GradeMax



Mark Scheme (Results)

Summer 2025

Pearson Edexcel International Advanced Level In Statistics (WST02) Paper 01

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EDEXCEL IAL MATHEMATICS
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

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)
   - dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - $*$ The answer is printed on the paper
   - ⎡ 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

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)	[F(1) = 1 so] $k(6\times1^2-1^4)=1$ leading to $k=\frac{1}{5}$*	B1*
		(1)
(b)	[1 – F(0.6) =] $1-\frac{1}{5}\left(6\times0.6^2-0.6^4\right)$	M1
	= 0.59392 awrt 0.594	A1
		(2)
(c)(i)	$\frac{1}{5}\left(6m^2-m^4\right)=\frac{1}{2}$	M1
	$2m^4-12m^2+5=0$ oe	A1
(ii)	m = 0.6711… awrt 0.671	A1
		(3)
(d)	$\left[\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{6}{5}x^2-\frac{1}{5}x^4\right)=\right]\frac{12}{5}x-\frac{4}{5}x^3$	M1
	$\left[\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{12}{5}x-\frac{4}{5}x^3\right)=\right]\frac{12}{5}-\frac{12}{5}x^2=0$	M1
	$x=1$	A1
		(3)
(e)	Mean < "Median" < "Mode"	M1
	So negative [skew]	A1ft
		(2)

		Notes	**Total 11**
(a)	**B1***	for use of F(1) = 1 leading to the given answer (minimum required is $k(6 – 1) = 1$) Allow use of F(1) – F(0) = 1 e.g. k(6 – 1) – k(0 – 0) = 1 The answer is given so no incorrect working can be seen	
(b)	**M1**	for using 1 – F(0.6) May be implied by $1-\frac{1269}{3125}$ or $\frac{1856}{3125}$	
	A1	awrt 0.594 Allow $\frac{1856}{3125}$	
(c)(i)	**M1**	for setting F(m) = 0.5 Allow any letter (including x)	
	A1	for a correct 3TQ oe **NB** the values of a, b and c must be integers	
(ii)	**A1**	awrt 0.671 Allow $\sqrt{\frac{6-\sqrt{26}}{2}}$ (must reject other roots if seen) **NB** It is possible to score M1A0A1	
(d)	**M1**	for differentiating F(x) with at least one $x^n \to x^{n-1}$ May be left in terms of k eg. $k(12x – 4x^3)$ Condone missing k	
	M1	for differentiating twice with at least one $x^n \to x^{n-1}$ and setting = 0 oe May be left in terms of k eg. $k(12 – 12x^2)=0$ Condone missing k	
	A1	Cao (Must reject x = –1 if seen)	
(e)	**M1**	a correct justification using the Mean and their Median and/or their Mode. This must be correct for their values Allow use of figures e.g. 0.64 < "0.671" < "1" Allow comparisons of "median" and "mode" on its own. Comparison with 0.5 is M0 unless 0.5 is their median or mode	
	A1ft	a correct conclusion based on their comparison (Do not allow a conclusion that is not fully supported by their comparison)	

Question Number	Scheme	Marks
2(a)	Poisson with $\lambda = 10$	B1
		(1)
(b)	**Customers** [enter the shop] singly/randomly/independently/at a constant rate	B1
		(1)
(c)	$H_0 : \lambda = "10"$ $H_1 : \lambda \neq "10"$	B1ft
		(1)
(d)	$[P(X \leqslant 3) =]$awrt 0.0103 $[P(X \leqslant 4) =]$awrt 0.0293	M1
	$[P(X \geqslant 17) =]$awrt 0.0270 $[P(X \geqslant 18) =]$awrt 0.0143	M1
	$X \leqslant 3 \cup X \geqslant 18$ oe	A1
		(3)
(e)	0.0103 + 0.0143 = 0.0246	M1
	So 2.46%	A1ft
		(2)
(f)	[16 is] not in the CR/Do not reject H_0/Not significant	M1
	There is insufficient evidence to suggest that the **rate/number/amount** of customers entering the shop has **changed**/[is] **different** oe	A1ft
		(2)
	Notes	**Total 10**

(a)	**B1**	for Poisson/Po and $\lambda = 10$
(b)	**B1**	for a correct assumption (must have context of customers/people) Ignore irrelevant or incorrect statements
(c)	**B1ft**	both hypotheses correct. Must be correctly attached to H_0 and H_1 in terms of λ or μ ft part a Allow $H_0 : \lambda = 20$ $H_1 : \lambda \neq 20$
(d)	**M1**	for use of Po(10) to find the lower critical value. May be implied by awrt 0.0103 or awrt 0.0293 or a correct lower critical region (These must be seen in part (d))
	M1	for use of Po(10) to find the upper critical value. May be implied by awrt 0.027 or awrt 0.0143 or awrt 0.973 or awrt 0.9857 or a correct upper critical region (These must be seen in part (d))
	A1	for a correct critical region oe e.g. $X < 4$ and $X > 17$ Allow $0 \leq x \leqslant 3$ and $18 \leq x \leqslant 20$ or {0, 1, 2, 3} {18, 19, …} Condone use of () or [] for {} Do not allow if written as probability statements Allow any letter. Accept CR $\leqslant 3$ CR $\geqslant 18$
(e)	**M1**	for adding the probabilities for the 2 tails of their CR together May be implied by a correct answer
	A1ft	awrt 0.0246 or ft their CR
(f)	**M1**	dependent on having found a 2 tailed CR in part (d) for a correct statement (ft their 2 tailed CR) – no context needed but do not allow contradicting non contextual comments. May be implied by a correct contextual statement on its own. We ignore any comparison of numbers/probabilities
	A1ft	correct conclusion in context (ft their 2 tailed CR). Must contain the words in bold oe. No hypotheses in part (c) then A0 Allow equivalent statements e.g. The mean **rate** has not **changed/still** 10

Question Number	Scheme	Marks
3(a)	$np = 3$ and $np(1-p) = 2.55$	M1
	p = 0.15 oe n = 20	A1 A1
		(3)
(b)	[B(40, 0.2) so] E(X) = 8	B1
	$[P(X > 8) =] 1 - P(X \leq 8)$	M1
	= 0.4069 Calc: 0.40687 … awrt 0.407	A1
		(3)
(c)(i)	$[Po(n \times p) =] Po(8)$	M1
	$[P(X \geq 12) =] 1 - P(X \leq 11)$	M1
	= 0.1119 Calc: 0.11192 awrt 0.112	A1
(ii)	because n is large and p is small	B1
		(4)

	Notes		**Total 10**
(a)	**M1**	for both $np = 3$ and $np(1-p) = 2.55$ Allow q to imply $1 - p$	
	A1	either p = 0.15 oe or n = 20	
	A1	both p = 0.15 oe and n = 20	
(b)	**B1**	for E(X) = 8 Condone μ/np = 8 May be implied by 40 × 0.2 = 8 or P(X > 8) or 1 – P($X \leqslant 8$) or P(X = 8)	
	M1	for writing or using $1 - P(X \leq 8)$	
	A1	awrt 0.407 **NB** cao scores 3 out of 3	
(c)(i)	**M1**	for writing or using Po(8) May be implied by awrt 0.112 or 0.888	
	M1	for writing or using $1 - P(X \leq 11)$	
	A1	awrt 0.112 (**NB** exact binomial gives awrt 0.1004 and would score M0M1A0) **NB** cao scores 3 out of 3	
(ii)	**B1**	allow n > 50 and p < 0.2 or equivalent worded statements. Allow p is close to 0. Do not allow because mean ≈ variance. Ignore any reference to np and $np(1-p)$	

Question Number	Scheme	Marks
4(a)	3, 6, 9, 12	B1
	[P(black)=] $\frac{2}{7}$ and [P(white)=] $\frac{5}{7}$	B1
	$\left[\mathrm{P}(X=3)=\right]\left(\frac{5}{7}\right)^3$ or $\left[\mathrm{P}(X=12)=\right]\left(\frac{2}{7}\right)^3$	M1
	$\left[\mathrm{P}(X=6)=\right]3\times\left(\frac{5}{7}\right)^2\times\frac{2}{7}$	M1
	$\left[\mathrm{P}(X=9)=\right]3\times\frac{5}{7}\times\left(\frac{2}{7}\right)^2$	M1
	X : 3, 6, 9, 12 **P(*X* = *x*)** : $\frac{125}{343}$ (0.3644…), $\frac{150}{343}$ (0.4373…), $\frac{60}{343}$ (0.1749…), $\frac{8}{343}$ (0.0233…)	A1
		(6)
(b)	$\left("\frac{283}{343}"\right)^n < 0.05$ oe	M1
	$n > 15.57\ldots$ or $n > \frac{\log(0.05)}{\log\left("\frac{283}{343}"\right)}$ or $n > \log_{\left("\frac{283}{343}"\right)}(0.05)$	dM1
	$n = 16$	A1
		(3)

	Notes	**Total 9**
(a)	**B1**	for all 4 possible outcomes and no extras
	B1	for writing or using $\frac{5}{7}$ and $\frac{2}{7}$. May be implied by a correct probability for P(X = 6) or P(X = 9) or P(X = 3) **and** P(X = 12) Allow awrt 0.714 and awrt 0.286
	M1	for p^3 where 0 < p < 1 May be implied by $\frac{125}{343}$ or awrt 0.364 or $\frac{8}{343}$ or awrt 0.023
	M1	for $3\times p^2\times(1-p)$ where 0 < p < 1 May be implied by $\frac{150}{343}$ or awrt 0.437 or $\frac{60}{343}$ or awrt 0.175
	M1	for $3\times p\times(1-p)^2$ where 0 < p < 1 May be implied by $\frac{150}{343}$ or awrt 0.437 **and** $\frac{60}{343}$ or awrt 0.175 or 4 probabilities that add to 1
	A1	for all 4 probabilities correct and associated with the correct values. Need not be in a table but probabilities must be attached to the correct total. If decimals are used then they must be awrt 0.364, awrt 0.437, awrt 0.175 and awrt 0.023
(b)	**M1**	for $\left(1-"\frac{60}{343}"\right)^n < 0.05$ oe Condone =/⩽ instead of <
	dM1	Dependent on the previous M mark for n > awrt 15.6 or $n > \frac{\log(0.05)}{\log\left("\frac{283}{343}"\right)}$ ft their $\frac{283}{343}$ or $n > \log_{\left("\frac{283}{343}"\right)}(0.05)$ ft their $\frac{283}{343}$ or for the two trials between n = 15 and 16 Allow = instead of >/⩾. Condone </⩽
	A1	cao (do not allow an inequality)

Question Number	Scheme			Marks
5(a)	$\frac{2}{21}\int_0^k x\,\mathrm{d}x +$ $\frac{2}{15}\int_k^6 (6-x)\,\mathrm{d}x = 1$	$\frac{1}{2}(k-0)\times\frac{2}{21}k$ and $\frac{1}{2}(6-k)\times\frac{2}{15}(6-k)$	For $0 \,,\, x \,,\, k$ $\mathrm{F}(x) = \frac{1}{21}x^2$	M1
	$\frac{2}{21}\left[\frac{x^2}{2}\right]_0^k +$ $\frac{2}{15}\left[6x - \frac{x^2}{2}\right]_k^6 [=1]$	$\frac{1}{2}(k-0)\times\frac{2}{21}k +$ $\frac{1}{2}(6-k)\times\frac{2}{15}(6-k) = 1$	For $k < x \,,\, 6$ $\mathrm{F}(x) = \frac{2}{15}\left(6x - \frac{x^2}{2}\right) - \frac{7}{5}$ oe	M1
	$\frac{1}{21}k^2 +$ $\frac{2}{15}\left(18 - \left(6k - \frac{k^2}{2}\right)\right)[=1]$	$\frac{1}{21}k^2 +$ $\frac{1}{15}(36 - 12k + k^2)[=1]$ oe	$\frac{1}{21}x^2 = \frac{2}{15}\left(6x - \frac{x^2}{2}\right) - \frac{7}{5}$	dM1
	$4k^2 - 28k + 49 = 0$ oe			dM1
	e.g. $(2k-7)^2 = 0$ leading to $k = 3.5$ *			A1*
				(5)
(b)	$\mathrm{E}(X) = \frac{2}{21}\int_0^{3.5} x^2\,\mathrm{d}x + \frac{2}{15}\int_{3.5}^6 (6x - x^2)\,\mathrm{d}x$			M1
	$\frac{2}{21}\left[\frac{x^3}{3}\right]_0^{3.5} + \frac{2}{15}\left[3x^2 - \frac{x^3}{3}\right]_{3.5}^6$			dM1
	$\frac{2}{21}\left(\frac{343}{24}\right) + \frac{2}{15}\left(36 - \left(\frac{147}{4} - \frac{343}{24}\right)\right) = \frac{19}{6}$			dM1A1
				(4)
(c)	$\mathrm{Var}(X) = \frac{277}{24} - "\left(\frac{19}{6}\right)"^2 = \frac{109}{72}$			M1A1
				(2)
	Notes			**Total 11**
(a)	**M1**	for writing/using the integral of f(x) and setting = 1 ignore limits or both areas identified (these do not need to be added nor set = 1) or a correct expression for F(x) between $0 \leqslant x \leqslant k$		
	M1	for an attempt at integration on either part with $x^n \to x^{n+1}$ ignore limits or adding the area of the 2 triangles and set = 1 or a correct expression for F(x) between $k \leqslant x \leqslant 6$		
	dM1	dependent on 1st M1 for substitution of k, 0 and 6 into the integral of f(x) or an un-simplified 3TQ quadratic or setting the 2 parts of F(x) equal to each other		
	dM1	dependent on previous M1 for a correct 3TQ equal to 0 e.g. $\frac{4}{35}k^2 - \frac{12}{15}k + \frac{7}{5} = 0$ oe		
	A1*	for solving the 3TQ leading to the given answer (Working must be shown)		

NB Solution based on the assumption that $\frac{2}{21}k=\frac{2}{15}(6-k)$ scores M0M0dM0dM0A0 e.g. $\frac{2}{21}k=\frac{2}{15}(6-k)$ or $\frac{1}{2}\times 6\times\frac{2}{21}k=1$ or $\frac{1}{2}(k-0)\times\frac{2}{21}k+\frac{1}{2}(6-k)\times\frac{2}{21}k=1$ Use of verification can score M1M1dM0dM0A0 e.g. $\frac{2}{21}\left[\frac{x^2}{2}\right]_0^{3.5}+\frac{2}{15}\left[6x-\frac{x^2}{2}\right]_{3.5}^{6}\ [=1]$ or $\frac{1}{2}(3.5-0)\times\frac{2}{21}(3.5)+\frac{1}{2}(6-3.5)\times\frac{2}{15}(6-3.5)=1$		
(b)	**M1**	for writing or using the integral of $xf(x)$ ignore limits but must be both parts
	dM1	dependent on 1st M1 for an attempt at integration on both parts with $x^n \to x^{n+1}$ ignore limits
	dM1	dependent on previous M1 for substitution of 3.5, 0 and 6 ($\frac{49}{36}$ and $\frac{65}{36}$ is the minimum required to imply this mark)
	A1	allow awrt 3.17
(c)	**M1**	for use of $\mathrm{E}(X^2)-\mathrm{E}(X)^2$ ft their E(X)
	A1	allow awrt 1.51

Question Number	Scheme		Marks
6(a)	$\frac{5-2}{b-a}=\frac{3}{16}$ oe or $1-\left(\frac{2-a}{b-a}+\frac{b-5}{b-a}\right)=\frac{3}{16}$ oe	$\frac{5-a}{b-a}=\frac{3}{16}$ oe	M1
	$\frac{a+b}{2}=6$ oe		M1
	$a=-2$ and $b=14$	$a=4.4$ and $b=7.6$	A1
			(3)
(b)	$[cE(X)+1=3\Rightarrow]6c+1=3$		M1
	$c=\frac{1}{3}$		A1
			(2)
(c)	$\left[\text{Var}X=\frac{(b-a)^2}{12}=\right]\frac{64}{3}$ oe	$\left[\text{Var}X=\frac{(b-a)^2}{12}=\right]\frac{64}{75}$ oe	B1ft
			(1)
(d)	$E(X^2)="\left(\frac{64}{3}\right)"+6^2=\frac{172}{3}$ or	$E(X^2)="\left(\frac{64}{75}\right)"+6^2=\frac{2764}{75}$	M1A1
			(2)
(e)	$P\left(\frac{3}{2}X-b>a\right)\Rightarrow P(X>8)=\frac{3}{8}$	$P\left(\frac{3}{2}X-b>a\right)\Rightarrow P(X>8)=0$	M1A1
			(2)

	Notes		**Total 10**
(a)	**M1**	for using P($2 < X < 5$) = $\frac{3}{16}$ **or** P($a < X < 5$) = $\frac{3}{16}$ to form a correct equation in a and b May be implied by $b - a = 16$	
	M1	for using E(X) = 6 to form a correct equation in a and b May be implied by $a + b = 12$	
	A1	for $a=-2$ and $b=14$ or a = 4.4 and b = 7.6	
(b)	**M1**	for use of $cE(X)+1=3$ or fully correct integration seen e.g. $c\int_{"-2"}^{"14"}\frac{1}{"16"}x\,dx+1[=3]$ May be implied by $c=\frac{1}{3}$	
	A1	Cao	
(c)	**B1ft**	ft their a and b Allow decimal answers correct to 3sf e.g 21.3	
(d)	**M1**	for use of Var(X) + E(X)^2 ft their Var(X) or a fully correct integration seen e.g. $\int_{"-2"}^{"14"}\frac{1}{"16"}x^2\,dx\left[=\frac{172}{3}\right]$ or $\int_{"4.4"}^{"7.6"}"\frac{5}{16}"x^2\,dx\left[=\frac{2764}{75}\right]$ ft their a and b	
	A1	for $\frac{172}{3}$ oe or awrt 57.3 or $\frac{2764}{75}$ or awrt 36.9 oe **NB** Answer must match the method used	
(e)	**M1**	for P(X > 8) or $P\left(X>\frac{2("a"+"b")}{3}\right)$ ft their a and b May be implied by a correct answer	
	A1	for $\frac{3}{8}$ oe or 0 Answer must match the method used	

Question Number	Scheme	Marks
7(a)	$X \sim \mathrm{B}(40, 0.3)$	B1
		(1)
(b)	Constant probability of buying **insurance** or Customers buy **insurance** independently	B1
		(1)
(c)	$[\mathrm{P}(X \leqslant 7) = \mathrm{P}(X < 8) =] 0.0553 \quad [\mathrm{P}(X \leqslant 6) = \mathrm{P}(X < 7) =] 0.0238$	M1
	So $r = 7$	A1
		(2)
(d)	B(200, 0.3) implies N(60, 42)	M1
	$\frac{t - 0.5 - "60"}{\sqrt{"42"}} = -1.62$ or $\frac{"60" - t + 0.5}{\sqrt{"42"}} = 1.62$	M1M1 B1
	[$t = 50.001\ldots$ so] $t = 50$	A1
		(5)
(e)	$\mathrm{H}_0 : p = 0.3 \quad \mathrm{H}_1 : p > 0.3$	B1
	$[\mathrm{P}(X \geqslant 11) =] 1 - \mathrm{P}(X \leqslant 10)$	M1
	$= 0.0978$ or CR $\geqslant 11$	A1
	Reject H_0/Significant/In CR	M1
	Evidence to suggest that **percentage/proportion/probability/number/amount** of customers who buy **insurance** has **increased** oe	A1ft
		(5)
	Notes	**Total 14**

(a)	**B1**	Allow Binomial $n = 40$ $p = 0.3$
(b)	**B1**	for a suitable assumption in context. Must include 'insurance' If multiple reasons given ignore any irrelevant or incorrect reasons provided, they are non-contradictory
(c)	**M1**	for either probability. May be implied by $r = 7$
	A1	Cao
(d)	**M1**	for writing or using N(60, 42) May be seen in a standardisation. If N(60, $\sqrt{42}$) written but 60 and $\sqrt{42}$ used in a standardisation then award M1
	M1	for standardising using t **or** $t - 0.5$ **or** $t + 0.5$ with their mean and their standard deviation
	M1	for a fully correct standardisation with their mean and their standard deviation
	B1	for ± 1.62 or better (calc: 1.620150314) seen or used. Must be compatible with their standardisation
	A1	Cao Do not allow $t = 50$ from incorrect working
(e)	**B1**	for both hypotheses in terms of p or π
	M1	for writing or using $1 - \mathrm{P}(X \leqslant 10)$ May be implied by a correct CR
	A1	for 0.0978 or correct CR
	M1	for a correct non contextual conclusion. ft their probability/CR provided a binomial distribution is used. Do not allow contradictory statements. May be implied by a correct contextual statement on its own.
	A1ft	a correct contextual statement with words in bold (Allow equivalent statements) ft their probability/CR provided a binomial distribution is used
	SC	If a two tailed test is used, then it is possible to score B0M1A1M1A1 $\mathrm{H}_0 : p = 0.3 \quad \mathrm{H}_1 : p \neq 0.3$ B0 $[\mathrm{P}(X \geqslant 11) =] 1 - \mathrm{P}(X \leqslant 10)$ or $[\mathrm{P}(X \geqslant 12) =] 1 - \mathrm{P}(X \leqslant 11)$ M1 $= 0.0978$ or CR $\geqslant 12$ A1 Do not reject H_0/Not significant/Not in CR M1 **Proportion** who buy **insurance** has not **increased** oe A1

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