



Mark Scheme (Results)

Summer 2013

GCE Statistics 1 (6683/01R)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2013

Publications Code UA036996

All the material in this publication is copyright

© Pearson Education Ltd 2013

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.

EDEXCEL GCE 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 \checkmark 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
 - \square 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.
 8. In some instances, the mark distributions (e.g. M1, B1 and A1) printed on the candidate's response may differ from the final mark scheme

Question	Scheme	Marks
1. (a)	$b = \frac{18.35}{312.1} [= 0.058795...]$ $a = 5.8 - "0.058795..." \times 4.8$ $\underline{a = \text{awrt } 5.52}$ <p>So $\underline{y = 5.52 + 0.0588x}$</p>	M1 M1 A1 A1 (4)
(b)	$\frac{e}{10} = "5.52" + "0.0588" \times \left(\frac{g-60}{4} \right)$ $4e = 220.71 + 0.588(g-60)$ $\underline{e = 46 + 0.15g}$	M1 dM1 A1A1 (4)
(c)	$e = "46" + "0.15" \times 100$ $= \underline{61}$	M1 A1 (2) [10]
Notes		
(a)	1 st M1 for a correct expression for b 2 nd M1 for a correct expression for a – ft their value of b 1 st A1 for $a = \text{awrt } 5.52$ 2 nd A1 for a correct equation in y and x with a and b correct to awrt 3 sf	
(b)	1 st M1 for substitutions into <u>their</u> equation to get an equation in e and g . Need $y = \frac{e}{10}$ and $x = \frac{g-60}{4}$ 2 nd dM1 Dep. on 1 st M1 for an attempt to simplify (at least removing fractions). Allow one slip 1 st A1 for an equation $e = \text{awrt } 46 \pm \dots$ 2 nd A1 for an equation $e = \dots + \text{awrt } 0.15g$	
ALT	1 st M1 for use of $d = \frac{10 \times \text{"their } b"}{4}$ or sight of 0.15 used as gradient 2 nd dM1 Dep. on 1 st M1 for use of $\bar{e} = 10 \times \text{"their } \bar{y}"$ or sight of 58 and use of $\bar{g} = 4 \times \text{"their } \bar{x}" + 60$ or sight of 79.2 and use of these values to find c in $c = \bar{e} - d\bar{g}$	
(c)	M1 for substituting $g = 100$ into their new equation (or $x = 10$ and then attempting to \times ans.by 10) A1 for awrt 61	

Question	Scheme				Marks
2. (a)	x	1	2	3	
	$P(X = x)$	<u>0.4</u>	0.25	0.35	
	$P(X = 2) = F(2) - F(1)$ (o.e.)				M1
					A1
					A1 (3)
	$P(X = 2) = \underline{\underline{0.25}}$ $P(X = 3) = \underline{\underline{0.35}}$				
(b)	$[F(1.8) = P(X \leq 1.8) = P(X \leq 1) =]$ <u>0.4</u>				B1 (1)
					[4]
	Notes				
(a)	M1 for $P(X = 1) = 0.4$ and evidence of a correct method for finding $P(X = 2)$ or $P(X = 3)$. Implied by correct ans. 1 st A1 for $P(X = 2) = 0.25$ 2 nd A1 for $P(X = 3) = 0.35$				
(b)	B1 for 0.4				

Question	Scheme	Marks
3. (a)	Width = $2 \times 1.5 = \underline{3 \text{ (cm)}}$ Area = $8 \times 1.5 = 12 \text{ cm}^2$ Frequency = 24 so $\frac{1 \text{ cm}^2}{24} = \underline{2 \text{ plants}}$ (o.e.) Frequency of 12 corresponds to area of 6 so height = $\underline{2 \text{ (cm)}}$	B1 M1 A1 (3)
(b)	$[Q_2 =] (5+) \frac{19}{24} \times 5$ or (use of $(n+1)$) $(5+) \frac{19.5}{24} \times 5$ $= 8.9583\dots$ <u>awrt 8.96</u> or $9.0625\dots$ awrt 9.06	M1 A1 (2)
(c)	$[\bar{x} =] \frac{755}{70}$ or <u>awrt 10.8</u> $[\sigma_x =] \sqrt{\frac{12037.5}{70} - \bar{x}^2} = \sqrt{55.6326\dots}$ $= \underline{\text{awrt 7.46}}$ (Accept $s = \text{awrt 7.51}$)	B1 M1A1ft A1 (4)
(d)	$\bar{x} > Q_2$ So <u>positive skew</u>	B1ft dB1 (2)
(e)	$\bar{x} + \sigma \approx 18.3$ so number of plants is e.g. $\frac{(25 - "18.3")}{10} \times 12 (+4)$ (o.e.) $= 12.04$ so <u>12</u> plants	M1 A1 (2)
	Notes	[13]
(a)	M1 for forming a relationship between area and no. of plants or their width \times their height = 6 A1 for height of 2 (cm). Make sure the 2 refers to height and not plants!	
(b)	M1 for a suitable fraction $\times 5$ (ignore end points) A1 for awrt 8.96 (or $\frac{215}{24}$ or $8\frac{23}{24}$) or 9.06 (or $\frac{145}{16}$ or $9\frac{1}{16}$) if using $(n+1)$	
(c)	B1 for a correct mean. Accept exact fraction or awrt 10.8 M1 for a correct expression for σ or σ^2 . Condone mixed up labelling- ft their mean A1ft for a correct expression – ft their mean but must have square root A1 for awrt 7.46 (use of $s = \text{awrt 7.51}$). Condone correct working and answer called variance.	
(d)	1 st B1ft for a correct comparison of their \bar{x} and their Q_2	
ALT	Allow use of a formula for skewness that involves $(\bar{x} - Q_2)$ or use of quartiles but must have correct values NB $Q_1 = 5.31$, $Q_3 = 14.46$ (awrt 14.5), $Q_3 - Q_2 \approx 5.5$, $Q_2 - Q_1 \approx 3.7/6$ 2 nd dB1 Dependent on a suitable reason for concluding “positive skew”. “correlation” is B0	
(e)	M1 for a suitable expression involving some interpolation (condone missing 4 so accept awrt 8) Condone use of end points of 25.5 and 14.5 in their interpolation expressions. A1 for 12 (condone awrt 12). Answer only 2/2	

Question	Scheme	Marks
4. (a)	$\left[P(M < 145) = \right] P\left(Z < \frac{145-150}{10}\right)$ $= P(Z < -0.5) \text{ or } P(Z > 0.5)$ $= \text{awrt } \underline{0.309}$	M1 A1 A1 (3)
(b)	$[P(B > 115) = 0.15 \Rightarrow] \frac{115-100}{d} = 1.0364$ $\underline{d = 14.5}$ <p>(Calc gives 1.036433...) (Calc gives 14.4727...)</p>	M1B1A1 A1 (4)
(c)	$[P(X > \mu + 15 X > \mu - 15) =] \frac{P(X > \mu + 15)}{P(X > \mu - 15)}$ $= \frac{0.35}{1-0.35}$ $= \underline{\frac{7}{13}} \text{ or } \underline{\text{awrt } 0.538}$	M1 A1 A1 (3)
[10]		
Notes		
<p style="text-align: center;">Condone poor use of notation if a correct line appears later.</p> <p>(a) M1 for standardising with 145, 150 and 10. Allow \pm and use of symmetry so 155 instead of 145 1st A1 for $P(Z < -0.5)$ or $P(Z > 0.5)$ i.e. a z value of ± 0.5 and a correct region indicated 2nd A1 for awrt 0.309 Answer only is 3/3</p> <p>(b) M1 for $\pm \frac{115-100}{d} = z$ where $z > 1$ Condone MR of $\mu = 150$ instead of 100 for M1B1 only B1 for a standardised expression $= \pm 1.0364$ (do not allow for use of $1 - 1.0364$) 1st A1 for $z = \text{awrt } 1.04$ and compatible signs i.e. a correct equation with $z = \text{awrt } 1.04$ 2nd A1 for awrt 14.5 (allow awrt 14.4 if $z = \text{awrt } 1.04$ is seen) Calc Answer only of awrt 14.473 scores M1B1A1A1 Answer only of awrt 14.48 scores M1B0A1A1</p> <p>(c) M1 for a correct ratio expression need $P(X > \mu + 15)$ on numerator. Allow use of a value for μ May be implied by next line. NB $\frac{0.35 \times 0.65}{0.65} = \frac{0.2275}{0.65}$ is M0 1st A1 for a correct ratio of probabilities 2nd A1 for awrt 0.538 or $\frac{7}{13}$ (o.e.). Allow 0.5385 provided 2nd A1 is scored.</p>		

Question	Scheme	Marks
5. (a)	$S_{yy} = 393 - \frac{61^2}{10} = \underline{\underline{20.9}}$ $S_{xy} = 382 - \frac{61 \times 60}{10} = \underline{\underline{16}}$	M1A1 A1 (3)
(b)	$[r] = \frac{16}{\sqrt{20.9 \times 28}}$ $= 0.66140\dots$ <p style="text-align: right;">awrt 0.661</p>	M1 A1 (2)
(c)	Researcher's belief suggests <u>negative</u> correlation, data suggests <u>positive</u> correlation So data does <u>not</u> support researcher's belief	B1 dB1 (2)
(d)	New x equals $\bar{x} = 6$ Since $S_{xx} = \sum (x - \bar{x})^2$ the value of S_{xx} is the same = 28	B1 dB1 (2)
(e)	$S_{xy} = \sum (x - \bar{x})(y - \bar{y}) = \sum (x - \bar{x})y$ so the new term will be zero (since mean = x) and since S_{yy} increases So r will decrease	B1 dB1 (2)
Notes		[11]
(a)	M1 for a correct expression for S_{yy} or S_{xy} 1 st A1 for $S_{yy} = 20.9$ 2 nd A1 for $S_{xy} = 16$	
(b)	M1 for a correct expression for r – ft their 20.9 (provided it is > 0) and their 16. Use of 382 for 16 or 393 for 20.9 is M0 A1 for awrt 0.661	
(c)	1 st B1 for a suitable reason <u>contrasting</u> belief with data. They must state the sign (positive or negative) of the correlation of data or the belief and imply the other is opposite 2 nd dB1 Dependent on a correct reason for saying it does <u>not</u> support the claim e.g. State “does not support the belief because data has positive correlation” scores B1B1 BUT State “does support the belief because data has positive correlation” scores B0B0	
(d)	1 st B1 for clearly stating that new value of $x = (6 =)$ mean 2 nd dB1 Dep. on 1 st B1 for a reason that shows S_{xx} is unchanged e.g. extra term is 0 so S_{xx} is the same	
ALT	1 st B1 for seeing $\sum x = 66$ and new $\sum x^2 = 424$ (or $388 + 6^2$) and attempt at S_{xx} 2 nd B1 for showing $S_{xx} = 28$ with $n = 11$ and no incorrect working seen and a final comment	
(e)	1 st B1 for a clear reason that mentions S_{xy} is the same <u>and</u> the increase in S_{yy} Saying that r increases or stays the same is B0B0 2 nd dB1 Dependent on 1 st B1 for saying r will decrease.	

Question	Scheme	Marks
6. (a)	$[P(B) = 0.4, P(A) = p + 0.1 \text{ so}] \quad 0.4 \times (p + 0.1) = 0.1 \text{ or } 0.4 \times P(A) = 0.1$ $p = \frac{1}{4} - 0.1 \quad \quad \quad \underline{p = 0.15}$	M1 M1A1 (3)
(b)	$\frac{5}{11} = \left[\frac{P(B \cap C)}{P(C)} \right] = \frac{0.2}{0.2 + q} \quad \text{or} \quad \frac{5}{11} = \frac{0.2}{P(C)}$ $11 \times 0.2 = 5 \times (0.2 + q)$ $r = 0.6 - (p + q) \quad \text{i.e. } \underline{r = 0.21}$	M1 dM1 A1 A1ft (4)
(c)	$\left[\frac{P((A \cup C) \cap B)}{P(B)} \right] = \frac{0.3}{0.4}$ $= \underline{0.75}$	M1 A1 (2) [9]
Notes		
(a)	1 st M1 for using independence in an attempt to form an equation in p or $P(A)$ 2 nd M1 for a correct attempt to solve their linear equation leading to $p = \dots$ A1 for 0.15 or exact equivalent	
(b)	1 st M1 for a clear attempt to use $P(B/C)$ to form an equation for q or $P(C)$. Assuming indep M0 2 nd dM1 Dep. on 1 st M1 for correctly simplifying to a linear equation in q or $P(C)$ e.g. accept $11 \times 0.2 = 5 \times 0.2 + q$ or $5P(C) = 2.2$ 1 st A1 for $q = 0.24$ or exact equivalent 2 nd A1ft for $0.6 - \text{their } (p + q)$ Dependent on 1 st M1 in (b) only.	
(c)	M1 for a correct ratio expression and one correct value (num < denom) <u>or</u> a fully correct ratio. Allow $\frac{P(A \cup C \cap B)}{P(B)}$ with one probability correct but only if num < denom. A numerator of $P(A \cup C) \times P(B)$ scores M0 A1 for 0.75 or an exact equivalent	

Question	Scheme	Marks
7. (a)	$E(S) = 0 + 1 \times 0.2 + 2 \times 0.1 + 4 \times 0.3 + 5 \times 0.2 = [0.2 + 0.2 + 1.2 + 1.0]$ <u>2.6</u>	M1 A1 (2)
(b)	$E(S^2) = 0 + 1 \times 0.2 + 2^2 \times 0.1 + 4^2 \times 0.3 + 5^2 \times 0.2$ or $0.2 + 0.4 + 4.8 + 5$ <u>10.4</u> (*)	M1 A1cso (2)
(c)	$\text{Var}(S) = 10.4 - ("2.6")^2$ <u>3.64</u> or $\frac{91}{25}$ (o.e.)	M1 A1 (2)
(d)(i)	$5E(S) - 3 = 5 \times "2.6" - 3$, <u>= 10</u>	M1, A1
(ii)	$5^2 \text{Var}(S) = 25 \times 3.64$, <u>= 91</u>	M1, A1 (4)
(e)	$5S - 3 > S + 3 \Rightarrow 4S > 6$ or $S > 1.5$, so need $P(S \geq 2)$ $P(S \geq 2) = \mathbf{\underline{0.6}}$	M1, A1 A1 (3)
(f)	$P(S_1 = 1) \times P(S_2 \leq 4) = 0.2 \times 0.8 = 0.16$ (*)	M1, A1cso(2)
(g)	$P(S_1 = 2) \times P(S_2 \leq 2) = 0.1 \times 0.5 = 0.05$ $P(S_1 = 4) \times P(S_2 \leq 1) = 0.3 \times 0.4 = 0.12$ Full method – all cases listed $P(S_1 = 5) \times P(S_2 = 0) = 0.2 \times 0.2 = 0.04$ all correct products $P(S_1 = 0) \times P(S_2 = \text{any value}) = 0.2 \times 1 = 0.20$ <u>= 0.57</u>	M1 A1 A1 (3) [18]
Notes		
(a)	M1 for an attempt at $\sum xP(X = x)$, at least 2 non-zero terms seen. Correct answer 2/2 A1 for 2.6 or any exact equivalent	
(b)	M1 for a correct attempt, at least 3 non-zero terms seen A1cso for 10.4 provided M1 is scored and no incorrect working seen	
(c)	M1 for $10.4 - \mu^2$, ft their μ . Must see their value of μ squared (A1 for 3.64 or any exact equiv.)	
(d)(i)	M1 for a correct expression using their 2.6 (A1 for 10)	
(ii)	M1 for $25 \times \text{Var}(S)$ - ft their $\text{Var}(S)$ (A1 for 91)	
(e)	M1 for solving the inequality as far as $pS > q$ where one of p or q are correct 1 st A1 for $P(S \geq 2)$ 2 nd A1 for 0.6 (provided $S > 1.5$ was obtained). Ans only of 0.6 scores 3/3	
(f)	A table showing all 25 cases can only score M1 in (g) if the correct cases are indicated. M1 for using independence (so multiplying) and attempting $P(S_2 \leq 4)$ e.g. $0.2 \times (0.2 + 0.2 + 0.1 + 0.3)$ or $0.04 + 0.04 + 0.02 + 0.06$ score M1 BUT $\frac{4}{25}$ (not from 0.2×0.8) is M0A0 A1cso for a fully correct explanation leading to 0.16. Must come from 0.2×0.8 not $\frac{4}{25}$	
(g)	M1 for all cases for S_1 or all 15 cases for X 1 st A1 for all correct probability products for S_1 or X 2 nd A1 for 0.57 Correct answer scores 3/3. Probabilities out of 25 score A0A0	

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467

Fax 01623 450481

Email publication.orders@edexcel.com

Order Code UA036996 Summer 2013

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE



Llywodraeth Cynulliad Cymru
Welsh Assembly Government

