $H_0$ or significant or 6 lies in the CR	<b>Dependent on 1<sup>st</sup> M1</b> See notes dM1
	So <u>percentage</u> (or <u>proportion</u> ) who buy <u>insurance</u> has <u>decreased</u> .	A1 cso
		[5]
		15



Question Number	Scheme		Marks
6. (e)	<b>Alternative Method: Normal approximation to the Binomial Distribution</b>		
	• Normal Approximation gives 0.0764 (or 0.07652...) and loses all A marks		
	$H_0 : p = 0.4, H_1 : p < 0.4$	Both hypotheses are stated correctly	B1
	$\{Y \sim B(25, 0.4) \approx Y \sim N(10, 6)\}$		
	$P(X \leq 6) \approx P(X < 6.5)$	$P(X \leq 6)$ or $P(X < 6.5)$	M1
	$= P\left(Z < \frac{6.5 - 10}{\sqrt{6}}\right)$		
	$= P(Z < -1.4288...)$		
	$\{= 1 - 0.9236\} = 0.0764$	<i>Award A0 here</i>	A0
$\{0.0764 < 0.10\}$			
Reject $H_0$ or significant	As in the main scheme	M1	
So <b>percentage</b> (or <b>proportion</b> ) who buy <b>insurance</b> has <b>decreased</b> . <i>Award A0 here</i>			A0
<b>Question 6 Notes</b>			
6. (a)	<b>B1 Note</b>	$X \sim B(30, 0.4)$ or $X \sim \text{Bin}(30, 0.4)$ . Condone $X \sim b(30, 0.4)$ $X \sim B(30, 0.4)$ o.e. must be seen in part (a) only.	
(b)	<b>B1 Note</b>	For any one of the two acceptable assumptions listed anywhere in part (b). A contextual statement, which refers to insurance, is required for this mark.	
(c)	<b>Note</b>	Award M1 A1 for $r = 8$ seen from no incorrect working.	
(d)	<b>1<sup>st</sup> M1</b>	For writing N or for using a normal approximation.	
	<b>1<sup>st</sup> A1</b>	For a correct mean of 40 and a correct variance of 24	
	<b>Note</b>	1 <sup>st</sup> M1 and/or 1 <sup>st</sup> A1 may be implied in applying the standardisation formula	
	<b>2<sup>nd</sup> M1</b>	For either $t - 0.5$ or $t + 0.5$ (i.e. an attempt at a continuity correction)	
	<b>3<sup>rd</sup> M1</b>	As described on the mark scheme.	
(e)	<b>B1</b>	$H_0 : p = 0.4, H_1 : p < 0.4$ correctly labelled. Also allow $H_0 : \pi = 0.4, H_1 : \pi < 0.4$ Also allow $H_0 : \pi = 0.4, H_1 : \pi < 0.4$ or $H_0 : p(x) = 0.4, H_1 : p(x) < 0.4$	
	<b>Note</b>	B0 for $H_0 = 0.4, H_1 < 0.4$	
	<b>1<sup>st</sup> M1</b>	<b>Probability Method &amp; CR Method:</b> Stating $P(X \leq 6)$	
	<b>1<sup>st</sup> A1</b>	Either 0.0736 or CR : $X \leq 6$ or CR : $X < 7$ <b>Note:</b> Condone CR $\leq 6$	
	<b>Note</b>	Award 1 <sup>st</sup> M1 1 <sup>st</sup> A1 for writing down CR : $X \leq 6$ or CR : $X < 7$ from no working.	
	<b>Note</b>	Give A0 for stating CR : $P(X \leq 6)$	
	<b>2<sup>nd</sup> dM1</b>	<b>dependent on the FIRST method mark being awarded.</b> For a correct follow through comparison based on their probability or CR and their significance level compatible with their <i>stated</i> alternative hypothesis. Do not allow non-contextual conflicting statements. Eg. “significant” and “accept $H_0$ ”.	
	<b>Note</b>	M1 can be implied by a correct contextual statement.	
	<b>2<sup>nd</sup> A1</b>	Award for a correct solution only with all previous marks in part (e) being scored. Correct conclusion which is in context, using the words <u>percentage</u> (or <u>proportion</u> ), <u>insurance</u> and <u>decreased</u> (or equivalent words for decreased).	

Question Number	Scheme	Marks
7. (a)	$\int_0^k \left(\frac{2x}{15}\right) \{dx\} + \int_5^k \frac{1}{5}(5-x) \{dx\} = 1$	Complete method of writing a correct equation for the area <b>with correct limits</b> and setting the result equal to 1 M1
	$\left[\frac{x^2}{15}\right]_{\{0\}}^{\{k\}} + \left[x - \frac{x^2}{10}\right]_{\{k\}}^{\{5\}} = 1$	Evidence of $x^n \rightarrow x^{n+1}$ M1
	$\left(\frac{k^2}{15}\right) + \left(5 - \frac{5^2}{10} - \left(k - \frac{k^2}{10}\right)\right) = 1$	Both $\frac{2x}{15} \rightarrow \frac{x^2}{15}$ and $\frac{1}{5}(5-x) \rightarrow x - \frac{x^2}{10}$ A1 o.e.
	$2k^2 + 150 - 75 - 30k + 3k^2 = 30$	
	$k^2 - 6k + 9 = 0 \text{ or } \frac{k^2}{6} - k + \frac{3}{2} = 0$	
	$(k-3)(k-3) = 0 \Rightarrow k = \dots$	Dependent on the 1 <sup>st</sup> M mark Attempt to solve a 3 term quadratic equation leading to $k = \dots$ dM1
	$k = 3$	$k = 3$ A1
(b)	{mode=} 3	3 or states their $k$ value from part (a) B1 ft [5]
(c)	$\left\{ P\left(X \leq \frac{k}{2} \mid X \leq k\right) = \frac{P\left(X \leq \frac{k}{2} \cap X \leq k\right)}{P(X \leq k)} \right\}$	[1]
	$= \frac{P\left(X \leq \frac{k}{2}\right)}{P(X \leq k)}$	Either $\frac{P\left(X \leq \frac{k}{2}\right)}{P(X \leq k)}$ or $\frac{F\left(\frac{k}{2}\right)}{F(k)}$ seen or implied. M1
	$= \frac{\int_0^{\frac{k}{2}} \left(\frac{2x}{15}\right) \{dx\}}{\int_0^k \left(\frac{2x}{15}\right) \{dx\}}$	see notes dM1
	$= \frac{\frac{1}{15} \left(\frac{k}{2}\right)^2}{\frac{k^2}{15}}$	Correct substitution of their limits or their $k$ into conditional probability formula. A1ft
	$\left\{ = \frac{\left(\frac{9}{60}\right)}{\left(\frac{9}{15}\right)} = \frac{0.15}{0.6} \right\} = \frac{1}{4}$	$\frac{1}{4}$ or 0.25 A1 cao
		[4] 10

Question 7 Notes	
7. (a)	<p><b>1<sup>st</sup> M1</b> <math>\int_0^k \left(\frac{2x}{15}\right) \{dx\} + \int_5^k \frac{1}{5}(5-x) \{dx\} = 1.</math> (<i>with correct limits and =1</i>) <math>\{dx\}</math> not needed.</p> <p><b>2<sup>nd</sup> M1</b> Evidence of <math>x^n \rightarrow x^{n+1}</math></p> <p><b>1<sup>st</sup> A1</b> <b>Both</b> <math>\frac{2x}{15} \rightarrow \frac{x^2}{15}</math> <b>and</b> <math>\frac{1}{5}(5-x) \rightarrow x - \frac{x^2}{10}</math></p> <p><b>3<sup>rd</sup> dM1</b> <b>dependent on the FIRST method mark being awarded.</b> Attempt to solve a <b>three term</b> quadratic equation. Please see table on page 20</p> <p><b>2<sup>nd</sup> A1</b> <math>k = 3</math> from correct working.</p> <p><b>Note</b> <b>WARNING:</b> <math>\frac{2x}{15} = \frac{1}{5}(5-x)</math> to get <math>k = 3</math> is M0M0A0M0A0.</p> <p><b>Note</b> It is possible to give M0M1A1M0A0 in part (a).</p>
(b)	<p><b>B1 ft</b> Mode = 3 or candidate states their <math>k</math> value from part (a), where <math>0 &lt; \text{their } k &lt; 5</math></p>
(c)	<p><b>1<sup>st</sup> M1</b> Either <math>\frac{P\left(X \leq \frac{k}{2}\right)}{P(X \leq k)}</math> or <math>\frac{F\left(\frac{k}{2}\right)}{F(k)}</math>, seen or implied by their later working.</p> <p><b>Note</b> Without reference to a correct conditional probability statement give 1<sup>st</sup> M0 for either <math>\frac{f\left(\frac{k}{2}\right)}{f(k)}</math> or <math>\frac{F(k) - F\left(\frac{k}{2}\right)}{F(k)}</math> or <math>\frac{P\left(X \leq \frac{k}{2}\right) \times P(X \leq k)}{P(X \leq k)}</math></p> <p><b>2<sup>nd</sup> dM1</b> <b>dependent on the FIRST method mark being awarded.</b> <b>Applies</b> the conditional probability statement by writing down</p> <ul style="list-style-type: none"> <li>• <math>\frac{\int_0^{\frac{k}{2}} \left(\frac{2x}{15}\right) \{dx\}}{\int_0^k \left(\frac{2x}{15}\right) \{dx\}}</math> with limits.</li> <li>• <math>\frac{F\left(\frac{k}{2}\right)}{F(k)}</math> where <math>F(x)</math> is defined as <math>F(x) = \frac{x^2}{15}</math></li> </ul> <p>These statements can be implied by later working.</p> <p><b>Note</b> Finding <math>P(X \leq 1.5) = 0.15</math> and <math>P(X \leq 3) = 0.6</math> without applying <math>\frac{0.15}{0.6}</math> is 2<sup>nd</sup> M0</p> <p><b>1<sup>st</sup> A1ft</b> Correct substitution of their limits or their <math>k</math> into conditional probability formula. <b>Note</b> Candidates can work in terms of <math>k</math> for this 1<sup>st</sup> A1 mark.</p> <p><b>2<sup>nd</sup> A1</b> <math>\frac{1}{4}</math> or 0.25 <b>cao</b> <b>Note</b> Condone giving 2<sup>nd</sup> A1 for achieving a correct answer of 0.25 where at least one of their stated <math>P\left(X \leq \frac{k}{2}\right)</math> or <math>P(X \leq k)</math> is greater than 1</p> <p><b>Note</b> Alternative method using similar triangles. Area up to <math>\frac{k}{2}</math> is <math>\frac{1}{4}</math> of the area up to <math>k</math>. This can score 4 marks.</p>

<p>7. (a)</p>	<p><b>Alternative Method 1 for Part (a) Using the CDF</b></p> $0 \leq x \leq k, F(x) = \int_0^k \frac{2t}{15} \{dt\} = \left[ \frac{2t^2}{30} \right]_0^x = \frac{x^2}{15}$ $k < x \leq 5, F(x) = F(k) + \int_k^x \frac{1}{5}(5-t) \{dt\}$ $= \frac{k^2}{15} + \left[ \frac{1}{5} \left( 5t - \frac{t^2}{2} \right) \right]_k^x$ $= \frac{k^2}{15} + \frac{1}{5} \left( \frac{5x - x^2}{2} \right) - \frac{1}{5} \left( 5k - \frac{k^2}{2} \right)$ $= x - \frac{x^2}{10} - k + \frac{k^2}{6}$		<p>Evidence of <math>x^n \rightarrow x^{n+1}</math> <b>2<sup>nd</sup> M1</b></p> <p><b>Both</b> <math>\frac{2x}{15} \rightarrow \frac{x^2}{15}</math> <b>and</b>  <math>\frac{1}{5}(5-x) \rightarrow x - \frac{x^2}{10}</math></p> <p><b>1<sup>st</sup> A1</b> o.e.</p>
	<p><math>\{F(5) = 1 \Rightarrow\} 5 - \frac{5^2}{10} - k + \frac{k^2}{6} = 1</math></p> <p>Complete method of writing a correct equation for the area <b>with correct limits</b> and setting <math>F(5) = 1</math></p> <p><b>1<sup>st</sup> M1</b></p>		
	<p><i>then apply the main scheme</i></p>		
<p>7. (a)</p>	<p><b>Alternative Method 2 for Part (a) Use of Area</b></p> $\frac{1}{2}k \left( \frac{2k}{15} \right) + \frac{1}{2} \left( \frac{5-k}{5} \right) (5-k) = 1$		<p>Complete area expression put = 1 <b>M1</b></p> <p>At least one term correct on LHS <b>M1</b></p> <p>Correct LHS <b>A1 o.e.</b></p>
	<p><i>then apply the main scheme</i></p>		
<p><b>General</b></p>	<p><b>Note</b></p>	<p>The c.d.f is defined as</p> $F(x) = \begin{cases} 0, & x < 0 \\ \frac{x^2}{15}, & 0 \leq x \leq 3 \\ x - \frac{x^2}{10} - \frac{3}{2}, & 3 < x \leq 5 \\ 1, & x > 5 \end{cases}$	
<p>7. (a)</p>	<p><b>Method mark for solving a 3 term quadratic of the form</b> <math>x^2 + bx + c = 0</math></p> <p><b>Factorising/Solving a quadratic equation is tested in Question 7(a).</b></p> <p><b>1. Factorisation</b>  <math>(x^2 + bx + c) = (x + p)(x + q)</math>, where <math> pq  =  c </math>, leading to <math>x = \dots</math>  <math>(ax^2 + bx + c) = (mx \pm p)(nx \pm q)</math>, where <math> pq  =  c </math> and <math> mn  =  a </math>, leading to <math>x = \dots</math></p> <p><b>2. Formula</b>  Attempt to use correct formula (with values for <math>a, b</math> and <math>c</math>)</p> <p><b>3. Completing the square</b>  Solving <math>x^2 + bx + c = 0</math>: <math>\left(x \pm \frac{b}{2}\right)^2 \pm q \pm c = 0</math>, <math>q \neq 0</math>, leading to <math>x = \dots</math></p>		

