



# Mark Scheme (Results)

January 2024

Pearson Edexcel International Advanced Level  
in Statistics S2 (WST02) Paper 01

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## General Marking Guidance

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

## General Instructions for Marking

The total number of marks for the paper is 75.

Edexcel Mathematics mark schemes use the following types of marks:

### 'M' marks

These are marks given for a correct method or an attempt at a correct method. In Mechanics they are usually awarded for the application of some mechanical principle to produce an equation, e.g. resolving in a particular direction; taking moments about a point; applying a suvat equation; applying the conservation of momentum principle; etc.

The following criteria are usually applied to the equation. To earn the M mark, the equation

- should have the correct number of terms
- each term needs to be dimensionally correct

For example, in a moments equation, every term must be a 'force x distance' term or 'mass x distance', if we allow them to cancel 'g' s.

For a resolution, all terms that need to be resolved (multiplied by sin or cos) must be resolved to earn the M mark.

'M' marks are sometimes dependent (DM) on previous M marks having been earned, e.g. when two simultaneous equations have been set up by, for example, resolving in two directions and there is then an M mark for solving the equations to find a particular quantity – this M mark is often dependent on the two previous M marks having been earned.

### 'A' marks

These are dependent accuracy (or sometimes answer) marks and can only be awarded if the previous M mark has been earned. e.g. M0 A1 is impossible.

### 'B' marks

These are independent accuracy marks where there is no method (e.g. often given for a comment or for a graph).

A and B marks may be f.t. – follow through – marks.

## General Abbreviations

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

- bod means benefit of doubt
- ft means follow through
  - the symbol  $\checkmark$  will be used for correct ft
- cao means correct answer only
- cso means correct solution only, i.e. there must be no errors in this part of the question to obtain this mark

- isw means ignore subsequent working
- awrt means answers which round to
- SC means special case
- oe means or equivalent (and appropriate)
- dep means dependent
- indep means independent
- dp means decimal places
- sf means significant figures
- \* means the answer is printed on the question paper
- $\square$  means the second mark is dependent on gaining the first mark

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.

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.

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.

Ignore wrong working or incorrect statements following a correct answer.

**Special notes for marking Statistics exams (for AAs only)**

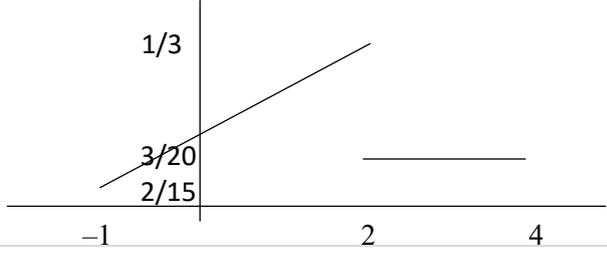
- Any correct method should gain credit. If you cannot see how to apply the mark scheme but believe the method to be correct then please send to review.
- For method marks, we generally allow or condone a slip or transcription error if these are seen in an expression. We do not, however, condone or allow these errors in accuracy marks.

Question Number	Scheme		Marks
1 (a)	[Mean =] 2.95		B1
	[Variance =] $\frac{2091}{180} - ("2.95")^2$		M1
	= 2.914.... ( $s^2 = 2.930...$ )		awrt 2.91 (2.93) A1
			(3)
(b)	The mean is close to the variance		B1
			(1)
(c)	$W \sim \text{Po}(3)$		
(i)	[P(W ...3) =] $1 - P(W \leq 2) = 0.5768$		awrt 0.577 M1 A1
(ii)	[P(4 < W < 8) =] $P(W \leq 7) - P(W \leq 4)$ or $P(W = 5) + P(W = 6) + P(W = 7)$		M1
	= 0.1728...		awrt 0.173 A1
			(4)
(d)	$X \sim N(21, 21)$		B1
		[P(X < 19) =] $P\left(Z \leq \frac{18.5 - 21}{\sqrt{21}}\right) [= -0.5455...]$ or	M1M1A1
		[P(X > 23) =] $P\left(Z \geq \frac{23.5 - 21}{\sqrt{21}}\right) [= 0.5455...]$	
		= 0.2912 (calc 0.29268...)*	A1*cso
			(5)
(e)	$Y \sim B(13, "0.29")$		M1
		[P(Y = 5) =] ${}^{13}C_5 ("0.29")^5 (1 - "0.29")^8 = 0.170465$ (calc 0.17317...)	awrt 0.17 M1 A1
			(3)
<b>Notes</b>			<b>Total 16</b>
(a)	<b>B1</b>	cao allow exact equivalents	
	<b>M1</b>	Ft their mean. Using $\frac{\sum fx^2}{180} - (\text{their mean})^2$ or $\frac{180}{179} \left( \frac{\sum fx^2}{180} - (\text{their mean})^2 \right)$	
	<b>A1cso</b>	Allow with a square root – may be implied by awrt 1.71 awrt 2.91 (2.93)	
(b)	<b>B1</b>	cao – Allow equivalent wording. Allow mean = variance. If no values/non compatible values calculated, then B0. Condone the use of ‘closed’ for ‘close’	
(c)(i)	<b>M1</b>	for $1 - P(W \leq 2)$ or $1 - 0.4232$	
	<b>A1</b>	awrt 0.577	
(ii)	<b>M1</b>	for $P(W \leq 7) - P(W \leq 4)$ or $P(W = 5) + P(W = 6) + P(W = 7)$ or $0.9881 - 0.8153$ or $0.1008 + 0.0504 + 0.0216$	
	<b>A1</b>	awrt 0.173	
(d)	<b>B1</b>	for writing or using $N(21, 21)$ . May be seen in a standardisation expression.	
	<b>M1</b>	for standardisation ( $\pm$ ) using their mean and sd. Allow 17.5, 18, 18.5, 19, 19.5, 22.5, 23, 23.5, 24, 24.5	
	<b>M1</b>	for using $19 \pm 0.5$ or $23 \pm 0.5$	
	<b>A1</b>	for a fully correct standardisation expression Implied by awrt $\pm 0.546$	
	<b>A1*</b>	awrt 0.291 or 0.293 from correct working seen	
(e)	<b>M1</b>	for writing or using $B(13, 0.29)$ ft their 0.29 (Must be 2 sf or better) or for $(p)^5(1-p)^8$ ft their 0.29 (Must be 2 sf or better) . Condone B(0.29, 13)	
	<b>M1</b>	for ${}^{13}C_5 (p)^5 (1-p)^8$ oe with $0 < p < 1$ Allow 1287 for ${}^{13}C_5$	
	<b>A1</b>	awrt 0.17 (0.17168 from using 0.2912)	

Question Number	Scheme		Marks
2 (a)	$[P(D < 108) = ] P\left(Z < \frac{108 - 112.4}{\sigma}\right) = 0.05$		
	$\Rightarrow \frac{108 - 112.4}{\sigma} = -1.6449$		M1 M1
	$\sigma = 2.6749... \text{ days (calc 2.67501... )}$		awrt 2.67/2.68 A1
			(3)
(b)	$J \sim B(25, 0.05)$		
	$[P(J \dots 4) = ] 1 - P(J \leq 3) = 1 - 0.9659$		M1
	$= 0.0341 \text{ (calc 0.034090...)}$		awrt 0.0341 A1
			(2)
(c)	$T \sim \text{Po}[200 \times "0.0341"] = 6.82 \text{ (calc 6.8181...)}$		M1
	$[P(T \dots 2) = ] 1 - P(X \leq 1) = 1 - (e^{-"6.82"} + e^{-"6.82"} \times "6.82")$		M1
	$= 0.99146... \text{ calc (0.99144...)}$		awrt 0.991 dA1
			(3)
<b>Notes</b>			<b>Total 8</b>
(a) (i)	<b>M1</b>	for standardisation using 108(Condone 107.5), 112.4 and $\sigma$ set equal to $z$ where $1.5 <  z  < 2.5$	
	<b>M1</b>	for correct equation awrt $-1.6449$ (Allow awrt 1.6449 if compatible with their equation)	
	<b>A1</b>	awrt 2.67/2.68 <b>NB</b> M1 M0 A1 is possible	
(b)	<b>M1</b>	for $1 - P(J \leq 3)$ or $1 - 0.9659$	
	<b>A1</b>	awrt 0.0341	
(c)	<b>M1</b>	for writing or using correct Poisson model ft their part (b) May be implied by 0.00853(73)	
	<b>M1</b>	for writing or using $1 - (e^{-\lambda} + e^{-\lambda} \times \lambda)$ where $1 < \lambda < 200$ (may be implied by awrt 0.991) Allow $1 - P(X \leq 1)$ if Poisson distribution is stated or used	
	<b>dA1</b>	dep on both method marks being awarded awrt 0.991 ( <b>NB</b> Binomial gives awrt 0.992 and if no working shown awrt 0.992 will gain M0M0A0) Allow 0.9915 if both M marks are awarded	

Question Number	Scheme		Marks
3 (a)	The vacuum <b>tubes shatter</b> independently		B1
	The probability of a vacuum <b>tube shattering</b> is constant		B1
			(2)
(b)	$C \sim B(15, 0.35)$ plus $[P(C \leq 9) = ]0.0142$ or $[P(C \leq 10) = ]0.0124$ or $[P(C \leq 9) = ]0.9876$		M1
	Critical regions $[0, ] C \leq 1$ or $10, C \leq ] 15]$		M1
	$[0, ] C \leq 1$ and $10, C \leq ] 15]$ plus $P(C \leq 9) = 0.0142$ and $P(C \leq 10) = 0.0124$		A1
			(3)
(c)	0.0266		B1ft (1)
(d)	[4 is not in the CR therefore] there is no evidence to reject <b>Rowan's</b> belief		B1ft (1)
(e)	$F \sim B(40, 0.35)$		
	$H_0: p = 0.35$ and $H_1: p < 0.35$		B1
	$P(F \leq 8) = 0.0303$ or CR $F \leq 8$		M1A1
	Sufficient evidence to reject $H_0$ or significant or 8 lies in the Critical region		M1
	There is sufficient evidence to support that the <b>proportion</b> of type <b>B</b> vacuum <b>tubes</b> that shatter when exposed to alternating high and low temperatures is less than 35%		A1 (5)
<b>Notes</b>			<b>Total 12</b>
(a)	<b>B1</b>	for one correct reason which must mention tube(s) and shatter/shattering or 2 correct reasons not in context	
	<b>B1</b>	for 2 correct reasons which must mention tube(s) and shatter/shattering at least once	
(b)	<b>M1</b>	for using the correct distribution to find awrt 0.0142 or awrt 0.0124 or awrt 0.988 Allow $B(15, 0.35)$ is written <b>and</b> one of awrt 0.014 or awrt 0.012 or awrt 0.99 is seen	
	<b>M1</b>	for lower CR or $C \leq 1$ oe e.g. $C < 2$ or upper CR $C \leq 10$ oe e.g. $C > 9$ Allow other notation and any letter(s) for CR Do not allow CR written as a probability statement	
	<b>A1</b>	for both CR correct with the relevant probabilities (3 sf and must be seen in part (b)). Do not allow CR written as a probability statement	
(c)	<b>B1ft</b>	for awrt 0.0266 or 2.66% or ft the sum of the probabilities in (b) for "their 2 critical regions" if seen. If no probabilities for their CR given then the answer must be 0.0266	
(d)	<b>B1ft</b>	for a correct statement consistent with their CR Must mention <b>Rowan/his/her</b> or a correct conclusion based on Rowan's belief with the words highlighted in bold e.g. no evidence to suggest that the <b>proportion/probability/number/amount</b> (allow <b>35%</b> as proportion) of <b>tubes</b> that shatter has changed oe	
(e)	<b>B1</b>	for both hypotheses correct in terms of $p$ or $\pi$	
	<b>M1</b>	for using or writing $P(F \leq 8)$ or awrt 0.0303	
	<b>A1</b>	for awrt 0.0303 or correct CR Allow $F \leq 8$ or $F < 9$ but not if part of a probability statement	
	<b>M1</b>	for a correct conclusion – need not be in context. ft their probability or CR. Ignore hypotheses. do not allow contradicting non contextual comments. May be implied by a correct contextual statement on its own	
	<b>A1</b>	for a correct conclusion – must be in context, with words highlighted in bold. ft their probability or CR only. Independent of hypotheses. Do not allow contradicting statements. Allow probability/number/amount/35% for proportion. Allow decreased for less than 35%	

Question	Scheme	Marks
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Number		
4 (a)		M1 A1  (2)
(b)	<p> <math>[P(G \leq 2)] = 1 - 2 \times \frac{3}{20} [= 0.7]</math> or <math>\frac{1}{2} \times 3 \times \left(\frac{2}{15} + \frac{1}{3}\right)</math> or <math>\frac{1}{15} \int_{-1}^2 (g+3) dg [= 0.7]</math> or  <math>\frac{1}{30} \times 2^2 + \frac{1}{5} \times 2 + \frac{1}{6} [= 0.7]</math>                      or  <math>\left[P\left(G \leq \frac{1}{2}\right)\right] = \frac{1}{2} \times 1.5 \times \left(\frac{2}{15} + \frac{3.5}{15}\right) [= 0.275]</math> or <math>\frac{1}{15} \int_{-1}^{0.5} (g+3) dg [= 0.275]</math> or  <math>\frac{1}{30} \times 0.5^2 + \frac{1}{5} \times 0.5 + \frac{1}{6} [= 0.275]</math>                      or  <math>\left[P\left(\frac{1}{2} \leq G \leq 2\right)\right] = \frac{1}{2} \times 1.5 \times \left(\frac{7}{30} + \frac{1}{3}\right) [= 0.425]</math> or <math>\frac{1}{15} \int_{0.5}^2 (g+3) dg [= 0.425]</math> or  <math>\frac{1}{30} \times (2^2 - 0.5^2) + \frac{1}{5} \times (2 - 0.5) [= 0.425]</math> </p> <p> <math>[P(1 \leq 2G \leq 6   G \leq 2)] = \frac{P\left(\frac{1}{2} \leq G \leq 2\right)}{P(G \leq 2)} = \frac{0.425}{0.7}</math> or <math>1 - \frac{0.275}{0.7}</math> oe  <math>= \frac{17}{28}</math> or 0.607... awrt 0.607                 </p>	M1          M1M1  A1  (4)
(c)	<p> <math>[E(H^2)] = 2.4 + 12^2 [= 146.4]</math> </p> <p> <math>[E(G)] = \int_{-1}^2 \frac{1}{15}(g^2 + 3g) dg + \int_2^4 \frac{3}{20} g dg</math> </p> <p> <math>[E(G)] = \left[\frac{1}{15}\left(\frac{1}{3}g^3 + \frac{3}{2}g^2\right)\right]_{-1}^2 + \left[\frac{3}{40}g^2\right]_2^4</math>  <math>= \frac{1}{15}\left(\frac{8}{3} + \frac{12}{2} + \frac{1}{3} - \frac{3}{2}\right) + \left(\frac{48}{40} - \frac{12}{40}\right) [= 1.4]</math> </p> <p> <math>[E(2H^2 + 3G + 3)] = 2 \times "146.4" + 3 \times "1.4" + 3</math>  <math>= 300</math> </p>	M1  M1  M1  dM1  M1  A1 (6)  <b>Total 12</b>

		Notes
(a)	<b>M1</b>	for correct shape $\left(g = \frac{3}{20} \text{ must be below } \frac{1}{3}\right)$ with the lines not joining at $x = 2$ and none below/touch the $x$ -axis. Ignore any broken/dotted lines drawn
	<b>A1</b>	for fully correct graph with labels on the $x$ axis
(b)	<b>M1</b>	For a correct method to find $P(G, 2)$ or $P\left(G, \frac{1}{2}\right)$ or $P\left(\frac{1}{2}, G, 2\right)$ May be implied by $0.7 / \frac{7}{10}$ or $0.425 = \frac{17}{40}$ or $0.275 / \frac{11}{40}$
	<b>M1</b>	for $\frac{p}{0.7}$ where $0 < p < 0.7$ or $\frac{0.425}{q}$ where $0.425 < q < 1$ or $1 - \frac{0.275}{r}$ where $0.275 < r < 1$ Allow un-simplified probabilities
	<b>M1</b>	For $\frac{P\left(\frac{1}{2}, G, 2\right)}{P(G, 2)}$ or a correct ratio of probabilities
	<b>A1</b>	$\frac{17}{28}$ oe or awrt 0.607
(c)	<b>M1</b>	for a correct method to find $E(H^2)$
	<b>M1</b>	for realising $\int xf(x)dx$ on both functions and adding together. Ignore limits
	<b>M1</b>	for attempting to integrate $(x^n \rightarrow x^{n+1})$ at least one part of $xf(x)$
	<b>dM1</b>	dep on previous M1 being awarded. For use of correct limits in one part of $xf(x)$ If working not shown, then this may be implied by 0.5 or 0.9 or 1.4. If integration is incorrect then working must be shown.
	<b>M1</b>	For using $2 \times$ "their $E(H^2)$ " + 3 "their $E(G) + 3$ , provided $E(H^2)$ and $E(G)$ have been shown. <b>NB</b> You may have to check their answer if no working is shown for $2 \times$ "their $E(H^2)$ " + 3 "their $E(G) + 3$
	<b>A1</b>	Cao

Question Number	Scheme		Marks
5(a)	$\frac{(a+6)^2}{12} = 27$		M1
	$a = \sqrt{27 \times 12} - 6 \Rightarrow 12^*$ or $a^2 + 12a - 288 = 0 \Rightarrow a = 12^*$		A1*
			(2)
(b)(i)	$\frac{12-b}{18} = \frac{3}{5}$ or $\frac{b+6}{18} = \frac{2}{5}$		M1
	$b = 1.2$		A1
			(2)
(ii)	$P(-6 < W < "0.6") = \frac{"0.6" + 6}{18}$		M1
	$= \frac{11}{30}$ or 0.3666....		A1ft
			(2)
(c)	Let $C$ be the point where the wood is cut and $x$ is the distance $AC$		
	$\frac{x}{2}$ and $\left(\frac{160-x}{2}\right)$	$L+W=80$ and $LW=975$	M1
	$\frac{x}{2} \times \left(\frac{160-x}{2}\right) = 975 \Rightarrow x = 30$ or $130$	$L(80-L) = 975 \Rightarrow L = 15$ or $65$	M1
	$P("30" < x < "130") = \frac{"130" - "30"}{160} \left[ = \frac{5}{8} \right]$ oe	$P("15" < x < "65") = \frac{"65" - "15"}{80} \left[ = \frac{5}{8} \right]$ oe	dM1
	$= \frac{5}{8}$ oe		A1
			(4)
<b>Notes</b>			<b>Total 10</b>
(a)	<b>M1</b>	for setting up the correct equation. Do not allow verification	
	<b>A1*</b>	for an un-simplified expression for $a$ leading to $a = 12$ or for a correct $3TQ = 0$ leading to $a = 12$ Condone any letter for $a$	
(b)(i)	<b>M1</b>	for setting up the correct equation	
	<b>A1</b>	Cao oe	
(ii)	<b>M1</b>	for a correct method. Do not ISW	
	<b>A1ft</b>	ft their value for $b$ , provided the answer is between 0 and 1	
(c)	<b>M1</b>	For both expressions seen. Allow any letters e.g. $\frac{y}{2}$ for $\left(\frac{160-x}{2}\right)$ May be implied by a correct equation for the area	
	<b>M1</b>	for a correct equation for area in terms of any letter. Condone an inequality	
	<b>dM1</b>	dep on previous method mark awarded. For a fully correct method ft their $x$ values provided add to 160 or 80 Do not ISW	
	<b>A1</b>	Cao	

Question Number	Scheme					Marks	
6(a)	8, 11, 14, 17, 20					M1	
	$[P(\text{even}) = ]\frac{1}{5}$ and $[P(\text{odd}) = ]\frac{4}{5}$					M1	
	$[P(X = 8) = ]\left(\frac{4}{5}\right)^4$ or $[P(X = 20) = ]\left(\frac{1}{5}\right)^4$					M1	
	$[P(X = 11) = ]4 \times \left(\frac{1}{5}\right)\left(\frac{4}{5}\right)^3$ or $[P(X = 17) = ]4 \times \left(\frac{4}{5}\right)\left(\frac{1}{5}\right)^3$					M1	
	$[P(X = 14) = ]^4C_2 \times \left(\frac{1}{5}\right)^2 \left(\frac{4}{5}\right)^2$					M1	
		$X$	8	11	14	17	20
	$P(X = x)$	$\frac{256}{625}$ (0.4096)	$\frac{256}{625}$ (0.4096)	$\frac{96}{625}$ (0.1536)	$\frac{16}{625}$ (0.0256)	$\frac{1}{625}$ (0.0016)	
						(6)	
(b)	$1 - (1 - "0.1536")^n > 0.95$ or $("0.8464")^n < 0.05$					M1	
	$n > 17.96$ or $n > \frac{\log(0.05)}{\log("0.8464")}$ or $n > \log_{"0.8464"}(0.05)$					M1	
	$n = 18$					A1	
						(3)	
<b>Notes</b>						<b>Total 9</b>	
(a)	<b>M1</b>	For at least 2 scores correct and no more than 3 incorrect					
	<b>M1</b>	for writing or using $\frac{4}{5}$ and $\frac{1}{5}$ . May be implied by a correct probability					
	<b>M1</b>	for $p^4$ where $0 < p < 1$					
	<b>M1</b>	for $4 \times (1 - p)p^3$ where $0 < p < 1$					
	<b>M1</b>	for $6 \times (1 - p)^2 p^2$ where $0 < p < 1$ or probabilities that add to 1 (at least 2 but not more than 5)					
	<b>A1</b>	for all 5 probabilities correct and associated with the correct values. Need not be in a table but probabilities must be attached to the correct total					
(b)	<b>M1</b>	for using $1 - (1 - P(Y = 0))^n > 0.95$ allow = instead of $>/\geq$ . condone $</\leq$ or allow for at least 2 trials for $n$ between 10 and 20 ft their $P(X = 14)$					
	<b>M1</b>	for $n > \text{awrt } 17.96$ or $n > \frac{\log(0.05)}{\log("0.8464")}$ ft their 0.8464 or $n > \log_{"0.8464"}(0.05)$ ft their 0.8464 or for the two trials for $n = 17$ and 18 Allow = instead of $>/\geq$ . condone $</\leq$ May be implied by a correct answer ft their 0.8464					
	<b>A1</b>	Cao (Do not allow any inequality for this mark)					

Question Number	Scheme		Marks	
7(a)	$f(x) = [k](a + 3bx^2 - 4x^3)$		M1	
	$[k](6bx - 12x^2) = 0$		M1	
	$9b - 27 = 0 \Rightarrow b = 3$ or $6 \times 3 \times 1.5 - 12 \times 1.5^2 = 0 \Rightarrow \therefore b = 3^*$		A1*	
			(3)	
(b)	$a + 3 - 1 - 4 = 0$ oe $[\Rightarrow a = 2]$		B1*	
			(1)	
(c)	$k(2 \times 2 + 3 \times 2^3 - 2^4 - 4) = 1 \quad \left[ \Rightarrow k = \frac{1}{8} \right]$		M1	
	$F(x) = 0.5$	$F(x) = 4$	$F(x) = 0$	
	$F(1.4) = 0.3988\dots$ $F(1.5) = 0.5078\dots$	$F(1.4) = 3.1904\dots$ $F(1.5) = 4.0625\dots$	$F(1.4) = -0.8(096\dots)$ $F(1.5) = 0.06(25\dots)$	M1A1
	$0.399 < 0.5 < 0.508$ therefore, the median lies between 1.4 and 1.5	$3.1904 < 4 < 4.0625$ therefore, the median lies between 1.4 and 1.5	$-0.8(096) < 0 < 0.06(25)$ therefore, the median lies between 1.4 and 1.5	A1
	<b>ALTERNATIVE M1A1A1 for <math>F(x) = 0</math></b>			
	$x_1 = 2.91\dots \quad x_2 = 1.49\dots \quad x_3 = -0.70\dots$ So $x = 1.49\dots$ as $1 \leq x \leq 2$			M1 A1
	$1.4 < 1.49\dots < 1.5$ [therefore, the median lies between 1.4 and 1.5]			dA1
			(4)	
<b>Notes</b>			<b>Total 8</b>	
(a)	<b>M1</b>	for attempting to differentiate $x^n \rightarrow x^{n-1}$ Condone missing $k$ (May be implied by 2 <sup>nd</sup> M1)		
	<b>M1</b>	for correctly differentiating twice and equating to zero. Condone missing $k$		
	<b>A1*</b>	substituting $x = 1.5$ leading to a correct linear equation in $b$ leading to $b = 3$		
(b)	<b>B1*</b>	for correctly using $F(1) = 0$ to form an equation in $a$ (May be seen in part (a)) and substitution of $b = 3$		
(c)	<b>M1</b>	for using $F(2) = 1$ to form a correct equation in terms of $k$ only. May be seen in any part of the question		
	<b>M1</b>	For a calculation of $F(1.4)$ <b>or</b> $F(1.5)$ correct to 2 sf (If $F(x) = 0$ used then allow 1 sf or better) (Allow $F(1.4) = \text{awrt } 3.190k$ <b>or</b> $F(1.5) = \text{awrt } 4.063k$ )		
	<b>A1</b>	For a calculation of $F(1.4)$ <b>and</b> $F(1.5)$ correct to 2 sf (If $F(x) = 0$ used then allow 1 sf or better)		
	<b>dA1</b>	Dependent on previous A1. For a correct comparison and conclusion. Allow comparisons in words e.g. For $F(X) = 0$ a comment about a change in sign implies a comparison with 0		
		<b>ALTERNATIVE</b>		
	<b>M1</b>	For solving the given equation. May be implied by 2.91... or 1.49... or -0.70...		
	<b>A1</b>	For $x = 1.49\dots$ identified as being in the range specified by the CDF. May be implied by rejecting the other solutions		
	<b>dA1</b>	Dependent on previous A1. For a correct comparison and conclusion		

Examples of other acceptable comparisons for 0.5

$F(1.4) < 0.5 < F(1.5)$ , Median lies between the range

$F(1.4) < F(\text{median}) < F(1.5)$ , so median lies between 1.4 and 1.5

$F(1.4) < F(Q2) < F(1.5)$ , therefore  $Q2$  lies between 1.4 and 1.5

$F(1.4) < F(m) < F(1.5)$ ,  $1.4 < m < 1.5$

$F(1.4) < 0.5$ ,  $F(1.5) > 0.5$ , so median of  $X$  lies between 1.4 and 1.5

Allow equivalent comparisons for 4 and 0

