Mark Scheme (Results)

January 2021

Pearson Edexcel Award
In Statistical Methods (AST30)
Level 3

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. 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

January 2021
Publications Code AST30_01_2101_MS

NOTES ON MARKING PRINCIPLES

1 Types of mark

M marks: method marks
A marks: accuracy marks
B marks: unconditional accuracy marks (independent of M marks)

2 Abbreviations

cao – correct answer only
isw – ignore subsequent working
oe – or equivalent (and appropriate)
indep - independent
ft – follow through
SC: special case
dep – dependent

3 No working

If no working is shown then correct answers normally score full marks
If no working is shown then incorrect (even though nearly correct) answers score no marks.

4 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.
If there is no answer on the answer line then check the working for an obvious answer.
Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.
If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

5 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

6 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect cancelling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

7 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

8 Use of ranges for answers

If an answer is within a range this is inclusive, unless otherwise stated.

9 Probability

Probability answers must be given as fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

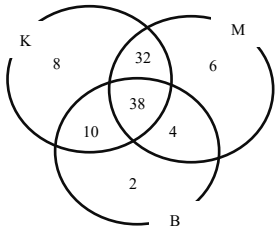
If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
1	(a)		categorical	1	B1 for categorical (Allow Qualitative)
	(b)	$\frac{40}{450} \times 65$	6	2	M1 for $\frac{40}{450} \times 65$ (= 5.77…) A1 cao
2	(a)		Correct sample space diagram	1	B1 cao
	(b)		$\frac{2}{16}$	1	B1 for $\frac{2}{16}$ oe
	(c)	$\left(\frac{2}{16}\right) \times 200$	25	2	M1 for '$\left(\frac{2}{16}\right)$' $\times 200$ A1 cao
3		35 : 210 = x : 30	5	2	M1 for $x = \frac{35}{210} \times 30$ oe A1 for 5
4	(a)	$\frac{4.5-3.6}{0.6}$	1.5	2	M1 for $\pm\left(\frac{4.5-3.6}{0.6}\right)$ A1 cao
	(b)	$-1.2 \times 0.6 + 3.6$	2.88	2	M1 for $-1.2 \times 0.6 + 3.6$ A1 cao

PAPER: AST30_01

Question	Working	Answer	Mark	Notes
5 (a)	8 | 4 5 6 | 4 6 8 5 2 | 0 7 5 5 | 3 8 6 | 2 9 2 | 1 10 Key: 4 | 5 represents 54 kg	Correct ordered stem and leaf diagram with a correct key	2	B1 for correct ordered leaves for farm A (allow one error or omission) B1 (independent) for a correct key
(b)	**A** / **B** **Median** 78 / 65 **Mean** 78.7 / 66.4 **Mode** 85 / 61 **Range** 48 / 40 **IQR** 26 / 20 **Skew** +ve skew / - ve skew	2 correct comparisons	2	B2 for two correct comparisons from: • median/mean/mode for A > median/mean/mode for B • range/IQR for A > range/IQR for B • A is positive skew **and** B is negative skew (Allow symmetrical for farm A) (B1 for one correct comparison)

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
6	(a)	48 + 1.5(48 – 28) (= 78) 90 > 78 So 90 is an outlier	correct conclusion	4	B1 for UQ = 48 and LQ = 28 M1 for '48' + 1.5('48' – '28') A1 for 78 A1 for correct conclusion from supporting working
	(b)		Correct box plot	3	B3 for a fully correct box plot with outlier marked at 90 (Allow the box plot to end at either 68 or 78) (B2 for a box plot without the outlier marked or one plotting error) (B1 for a box plot without the outlier marked and one plotting error or two plotting errors)
	(c)		3 correct comparisons	3	B1 for a correct comparison of median e.g. median for Spanish > median for French B1 for a correct comparison of range/IQR e.g. range/IQR for Spanish > range/IQR for French B1 for a correct comparison of skew e.g. Spanish is symmetrical **and** French is positive skew
7	(a)		Correct tree diagram	2	B2 for fully correct tree diagram (B1 for $\frac{3}{6}, \frac{2}{6}, \frac{1}{6}$ in the correct place on the given branches **or** 5 branches drawn and correctly labelled)
	(b)	$\frac{4}{7}\times\frac{3}{6}+\frac{4}{7}\times\frac{2}{6}+\frac{2}{7}\times\frac{4}{6}$	$\frac{28}{42}$	3	M1 for $\frac{4}{7}\times\frac{3}{6}$ or $\frac{4}{7}\times\frac{2}{6}$ or $\frac{2}{7}\times\frac{4}{6}$ M1 for $\frac{4}{7}\times\frac{3}{6}+\frac{4}{7}\times\frac{2}{6}+\frac{2}{7}\times\frac{4}{6}$ A1 for $\frac{28}{42}$ oe

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
8	(a)		upward	1	B1 for upward oe
	(b)	400 – 540	–140	2	M1 for ±(400 – 540) A1 cao
9	(a)		Correct Venn diagram	4	B1 for 3 overlapping circles with 2 **and** 32 **and** 38 in the correct places B1 for 10 **and** 4 in the correct places B1 for 6 in the correct place B1 for 8 in the correct place
	(b)		$\frac{42}{88}$	2	M1 for $\frac{'10'+32}{'8'+'10'+38+32}$ A1 for $\frac{42}{88}$ oe
10	(a)	$\sum d^2 = 16 + 1 + 16 + 25 + 25 + 25 + 25 + 16 + 1 + 16 \ (= 166)$ $1 - \frac{6\times166}{10(10^2-1)}$	-0.006	3	M1 for $\sum d^2 = 16 + 1 + 16 + 25 + 25 + 25 + 25 + 16 + 1 + 16 \ (= 166)$ M1 for $1 - \frac{6\times'166'}{10(10^2-1)}$ A1 cao
	(b)(i)		No correlation	1	B1 for No (correlation) **or** none (Allow very weak/little negative correlation)
	(b) (ii)		Correct interpretation	1	B1 for a correct interpretation e.g. there is no association/agreement between the rankings given by the two judges (Allow there is very little/almost no agreement between the two judges)

PAPER: AST30_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
11 (a)		Correct interpretation	1	B1 for 14.6% decrease (from previous year)
(b)	$\frac{117}{102} \times 100$ $\frac{121}{117} \times 100$	114.7 103.4	2	M1 for either $\frac{117}{102} \times 100$ (= 114.7) **or** $\frac{121}{117} \times 100$ (= 103.4) A1 for 114.7 **and** 103.4
(c)	$\sqrt[4]{85.4 \times 91.9 \times 114.7 \times 103.4}$	No with supporting working	4	M1 for $\sqrt[4]{85.4 \times 91.9 \times '114.7' \times '103.4'}$ A1 for 98.2 M1 (**dependent on 1st M1**) for (the geometric mean shows an) average annual decrease is '1.8'% or 98.2 < 100 A1ft for Rita is incorrect
12 (a)		shown	1	B1 for $2576.47 - \frac{176.9^2}{15}$
(b)(i)	$\frac{1907.63}{\sqrt{490.2 \times 9034.93}}$	0.906	2	M1 for $\frac{1907.63}{\sqrt{490.2 \times 9034.93}}$ A1 for 0.906
(b)(ii)		positive	1	B1 for positive
13		Two correct sketches	4	B1 for two bell shaped curved labelled male and female B1 for male curve centred on 60 **and** starting at 46-50 and ending at 70-74 B1 for female curve centred on 55 **and** starting at 38-42 and ending at 68-72 B1 for male curve taller than female curve

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
14	(a)	$\frac{2}{5}+\frac{1}{3}-0$	$\frac{11}{15}$	2	M1 for $\frac{2}{5}+\frac{1}{3}-0$ A1 for $\frac{11}{15}$ oe
	(b)	$\frac{5}{8}=\frac{2}{5}+\mathrm{P}(B)-\frac{2}{5}\mathrm{P}(B)$ $\frac{9}{40}=\frac{3}{5}\mathrm{P}(B)$	$\frac{3}{8}$	3	M1 for $\frac{5}{8}=\frac{2}{5}+\mathrm{P}(B)-\frac{2}{5}\mathrm{P}(B)$ M1 for $\frac{9}{40}=\frac{3}{5}\mathrm{P}(B)$ A1 for $\frac{3}{8}$ oe
15	(a)	$^{15}/_{150}=0.1$ $^{35}/_{100}=0.35$ $^{42}/_{100}=0.42$ $^{38}/_{100}=0.38$ $^{30}/_{150}=0.2$	Correct histogram drawn	4	M1 for attempting to calculate frequency densities e.g. 0.1, 0.35, 0.42, 0.38, 0.2 A2 for five bars with correct widths and drawn to the correct heights (A1 for four correct) B1 for suitable vertical scale with frequency density labelled **or** key
	(b)	$(825\times 15+950\times 35+1050\times 42+$ $1150\times 38+1275\times 30)\div 160$	1072.97	3	M1 for $\sum f\times w$ (w must be midpoints) (allow one arithmetic error) M1 (dependent) for '$\sum f\times w$' ÷ 160 A1 for 1072.96 – 1072.97
	(c)	$\sqrt{\frac{187125625}{160}-\left(\frac{171675}{160}\right)^2}$	135.18	2	M1 for $\sqrt{\frac{187125625}{160}-(\text{'mean'})^2}$ A1 for 135.17 – 135.18

PAPER: AST30_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
16 (a)		2 correct comparisons	2	B2 for two comparisons from 1. Comparison of skews e.g. before change symmetrical and after change negative skew 2. Comparison of corresponding frequencies/areas e.g. sales after change have increased 3. Comparison of modal class intervals/class interval that contains the median/mean e.g. the modal class interval/class interval that contains the median/mean have increased after the wrapper change 4. Comparison of spread e.g. the standard deviation for both before and after the change are the same (96) 5. Sales before change has less days than sales after change o.e.
(b)		Correct advantage and correct disadvantage	2	B1 for a correct advantage e.g. it is data that you collect yourself so the reliability is known B1 for a correct disadvantage e.g. it is more time consuming/more expensive

PAPER: AST30_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
17 (i)	$P\left(\frac{200-202}{5}\right)$ 1 – 0.6554	0.3446	6	M1 for $\pm\left(\frac{200-202}{5}\right)$ (may be implied by -0.4 **or** 0.4) M1 for 1 – 0.6554 A1 for 0.3446 (accept 0.344 **or** 0.345)
(ii)	$P\left(\frac{210-202}{5}\right)$ 0.9452 – 0.3446	0.6006		M1 for $\pm\left(\frac{210-202}{5}\right)$ (may be implied by 1.6 **or** -1.6) M1 for 0.9452 – 0.3446 A1 for 0.6 – 0.601
18	$^{10}C_0 \times (0.02)^0(0.98)^{10}$ (= 0.81707…) $^{10}C_1 \times (0.02)^1(0.98)^9$ (= 0.16674…) 0.81707… + 0.16674…	0.9838	5	M1 for $^{10}C_0 \times (0.02)^0(0.98)^{10}$(=0.81707…) **or** $^{10}C_1 \times (0.02)^1(0.98)^9$(= 0.16674…) A1 for 0.81707… A1 for 0.16674… M1 (**dep on 1st M1**) for '0.81707…' + '0.16674…' A1 for awrt 0.984

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom