Pearson
Edexcel

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
(i) should have the correct number of terms
(ii) 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 $\surd$ 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
- ⌊ 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~ Po(3)	
(i)	$\left[\mathrm{P}(W \ldots 3)=\right]1-\mathrm{P}(W \,„\, 2) = 0.5768$ awrt 0.577	M1 A1
(ii)	$\left[\mathrm{P}(4<W<8)=\right]\mathrm{P}(W \,„\, 7)-\mathrm{P}(W \,„\, 4)$ or $\mathrm{P}(W=5)+\mathrm{P}(W=6)+\mathrm{P}(W=7)$	M1
	= 0.1728… awrt 0.173	A1
		(4)
(d)	X~N(21,21)	B1
	$\left[\mathrm{P}(X<19)=\right]\mathrm{P}\left(Z \,„\, \frac{18.5-21}{\sqrt{21}}\right)[=-0.5455...]$ or $\left[\mathrm{P}(X>23)=\right]\mathrm{P}\left(Z \ldots \frac{23.5-21}{\sqrt{21}}\right)[=0.5455...]$	M1M1A1
	= 0.2912 (calc 0.29268…)*	A1*cso
		(5)
(e)	Y ~ B(13, "0.29")	M1
	$\left[\mathrm{P}(Y=5)=\right]\ {}^{13}C_5("0.29")^5(1-"0.29")^8 = 0.170465$ (calc 0.17317…) awrt 0.17	M1 A1
		(3)

	Notes		Total 16
(a)	**B1**	cao allow exact equivalents	
	M1	Ft their mean. Using $\frac{\sum fx^2}{180}-(\text{their mean})^2$ or $\frac{180}{179}\left(\frac{\sum fx^2}{180}-(\text{their mean})^2\right)$ Allow with a square root – may be implied by awrt 1.71	
	A1cso	awrt 2.91 (2.93)	
(b)	**B1**	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)	**M1**	for $1-\mathrm{P}(W \,„\, 2)$ or 1 – 0.4232	
	A1	awrt 0.577	
(ii)	**M1**	for $\mathrm{P}(W \,„\, 7)-\mathrm{P}(W \,„\, 4)$ **or** $\mathrm{P}(W=5)+\mathrm{P}(W=6)+\mathrm{P}(W=7)$ **or** 0.9881 – 0.8153 **or** 0.1008 + 0.0504 + 0.0216	
	A1	awrt 0.173	
(d)	**B1**	for writing or using N(21,21). May be seen in a standardisation expression.	
	M1	for standardisation (±) using their mean and sd. Allow 17.5, 18, 18.5, 19, 19.5, 22.5, 23, 23.5, 24, 24.5	
	M1	for using 19 ± 0.5 or 23 ± 0.5	
	A1	~~for~~ a fully correct standardisation expression Implied by awrt ±0.546	
	A1*	awrt 0.291 or 0.293 from correct working seen	
(e)	**M1**	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)	
	M1	for ${}^{13}C_5(p)^5(1-p)^8$ oe with $0 < p < 1$ Allow 1287 for ${}^{13}C_5$	
	A1	awrt 0.17 (0.17168 from using 0.2912)	

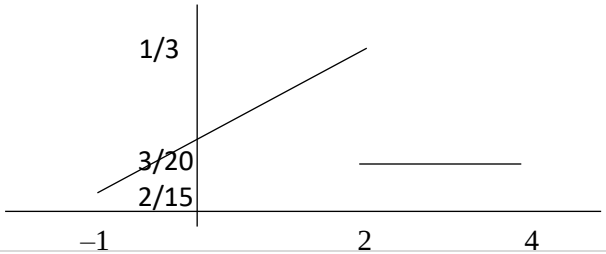
Question Number	Scheme	Marks
2 (a)	$\left[\mathrm{P}(D<108)=\right]\ \mathrm{P}\left(Z<\dfrac{108-112.4}{\sigma}\right)=\ 0.05$	
	$\Rightarrow \dfrac{108-112.4}{\sigma}=-1.6449$	M1 M1
	$\sigma = 2.6749...$ days (calc 2.67501…) awrt 2.67/2.68	A1
		(3)
(b)	$J \sim \mathrm{B}(25,\ 0.05)$	
	$\left[\mathrm{P}(J\ \ldots 4)=\right]1-\mathrm{P}(J\ ,,\ 3)=1-0.9659$	M1
	$= 0.0341$ (calc 0.034090…) awrt 0.0341	A1
		(2)
(c)	$T \sim \mathrm{Po}[200\times"0.0341"]=6.82$ (calc 6.8181…)	M1
	$\left[\mathrm{P}(T\ \ldots 2)=\right]1-\mathrm{P}(X\ ,,\ 1)=1-\left(\mathrm{e}^{-"6.82"}+\mathrm{e}^{-"6.82"}\times"6.82"\right)$	M1
	$= 0.99146\ldots$ calc (0.99144…) awrt 0.991	dA1
		(3)

	Notes	**Total 8**
(a) (i)	**M1**	for standardisation using 108(Condone 107.5), 112.4 and σ set equal to z where $1.5<\lvert z\rvert<2.5$
	M1	for correct equation awrt –1.6449 (Allow awrt 1.6449 if compatible with their equation)
	A1	awrt 2.67/2.68 **NB** M1 M0 A1 is possible
(b)	**M1**	for $1-\mathrm{P}(J\ ,,\ 3)$ or 1 – 0.9659
	A1	awrt 0.0341
(c)	**M1**	for writing or using correct Poisson model ft their part (b) May be implied by 0.00853(73)
	M1	for writing or using $1-\left(\mathrm{e}^{-"\lambda"}+\mathrm{e}^{-"\lambda"}\times"\lambda"\right)$ where $1<\lambda<200$ (may be implied by awrt 0.991) Allow $1-\mathrm{P}(X\ ,,\ 1)$ if Poisson distribution is stated or used
	dA1	dep on both method marks being awarded awrt 0.991 (**NB** 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 **tubes shatter** independently	B1
	The probability of a vacuum **tube shattering** is constant	B1
		(2)
(b)	$C \sim B(15, 0.35)$ plus $[P(C \leqslant 1) =]0.0142$ or $[P(C \geqslant 10) =]0.0124$ or $[P(C \leqslant 9) =]0.9876$	M1
	Critical regions $[0 \leqslant] C \leqslant 1$ or $10 \leqslant C [\leqslant 15]$	M1
	$[0 \leqslant] C \leqslant 1$ and $10 \leqslant C [\leqslant 15]$ plus $P(C \leqslant 1) = 0.0142$ and $P(C \geqslant 10) = 0.0124$	A1
		(3)
(c)	0.0266	B1ft
		(1)
(d)	[4 is not in the CR therefore] there is no evidence to reject **Rowan's** belief	B1ft
		(1)
(e)	$F \sim B(40, 0.35)$	
	$H_0: p = 0.35$ and $H_1: p < 0.35$	B1
	$P(F \leqslant 8) = 0.0303$ or CR $F \leqslant 8$	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 **proportion** of type *B* vacuum **tubes** that shatter when exposed to alternating high and low temperatures is less than 35%	A1
		(5)

	Notes	**Total 12**
(a)	**B1**	for one correct reason which must mention tube(s) and shatter/shattering or 2 correct reasons not in context
	B1	for 2 correct reasons which must mention tube(s) and shatter/shattering at least once
(b)	**M1**	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 **and** one of awrt 0.014 or awrt 0.012 or awrt 0.99 is seen
	M1	for lower CR or $C \leqslant 1$ oe e.g. $C < 2$ or upper CR $C \geqslant 10$ oe e.g. $C > 9$ Allow other notation and any letter(s) for CR Do not allow CR written as a probability statement
	A1	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)	**B1ft**	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)	**B1ft**	for a correct statement consistent with their CR Must mention **Rowan/his/her** or a correct conclusion based on Rowan's belief with the words highlighted in bold e.g. no evidence to suggest that the **proportion/probability/number/amount** (allow **35%** as proportion) of **tubes** that shatter has changed oe
(e)	**B1**	for both hypotheses correct in terms of p or π
	M1	for using or writing $P(F \leqslant 8)$ or awrt 0.0303
	A1	for awrt 0.0303 or correct CR Allow $F \leqslant 8$ or $F < 9$ but not if part of a probability statement
	M1	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
	A1	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

Number		
4 (a)		M1 A1
		(2)
(b)	$\left[\mathrm{P}(G\text{ ,, }2)=\right]1-2\times\frac{3}{20}\left[=0.7\right]$ or $\frac{1}{2}\times3\times\left(\frac{2}{15}+\frac{1}{3}\right)$ or $\frac{1}{15}\int_{-1}^{2}(g+3)\,\mathrm{d}g[=0.7]$ or $\frac{1}{30}\times2^2+\frac{1}{5}\times2+\frac{1}{6}\left[=0.7\right]$ or $\left[\mathrm{P}\left(G\text{ ,, }\frac{1}{2}\right)\right]=\frac{1}{2}\times1.5\times\left(\frac{2}{15}+\frac{3.5}{15}\right)\left[=0.275\right]$ or $\frac{1}{15}\int_{-1}^{0.5}(g+3)\,\mathrm{d}g[=0.275]$ or $\frac{1}{30}\times0.5^2+\frac{1}{5}\times0.5+\frac{1}{6}\left[=0.275\right]$ or $\left[\mathrm{P}\left(\frac{1}{2}\text{ ,, }G\text{ ,, }2\right)=\right]\ \frac{1}{2}\times1.5\times\left(\frac{7}{30}+\frac{1}{3}\right)\left[=0.425\right]$ or $\frac{1}{15}\int_{0.5}^{2}(g+3)\,\mathrm{d}g[=0.425]$ or $\frac{1}{30}\times\left(2^2-0.5^2\right)+\frac{1}{5}\times\left(2-0.5\right)\left[=0.425\right]$	M1
	$\left[\mathrm{P}(1,,\ 2G,,\ 6\,|\,G,,\ 2)=\right]\frac{\mathrm{P}\left(\frac{1}{2},,\ G,,\ 2\right)}{\mathrm{P}\left(G,,\ 2\right)}=\frac{0.425}{0.7}$ or $1-\frac{0.275}{0.7}$ oe	M1M1
	$=\frac{17}{28}$ or $0.607\ldots$ awrt 0.607	A1
		(4)
(c)	$\left[\mathrm{E}\left(H^2\right)=\right]2.4+12^2\left[=146.4\right]$	M1
	$\left[\mathrm{E}\left(G\right)=\right]\int_{-1}^{2}\frac{1}{15}\left(g^2+3g\right)\mathrm{d}g+\int_{2}^{4}\frac{3}{20}g\ \mathrm{d}g$	M1
	$\left[\mathrm{E}\left(G\right)=\right]\left(\frac{1}{15}\left(\frac{1}{3}g^3+\frac{3}{2}g^2\right)\right)_{-1}^{2}+\left(\frac{3}{40}g^2\right)_{2}^{4}$	M1
	$=\frac{1}{15}\left(\frac{8}{3}+\frac{12}{2}+\frac{1}{3}-\frac{3}{2}\right)+\left(\frac{48}{40}-\frac{12}{40}\right)\left[=1.4\right]$	dM1
	$\left[\mathrm{E}\left(2H^2+3G+3\right)=\right]2\times\text{"146.4"}+3\times\text{"1.4"}+3$	M1
	$=300$	A1 (6)
		Total 12

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

Question Number	Scheme	Marks
5(a)	$\frac{(a+6)^2}{12}=27$	M1
	$a=\sqrt{27\times12}-6\Rightarrow 12^*$ 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)	$\text{P}(-6<W<\text{"0.6"})=\frac{\text{"0.6"}+6}{18}$	M1
	$=\frac{11}{30}$ or $0.3666\ldots$	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
	$\text{P}(\text{"30"}<x<\text{"130"})=\frac{\text{"130"}-\text{"30"}}{160}\left[=\frac{5}{8}\right]$ oe | $\text{P}(\text{"15"}<x<\text{"65"})=\frac{\text{"65"}-\text{"15"}}{80}\left[=\frac{5}{8}\right]$ oe	dM1
	$=\frac{5}{8}$ oe	A1
		(4)

	Notes	Total 10
(a)	**M1**	for setting up the correct equation. Do not allow verification
	A1*	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)	**M1**	for setting up the correct equation
	A1	Cao oe
(ii)	**M1**	for a correct method. Do not ISW
	A1ft	ft their value for b, provided the answer is between 0 and 1
(c)	**M1**	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
	M1	for a correct equation for area in terms of any letter. Condone an inequality
	dM1	dep on previous method mark awarded. For a fully correct method ft their x values provided add to 160 or 80 Do not ISW
	A1	Cao

Question Number	Scheme	Marks
6(a)	8, 11, 14, 17, 20	M1
	$\left[\mathrm{P}(\text{even})=\right]\frac{1}{5}$ and $\left[\mathrm{P}(\text{odd})=\right]\frac{4}{5}$	M1
	$\left[\mathrm{P}(X=8)=\right]\left(\frac{4}{5}\right)^4$ or $\left[\mathrm{P}(X=20)=\right]\left(\frac{1}{5}\right)^4$	M1
	$\left[\mathrm{P}(X=11)=\right]4\times\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)^3$ or $\left[\mathrm{P}(X=17)=\right]4\times\left(\frac{4}{5}\right)\left(\frac{1}{5}\right)^3$	M1
	$\left[\mathrm{P}(X=14)=\right]{}^4C_2\times\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^2$	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)	A1
		(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)
	Notes	**Total 9**

(a)	**M1**	For at least 2 scores correct and no more than 3 incorrect
	M1	for writing or using $\frac{4}{5}$ and $\frac{1}{5}$. May be implied by a correct probability
	M1	for p^4 where $0<p<1$
	M1	for $4\times(1-p)p^3$ where $0<p<1$
	M1	for $6\times(1-p)^2p^2$ where $0<p<1$ or probabilities that add to 1 (at least 2 but not more than 5)
	A1	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)	**M1**	for using $1-(1-\mathrm{P}(Y=0))^n>0.95$ allow = instead of >/⩾. condone </⩽ or allow for at least 2 trials for n between 10 and 20 ft their P(X = 14)
	M1	for $n>$ 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 >/⩾. condone </⩽ May be implied by a correct answer ft their 0.8464
	A1	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 $6\times3\times1.5-12\times1.5^2=0\Rightarrow\therefore b=3$ *	A1*
		(3)
(b)	$a+3-1-4=0$ oe $[\Rightarrow a=2]$	B1*
		(1)
(c)	$k(2\times2+3\times2^3-2^4-4)=1 \quad \left[\Rightarrow k=\frac{1}{8}\right]$	M1
	F(x) = 0.5 / F(x) = 4 / F(x) = 0	
	F(1.4) = 0.3988… F(1.5) = 0.5078… / F(1.4) = 3.1904… F(1.5) = 4.0625… / F(1.4) = –0.8(096…) F(1.5) = 0.06(25…)	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
	ALTERNATIVE M1A1A1 for F(x) = 0	
	$x_1=2.91...$ $x_2=1.49...$ $x_3=-0.70...$ So x = 1.49… as $1\leqslant x\leqslant 2$	M1 A1
	$1.4<1.49...<1.5$ [therefore, the median lies between 1.4 and 1.5]	dA1
		(4)

	Notes	Total 8
(a)	**M1**	for attempting to differentiate $x^n\rightarrow x^{n-1}$ Condone missing k (May be implied by 2nd M1)
	M1	for correctly differentiating twice and equating to zero. Condone missing k
	A1*	substituting x = 1.5 leading to a correct linear equation in b leading to b = 3
(b)	**B1***	for correctly using F(1) = 0 to form an equation in a (May be seen in part (a)) and substitution of b = 3
(c)	**M1**	for using F(2) = 1 to form a correct equation in terms of k only. May be seen in any part of the question
	M1	For a calculation of F(1.4) **or** F(1.5) correct to 2 sf (If F(x) =0 used then allow 1 sf or better) (Allow F(1.4) = awrt 3.190k **or** F(1.5) = awrt 4.063k)
	A1	For a calculation of F(1.4) **and** F(1.5) correct to 2 sf (If F(x) =0 used then allow 1 sf or better)
	dA1	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
		ALTERNATIVE
	M1	For solving the given equation. May be implied by 2.91… or 1.49… or –0.70…
	A1	For x =1.49… identified as being in the range specified by the CDF. May be implied by rejecting the other solutions
	dA1	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(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

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