

# Mark Scheme (Results)

Summer 2012

GCE Statistics S1  
(6683) Paper 1

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**Summer 2012  
6683 Statistics S1  
Mark Scheme**

**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.

## 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 and can be used if you are using the annotation facility on ePEN.

- 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.

## General Principles for Mathematics Marking

(But note that specific mark schemes may sometimes override these general principles).

### Method mark for solving 3 term quadratic:

#### 1. Factorisation

$(x^2 + bx + c) = (x + p)(x + q)$ , where  $|pq| = |c|$ , leading to  $x = \dots$

$(ax^2 + bx + c) = (mx + p)(nx + q)$ , where  $|pq| = |c|$  and  $|mn| = |a|$ , leading to  $x = \dots$

#### 2. Formula

Attempt to use correct formula (with values for  $a$ ,  $b$  and  $c$ ), leading to  $x = \dots$

#### 3. Completing the square

Solving  $x^2 + bx + c = 0$  :  $(x \pm \frac{b}{2})^2 \pm q \pm c$ ,  $q \neq 0$ , leading to  $x = \dots$

### Method marks for differentiation and integration:

#### 1. Differentiation

Power of at least one term decreased by 1. ( $x^n \rightarrow x^{n-1}$ )

#### 2. Integration

Power of at least one term increased by 1. ( $x^n \rightarrow x^{n+1}$ )

### Use of a formula

Where a method involves using a formula that has been learnt, the advice given in recent examiners' reports is that the formula should be quoted first.

Normal marking procedure is as follows:

Method mark for quoting a correct formula and attempting to use it, even if there are mistakes in the substitution of values.

Where the formula is not quoted, the method mark can be gained by implication from correct working with values, but may be lost if there is any mistake in the working.

# Summer 2012

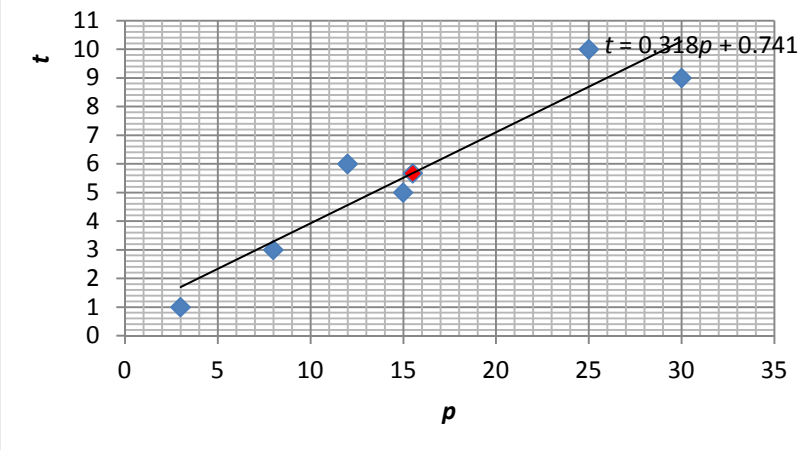
## 6683 Statistics S1

### Mark Scheme

Question	Scheme	Marks																
<b>1.</b>	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;"><math>x</math></td> <td style="padding: 5px;"><math>-1</math></td> <td style="padding: 5px;"><math>0</math></td> <td style="padding: 5px;"><math>1</math></td> <td style="padding: 5px;"><math>2</math></td> </tr> <tr> <td style="padding: 5px;"><math>P(X=x)</math></td> <td style="padding: 5px;"><math>4k</math></td> <td style="padding: 5px;"><math>k</math></td> <td style="padding: 5px;"><math>0</math></td> <td style="padding: 5px;"><math>k</math></td> </tr> </table>	$x$	$-1$	$0$	$1$	$2$	$P(X=x)$	$4k$	$k$	$0$	$k$	M1						
	$x$	$-1$	$0$	$1$	$2$													
	$P(X=x)$	$4k$	$k$	$0$	$k$													
	(a)	$4k + k + (0) + k = 1$ (Allow verify approach) $6k = 1 \Rightarrow k = \frac{1}{6}$ (*)	A1 A1cso (3)															
(b)	$[E(X)] = -4k (+0+0) + 2k$ or $-2k$ or $-1 \times \frac{4}{6} + 2 \times \frac{1}{6}$ $= -\frac{1}{3}$ (or $-0.\bar{3}$ )	M1 A1 (2)																
(c)	$[E(X^2)] = (-1)^2 \times 4k + (0+0) + 2^2 k$ or $4k + 4k$ or $(-1)^2 \times \frac{4}{6} + 2^2 \times \frac{1}{6}$ (o.e.) $= \frac{4}{3}$ (*)	M1 A1cso (2)																
(d)	$[\text{Var}(X)] = \frac{4}{3} - \left(-\frac{1}{3}\right)^2$ or $8k - 4k^2 = \left[\frac{11}{9}\right]$ $\text{Var}(1-3X) = (-3)^2 \text{Var}(X)$ or $9\text{Var}(X)$ $= 11$	<table style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;"><math>Y = 1 - 3X : 4</math></td> <td style="padding: 5px;"><math>1</math></td> <td style="padding: 5px;"><math>-2</math></td> <td style="padding: 5px;"><math>-5</math></td> </tr> <tr> <td style="padding: 5px;">Prob:</td> <td style="padding: 5px;"><math>4k</math></td> <td style="padding: 5px;"><math>k</math></td> <td style="padding: 5px;"><math>0</math></td> </tr> <tr> <td colspan="4" style="text-align: center; padding: 5px;">And <math>E(Y) = 12k</math></td> </tr> <tr> <td colspan="4" style="padding: 5px;"><math>E(Y^2) = 90k</math> and <math>\text{Var}(Y) = 90k - 144k^2</math></td> </tr> </table>	$Y = 1 - 3X : 4$	$1$	$-2$	$-5$	Prob:	$4k$	$k$	$0$	And $E(Y) = 12k$				$E(Y^2) = 90k$ and $\text{Var}(Y) = 90k - 144k^2$			
$Y = 1 - 3X : 4$	$1$	$-2$	$-5$															
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<b>Notes</b>		<b>[10]</b>																

<b>Verify</b>	(a)	<p>M1 for attempt at <math>P(X=x)</math> with at least 2 correct. Do not give for 4, 1, etc but <math>\frac{4}{6}, \frac{1}{6}</math> are OK</p> <p>1<sup>st</sup> A1 for at least <math>4k + k + k = 1</math> seen. Allow <math>\frac{4}{6} + \frac{1}{6} + \frac{1}{6} = 1</math> [Must see = 1]</p> <p>2<sup>nd</sup> A1cso provided previous 2 marks are scored and no incorrect working seen</p> <p>It's not essential to see <math>P(X = -1) = 4k</math> etc but if wrongly assigned probabilities such as <math>P(X = 2) = 4k</math> and <math>P(X = -1) = k</math> are seen then the final A1 is lost.</p> <p>To score final A1cso there must be a comment such as "therefore <math>k = \frac{1}{6}</math>"</p>	
	(b)	<p><b>Division by 4 (or any other <math>n</math>) in (b), (c) or (d) is M0. Do not apply ISW</b></p> <p>M1 for a full correct expression for <math>E(X)</math>, ft their <u>probabilities</u>. Allow in terms of <math>k</math>.</p> <p>A1 for <math>-\frac{1}{3}</math> or exact equivalent only. Just <math>-\frac{1}{3}</math> scores M1A1</p>	
	(c)	<p>M1 for evidence of both non-zero terms seen. May be simplified but 2 terms needed.</p> <p>A1cso for M1 seen leading to <math>\frac{4}{3}</math> or any exact equivalent. Condone <math>-1^2 \times 4k</math> but not <math>-4k</math></p>	
	(d)	<p>1<sup>st</sup> M1 for correct attempt at <math>\text{Var}(X)</math> - follow through their <math>E(X)</math> and allow in terms of <math>k</math> Award if a correct formula is seen and some correct substitution made.</p> <p>2<sup>nd</sup> M1 for correct use of <math>\text{Var}(aX+b)</math>. Condone <math>-3^2 \text{Var}(X)</math> if it eventually yields <math>9\text{Var}(X)</math></p> <p>A1cao for 11 only</p>	

Question	Scheme	Marks
<p>2.</p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	$[S_{xy} =] 23070 - \frac{477 \times 480}{12} [= 3990]$ $r = \frac{"3990"}{\sqrt{5606.25 \times 4244}}$ $= 0.81799\dots$ <p style="text-align: right;"><b>awrt 0.818</b></p> <p><b>0.818</b></p> <p>Positive correlation <u>or</u> value of <math>r</math> is close to 1 <u>or</u> value of <math>r &gt; 0</math> (NOT "high/ strong correlation")</p> <p>So there <u>is support</u> for the bank's claim <u>or</u> "increase in unemployment is accompanied by increase in house repossessions"</p>	<p>B1</p> <p>M1</p> <p>A1 (3)</p> <p>B1ft (1)</p> <p>B1</p> <p>B1 (2)</p> <p style="text-align: right;"><b>[6]</b></p>
<b>Notes</b>		
<p>(a)</p> <p>(b)</p> <p>(c)</p> <p>(c) SC</p>	<p style="text-align: center;"><b>Marks for part (a) must be seen in (a), do not award if only seen in (b)</b></p> <p>B1 for a correct expression for <math>S_{xy}</math></p> <p>M1 for correct attempt at <math>r</math> f.t. their 3990 but <math>\frac{23070}{\sqrt{5606.25 \times 4244}}</math> is M0</p> <p>A1 for awrt 0.818 If an answer of 0.82 only is seen then B1M1A0 can be given</p> <p>B1ft for awrt 0.818 or f.t. their answer to part (a) for <math> r  &lt; 1</math>. Allow 2sf or 1sf follow through Answer in (b) must be correct or match one of their answers in (a). Must be a number.</p> <p>1<sup>st</sup> B1 for a reason of positive correlation (allow even if <math>r &gt; 1</math>) "positive skew" or "positive gradient" is B0 but 2<sup>nd</sup> B1 is still possible</p> <p>2<sup>nd</sup> B1 for a comment that suggest this supports the claim. Marks in (c) are independent but first B1 requires some idea of <u>positive</u> correlation</p> <p>If <math> r  &lt; 0.2</math> allow this alternative to the mark scheme:</p> <p>1<sup>st</sup> B1 for saying there is no or little correlation</p> <p>2<sup>nd</sup> B1 for a comment that says this does <u>not</u> support the bank's claim</p>	

Question		Marks
<p><b>3. (a)</b></p>	 <p>(b) Points (appear to) lie close to a (straight) line <u>or</u> “strong /high correlation”</p> <p>(c) <math>\sum p = 93</math> and <math>\sum t = 34</math> (may be seen in table)  <math>S_{pt} = 694 - \frac{93 \times 34}{6} = [167]</math> <u>or</u> <math>S_{pp} = 1967 - \frac{93^2}{6} = [525.5]</math>  <math>S_{pt} = 167</math> ; <math>S_{pp} = \text{awrt } 526</math></p> <p>(d) <math>b = \left[ \frac{S_{pt}}{S_{pp}} \right] = \frac{167}{525.5} = [0.31779\dots]</math> (check their answer if expression not seen)  <math>a = \frac{34}{6} - 0.31779\dots \times \frac{93}{6} = 5.666\dots - 0.31779\dots \times 15.5 = , 0.74088\dots</math> awrt 0.74  <math>t = \mathbf{0.741 + 0.318p}</math> (Accept <math>a = \frac{2336}{3153}</math> and <math>b = \frac{334}{1051}</math> in their equation)</p> <p>(e) <math>(\bar{p}, \bar{t}) = (15.5, 5.7)</math> plotted on the graph (not wholly outside the circle)                  Correct line plotted as per overlay. For <math>p = 5</math>; <math>2 &lt; t &lt; 3</math> <u>and</u> for <math>p = 30</math>; <math>10 &lt; t &lt; 11</math>                  Their line must stretch roughly as far as the points and go through the <math>(\bar{p}, \bar{t})</math> circle</p> <p>(f) <math>t = "0.741" + "0.318" \times 16</math>  <math>= 5.825\dots</math> <b>awrt 5.8</b></p>	<p>Use overlay</p> <p>B1 B1</p> <p>(2)</p> <p>B1 (1)</p> <p>M1 M1 A1; A1 (4)</p> <p>B1ft</p> <p>M1, A1</p> <p>A1 (4)</p> <p>B1 B1 (2)</p> <p>M1 A1 (2)</p> <p>[15]</p>
<b>Notes</b>		
<p>(a)</p> <p>(c)</p> <p>(d)</p> <p>(f)</p>	<p>B2 for all 6 data points plotted correctly. B1 for any 5 correct. Points not wholly outside the circles.</p> <p>1<sup>st</sup> M1 for attempting <math>\sum p</math> and <math>\sum t</math>. Allow <math>80 &lt; \sum p &lt; 100</math> and <math>30 &lt; \sum t &lt; 40</math>                  2<sup>nd</sup> M1 for one correct expression for <math>S_{pt}</math> or <math>S_{pp}</math>, f.t. their <math>\sum p</math> and <math>\sum t</math>. 1<sup>st</sup> A1 for <math>S_{pt}</math> 2<sup>nd</sup> for <math>S_{pp}</math></p> <p>B1ft for correct expression for the gradient, f.t. their 167 and 525.5 from (c)                  M1 for correct use of <math>a = \bar{t} - b\bar{p}</math> f.t. their values. Condone 5.6 for <math>\bar{t}</math>                  1<sup>st</sup> A1 for awrt 0.74 NB use of 526 gives 0.745566... and gets A0                  2<sup>nd</sup> A1 for a correct equation for <math>t</math> in terms of <math>p</math> with <math>a</math> and <math>b</math> awrt 3sf An equn in <math>y</math> or <math>x</math> is A0</p> <p>M1 for clear use of their line (equation or on graph) and <math>p = 16</math> to estimate <math>t</math>.                  This may be an expression or lines marked on the diagram                  A1 for awrt 5.8, even if their line is not fully correct. Accept “<math>t &gt; 5.8</math>”(oe). Answer only 2/2</p>	



Question	Scheme	Marks
4.	<p>(a) <math>B, W</math> <u>or</u> <math>T, W</math> [ accept <math>B \cup T, W</math> <u>or</u> <math>B \cap T, W</math> ] [Condone <math>P(B), P(W)</math> etc]            Since there is no <u>overlap</u> between the events <u>or</u> cannot happen together (o.e.)            (Accept comment in context e.g. “no one walks and takes the train”)</p> <p>(b) e.g. <math>P(B) = \frac{9}{25}, P(T) = \frac{8}{25}, P(B \cap T) = \frac{5}{25}</math>  <math>P(B \cap T) \neq P(B) \times P(T)</math> [<math>0.2 \neq 0.36 \times 0.32 = 0.1152</math> o.e.]            So <math>B</math> and <math>T</math> are <u>not</u> independent</p> <p>(c) <math>[P(W) =] \frac{7}{25}</math> <u>or</u> 0.28</p> <p>(d) <math>[P(B \cap T) =] \frac{5}{25}</math> <u>or</u> <math>\frac{1}{5}</math> <u>or</u> 0.2</p> <p>(e) <math>[P(T   B) =] \frac{P(T \cap B)}{P(B)} = \frac{\text{"(d)"}}{(5+4)/25}</math>  <math>= \frac{5}{9}</math> <u>or</u> 0.<del>5</del></p>	B1 B1 (2) M1 M1 A1cso (3) B1 (1) B1 (1) M1 A1 (2) <b>[9]</b>
<b>Notes</b>		
	<p>(a) 1<sup>st</sup> B1 for a suitable pair. Do not accept universally exclusive pairs such as <math>B</math> and <math>B'</math> etc            2<sup>nd</sup> B1 for any <u>correct</u> statement. Accept use of symbols e.g.: <math>B \cap W = \emptyset</math> <u>or</u> <math>P(T \cap W) = 0</math> etc            But <math>T \cap W = 0</math> is B0 (since it is not a correct statement)</p> <p>(b) 1<sup>st</sup> M1 for an attempt at all required probabilities with labels for a suitable test (allow one error).            Accept use of <math>A</math> and <math>B</math> as long as they can be identified as <math>B</math> and <math>T</math> by correct probabilities            Must be probabilities not integers such as 5, 9, 8 etc for both these M marks            2<sup>nd</sup> M1 for <math>P(B) \times P(T)</math> evaluated (correct for <u>their</u> probabilities)  <u>or</u> <math>P(B \cap T) \neq P(B) \times P(T)</math> stated or implied in symbols or using their probabilities.  <u>or</u> <math>P(B   T) \neq P(B)</math> <u>or</u> <math>P(T   B) \neq P(T)</math> stated or implied in symbols or using their probabilities.            A1 for a conclusion of <u>not</u> independent. Requires all probabilities used to be correct and seen.            This A mark is dependent on both Ms</p> <p>NB <math>P(B   T) = \frac{5}{8}</math> &amp; <math>P(B) = \frac{9}{25}</math> <u>or</u> <math>P(T   B) = \frac{5}{9}</math> &amp; <math>P(T) = \frac{8}{25}</math> seen, followed by a correct conclusion scores 3/3</p> <p>(e) M1 for a correct ratio of probabilities e.g. <math>\frac{5/25}{(5+4)/25}</math> <u>or</u> <math>\frac{5}{5+4}</math> <u>or</u>            A correct ratio expression and at least one correct (or correct f.t.) probability substituted.            A1 for <math>\frac{5}{9}</math> with no incorrect working seen but <math>\frac{5}{9}</math> following from <math>P(B   T)</math> is 0/2. <math>\frac{5}{9}</math> alone is 2/2</p>	

## Scheme

Question	Scheme	Marks
5. (a)	One large square = $\frac{450}{22.5}$ or one small square = $\frac{450}{562.5}$ (o.e. e.g. $\frac{562.5}{450}$ ) One large square = 20 cars or one small square = 0.8 cars or 1 car = 1.25 squares No. > 35 mph is: $4.5 \times 20$ or $112.5 \times 0.8$ (or equivalent e.g. using fd) $= \underline{90}$ (cars)	M1 A1 dM1 A1 (4)
(b)	$[\bar{x}] = \frac{30 \times 12.5 + 240 \times 25 + 90 \times 32.5 + 30 \times 37.5 + 60 \times 42.5}{450} \left[ = \frac{12975}{450} \right]$ $= 28.83... \text{ or } \frac{173}{6} \text{ awrt } \underline{28.8}$	M1 M1 A1 (3)
(c)	$[Q_2 =] 20 + \frac{195}{240} \times 10$ (o.e.) [Allow use of $(n+1)$ giving 195.5 instead of 195] $= 28.125$ [Use of $(n+1)$ gives 28.145...] awrt <u>28.1</u>	M1 A1 (2)
(d)	$Q_2 < \bar{x}$ So <u>positive skew</u>	[Condone $Q_2 \approx \bar{x}$ ] [so (almost) <u>symmetric</u> ]
(e)	[If chose <u>skew</u> in (d)] <b>median</b> ( $Q_2$ ) Since the data is skewed or median not affected by extreme values	[If chose <u>symmetric</u> in (d)] <b>mean</b> ( $\bar{x}$ ) Since it uses all the data
		B1ft dB1ft (2)
		B1 dB1 (2)
		[13]
	<b>Notes</b>	
(a)	1 <sup>st</sup> M1 for attempt to count squares (accept "22.5" in [22, 23] and "562.5" in [550, 575]) and use 450 to obtain a measure of scale. [If using fd must use 450 to obtain scale factor]	
	1 <sup>st</sup> A1 for a correct calc. for 20 or 0.8 or 1.25 etc [May be fd = 4 to 1 large sq. or 0.8 to 1 small sq. May be on the diagram.]	
	2 <sup>nd</sup> dM1 dep on 1 <sup>st</sup> M1 for correctly counting squares for > 35 mph and forming suitable expr'	
	2 <sup>nd</sup> A1 for 90 with no incorrect working seen. e.g. $\frac{4.5}{22.5} \times 450$ scores M1A1M1 and A1 when = 90 is seen. Answer only is 4/4	
(b)	1 <sup>st</sup> M1 for clear, sensible use of mid-points at least 3 of (12.5, 25, 32.5, 37.5, 42.5) seen	
	2 <sup>nd</sup> M1 for an expression for $\bar{x}$ (at least 3 correct terms on num' and a compatible denominator) Follow through their frequencies.	
	You may see these fractions: $\frac{16218.75}{562.5}$ (small squares), $\frac{12975}{450}$ (frequencies), $\frac{648.75}{22.5}$ (large squares)	
	A1 for awrt 28.8 (answer only is 3/3)	
(c)	M1 for a full expression for median (using their frequencies). May see e.g. $25 + \frac{75}{120} \times 5$ etc	
	Do not accept boundaries of 19.5 or 20.5, these are M0A0	
	A1 for awrt 28.1 (answer only is 2/2) [For use of $(n+1)$ accept 28.15 but not 28.2]	
(d)	1 <sup>st</sup> B1ft for a correct statement about their $Q_2$ and $\bar{x}$ [Condone $Q_2 \approx \bar{x}$ only if $ Q_2 - \bar{x}  < 1$ ]	
	Do not accept an argument based on the shape of the graph alone.	
	2 <sup>nd</sup> dB1ft dependent on 1 <sup>st</sup> B1 for a <u>compatible</u> description of skewness. F.t. their values	
<b>Quartiles</b>	If $Q_1 = 23.4$ and $Q_3 = 33.7 \sim 33.8$ are seen allow comparison of quartiles for 1 <sup>st</sup> B1 in (d)	
(e)	1 <sup>st</sup> B1 for a correct choice based on their skewness comment in (d). If no choice made in (d) only $Q_2$	
	2 <sup>nd</sup> dB1 for a suitable compatible comment	

Question	Scheme	Marks
<p>6. (a)</p> <p>(b)</p> <p>(c)</p>	$[z =] \pm \left( \frac{150 - 162}{7.5} \right)$ $[z =] - 1.6$ $[P(F > 150) = P(Z > -1.6) =] = 0.9452(0071\dots)$ $z = \pm 0.2533 \text{ (or better seen)}$ $(\pm) \frac{s - 162}{7.5} = 0.2533(47\dots)$ $s = 163.9$ $z = \pm 1.2816 \text{ (or better seen)}$ $\frac{162 - \mu}{9} = -1.2815515\dots$ $\mu = 173.533\dots$	<p>M1</p> <p>A1</p> <p>A1 (3) <b>awrt 0.945</b></p> <p>B1</p> <p>M1</p> <p>A1 (3) <b>awrt 164</b></p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1 (4) <b>awrt 174</b></p> <p style="text-align: right;"><b>[10]</b></p>
<b>Notes</b>		
<p>(a)</p> <p>(b)</p> <p>(c)</p> <p><b>NB</b></p>	<p>M1 for attempting to standardise with 150, 162 and 7.5. Accept <math>\pm</math>  Allow use of symmetry and therefore 174 instead of 150  1<sup>st</sup> A1 for <math>-1.6</math> seen. Allow 1.6 seen if 174 used or awrt 0.945 is seen. Sight of 0.945(2) is A1.  2<sup>nd</sup> A1 for awrt 0.945 Do not apply ISW, if 0.9452 is followed by <math>1 - 0.9452</math> then award A0  Correct answer only 3/3</p> <p>B1 for <math>(z =) \pm 0.2533</math> (or better) seen.  Giving <math>z = \pm 0.25</math> or <math>\pm 0.253</math> scores B0 here but may get M1A1  M1 for standardising with <math>s</math> (o.e.), 162 and 7.5, allow <math>\pm</math>, and setting equal to a <math>z</math> value  Only allow <math>0.24 \leq z \leq 0.26</math> Condone e.g. 160 for 162 etc  A1 for awrt 164 (Correct answer only scores B0M1A1)</p> <p>B1 for <math>(z =) \pm 1.2816</math> (or better) seen. Allow awrt <math>\pm 1.28</math> if B0 scored in (b) for <math>z =</math> awrt <math>\pm 0.25</math>  M1 for attempting to standardise with 162, 9 and <math>\mu</math>, and setting equal to a <math>z</math> value where  <math>1.26 &lt;  z  &lt; 1.31</math>. Allow <math>\pm</math> here so signs don't have to be compatible.  1<sup>st</sup> A1 for a correct equation <u>with</u> compatible signs and <math>1.26 &lt;  z  &lt; 1.31</math>  2<sup>nd</sup> A1 for awrt 174 (Correct answer only scores B0M1A1A1). <b>Dependent on 1<sup>st</sup> A1</b></p> <p>An equation <math>\frac{162 - \mu}{9} = 1.2816</math> leading to an answer of <math>\mu = 174</math> is A0A0 <u>unless</u> there is clear  correct working such as: <math>\frac{162 - x}{9} = 1.2816 \Rightarrow x = \dots \therefore \mu = 162 + (162 - x) = 174</math> then award A1A1</p> <p>A common error is: <math>\frac{162 - \mu}{9} = 1.2816</math> followed by <math>\mu = 162 + 9 \times 1.2816 =</math> awrt 174 It gets  A0A0</p>	

Question	Scheme	Marks
7. (a)		<p>B1 B1 B1 (3)</p>
(b)	$P(\text{Exactly one defect}) = 0.03 \times 0.3 + 0.97 \times 0.02 \text{ or } P(PS \cup Split) - 2P(PS \cap Split)$ $= [0.009 + 0.0194 = ] \quad \text{awrt } \underline{\underline{0.0284}}$	<p>M1A1ft A1 cao (3)</p>
(c)	$P(\text{No defects}) = (1 - 0.03) \times (1 - 0.02) \times (1 - 0.05) \text{ (or better)}$ $= 0.90307 \quad \text{awrt } \underline{\underline{0.903}}$	<p>M1 A1 cao (2)</p>
(d)	$P(\text{Exactly one defect}) = (b) \times (1 - 0.05) + (1 - 0.03) \times (1 - 0.02) \times 0.05$ $= "0.0284" \times 0.95 + 0.97 \times 0.98 \times 0.05$ $= [0.02698 + 0.04753] = 0.07451 \quad \text{awrt } \underline{\underline{0.0745}}$	<p>M1 M1 A1ft A1 cao (4) [12]</p>

**Notes**

	<p><b>Allow MR of 0.2 for 0.02 or 0.3 for 0.03 on tree diagram to score all M and A1ft marks only</b></p> <p>(a) 1<sup>st</sup> B1 for 2 branch then 4 branch shape 2<sup>nd</sup> dB1 dep. on 1<sup>st</sup> B1 for labels showing stitching (accept letters) and 0.03 value correctly placed 3<sup>rd</sup> dB1 dep. on 1<sup>st</sup> B1 for labels showing splitting and 0.7 and 0.02 correctly placed [probabilities shown in brackets are <u>not</u> required and any such values given can be ignored in (a)]</p> <p>(b) M1 for <math>0.03 \times p + 0.02 \times q</math> where <math>p</math> and <math>q</math> follow from their tree diagram. Extra terms is M0 1<sup>st</sup> A1ft for a fully correct expression. Accept <math>1 - 0.7</math> for 0.3 and <math>1 - 0.03</math> for 0.97 Follow through 0.2 and 0.3 MR only</p> <p>MR 0.2 for 0.02 <math>\rightarrow 0.203</math> or 0.3 for 0.03 <math>\rightarrow 0.104</math> or both <math>\rightarrow 0.23</math> should score M1A1A0 2<sup>nd</sup> A1 cao for 0.0284 only (or exact equivalent such as <math>\frac{71}{2500}</math>)</p> <p><b>Do not allow 0.5 as MR of 0.05 so no M or A marks in (c) or (d)</b></p> <p>(c) M1 for <math>(\text{their } 0.97) \times (\text{their } 0.98) \times (1 - 0.05)</math> (or better) f.t. values from their tree diagram A1 cao for awrt 0.903</p> <p>(d) 1<sup>st</sup> M1 for one correct triple (or correct ft from their tree) of:  <math display="block">[0.03 \times 0.3 \times (1 - 0.05)] + [0.97 \times 0.02 \times (1 - 0.05)] + [0.97 \times 0.98 \times 0.05]</math>                 2<sup>nd</sup> M1 for two correct triples or correct ft from their tree and adding <u>or</u> their (b) <math>\times (1 - 0.05)</math>                  1<sup>st</sup> A1ft for a fully correct expression or f.t. their (b) and 0.2 or 0.3 MR only</p> <p>MR 0.2 for 0.02 <math>\rightarrow 0.23165</math> or 0.3 for 0.03 <math>\rightarrow 0.1331</math> or both <math>\rightarrow 0.2465</math> (or awrt 3sf) scores M1M1A1A0 2<sup>nd</sup> A1 cao for awrt 0.0745</p>
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