

Mark Scheme (Results)

Summer 2013

Edexcel Level 3 Award (AST30)
Statistical Methods

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NOTES ON MARKING PRINCIPLES

- 1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- 2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- 3 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.
- 4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- 5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- 6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.
 - ii) *select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.
 - iii) *organise information clearly and coherently, using specialist vocabulary when appropriate.*
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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.

8 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.

9 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 canceling 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.

10 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.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

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

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme

M1 – method mark

A1 – accuracy mark

B1 – Working mark

C1 – communication mark

QWC – quality of written communication

oe – or equivalent

cao – correct answer only

ft – follow through

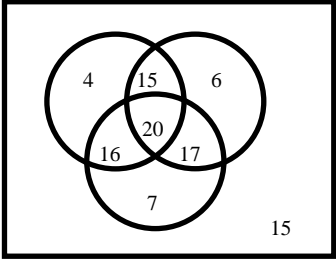
sc – special case

dep – dependent (on a previous mark or conclusion)

indep – independent

isw – ignore subsequent working

PAPER: AST30_01					
Question		Working	Answer	Mark	Notes
1			35	2	M1 for $27 \div 39 \times 50$ or 34.6... A1 for 34 or 35
2	(a)		box plot	3	B3 for box plot with all of: 1. median drawn at 48–50 2. quartiles drawn at 34–36 and 60–62 3. whiskers drawn at 10 and 94 (B2 for two of these B1 for one of these)
	(b)		comparisons	3	B3 ft for 3 from 1. correct comparison of a point, eg medians, largest values 2. correct comparison of spread, eg range, IQR 3. correct comparison of skew (B2 for 2 correct comparisons, B1 for 1 correct comparison)
	(c)		proof	3	M1 for $40 + 1.5 \times (40 - 22)$ A1 for 67 A1 for correct comment, eg $88 > 67$ oe OR M1 for $22 + (88 - 40) \div 1.5$ A1 for 54 A1 for correct comment, eg $54 > 40$ oe

PAPER: AST30_01					
Question		Working	Answer	Mark	Notes
3	(a)		0.4, 0.6 0.35, 0.65 0.35, 0.65	3	B3 for a tree diagram with 6 correct probabilities in correct positions (B2 for 4 correct, B1 for 2 correct)
	(b)		0.47	3	M1 for $0.4 \times 0.65 (=0.26)$ or $0.6 \times 0.35 (=0.21)$ M1 for $0.4 \times 0.65 + 0.6 \times 0.35$ A1 for 0.47 oe OR M2 for $1 - (0.4 \times 0.35 + 0.6 \times 0.65)$ A1 for 0.47 oe
4	(a)			4	B1 for 20 B1 for 16, 15 and 17 B1 for 4, 6 and 7 B1 for 15 or ft their Venn diagram
	(b)		$\frac{35}{58}$	2	M1 for $\frac{35}{a}$, $a > 35$ or $\frac{b}{58}$, $b < 58$ or ft their Venn diagram A1 ft for $\frac{35}{58}$ or 0.6(0) oe

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Question		Working	Answer	Mark	Notes
5	(a)		46.3125	3	M1 for $25 \times 20 + 36 \times 50 + 14 \times 70 + 5 \times 85 (=3705)$ condone one error M1 for '3705' $\div (25 + 36 + 15 + 4)$ A1 for 46.3 – 46.4 NB may be seen in part b if part a not attempted
	(b)		20.3 – 20.4	2	M1 for $\sqrt{[204 \ 725 \div 80 - ('46.3125')^2]}$ A1 for 20.3 – 20.4
	(c)		histogram	4	M1 for frequency \div class width or 0.625 or 1.8 or 0.7 or 0.5 A2 for four blocks with correct widths and correct heights (A1 for 3 correct) A1 for appropriate vertical scale or key

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Question		Working	Answer	Mark	Notes
6	(a)	Rank cost 3, 6, 4, 7, 2, 8, 5, 1 Rank mileage 2, 3, 5, 6, 7, 1 4, 8 differences 1, 3, 1, 1, 5, 7, 1, 7 $\sum d^2 = 136$ $\frac{1 - 6 \times 136}{[8 \times (8^2 - 1)]}$	-0.619	4	M1 for attempt to rank costs and mileages condone one error in each accept reverse ordering M1 for attempt to find $\sum d^2$ for 8 differences condone one error M1 for attempt to find $1 - 6 \times \sum d^2 \div [n(n^2 - 1)]$, with $n = 8$ A1 for -0.6 to -0.62
	(b)(i)		interpretation	2	B1 (indep) for correct interpretation, eg the greater the mileage the lower the selling price oe accept negative oe NB may be awarded if seen in part ii and no contradiction
	(ii)		comment		B1 (dep) for correct comment, eg good – strong (correlation) oe or ft part a provided $-1 < r < 1$

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Question		Working	Answer	Mark	Notes
7	(a)		225	2	M1 for $\frac{30}{B} = \frac{4}{30}$ oe A1 cao
	(b)		marked beads are well mixed with other beads	1	B1 for a correct assumption, eg (marked) beads are well mixed or beads have an equal chance of being chosen
8	(a)		(2,79), (3,82), (1,85), (2, 89), (3,92), (1,96), (2,99)	4	M1 for a correct attempt to calculate at least one 3-point moving average, eg $(72+89+76)\div 3$ M1 for plotting at least three 3-point moving averages consistently M1 for plotting seven 3-point moving averages with correct heights or correct positions A1 cao
	(b)		upwards	1	B1 for upwards oe
	(c)(i)		3.3 – 4.7	4	M1 for lobj through moving averages M1 for $\pm[(74-72)+(85-81)+(96-90)]\div 3$ or $\pm(3.3 - 4.7)$
	(ii)	$1 - (0.25 + 0.10 + 0.35)$	101 – 103		M1 for seasonal adjustment $(106 \pm (2 + 4 + 6)\div 3)$ A1 for 101 – 103 or ft their lobj

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Question		Working	Answer	Mark	Notes
9	(a)		27.50	2	M1 for $105.8 \div 100 \times 25.99$ A1 for 27.49 – 27.5
	(b)(i)		103.8	4	M1 for $\sqrt[3]{102.1 \times 103.5 \times 105.8}$ A1 for 103.7 – 103.8
	(ii)		Average annual increase of 3.8%		B1 for 3.7 – 3.8% B1 (dep) for (average annual) increase oe or ft part b provided geometric mean attempted
10	(a)		eg quicker	1	B1 for advantage, eg quicker, cheaper, easier (to process)
	(b)		list of the children	1	B1 for list (of children) oe
	(c)		5	2	M1 for $25 \div 141 \times 30$ or 5.3... A1 for 5 or 6
11	(a)		0.9	2	M1 for $0.7 + 0.6 - 0.4$ A1 for 0.9 oe
	(b)		$\frac{4}{6}$	2	M1 for $0.4 \div 0.6$ A1 for $\frac{4}{6}$ oe
	(c)		mutually exclusive	1	B1 for mutually exclusive or can't happen at the same time oe

PAPER: AST30_01					
Question		Working	Answer	Mark	Notes
12	(a)		-1.26	2	M1 for $(49.2 - 52.6) \div 2.7$ A1 for -1.25(9...) (SC B1 for 1.25(9...))
	(b)		Jenny + reason	1	B1 (dep) for Jenny and correct reason, eg greater negative (standardised time) or 49.36 or ft '-1.26' provided $ -1.26 < 3$
13			$\frac{49}{153}$	4	M1 for 17 and 18 as denominators M1 for $\frac{4}{18} \times \frac{3}{17}$ or $\frac{6}{18} \times \frac{5}{17}$ or $\frac{8}{18} \times \frac{7}{17}$ M1 for $\frac{4}{18} \times \frac{3}{17} + \frac{6}{18} \times \frac{5}{17} + \frac{8}{18} \times \frac{7}{17}$ A1 for $\frac{49}{153}$ or 0.32(0) oe OR M1 for $\frac{4}{18} \times \frac{4}{18}$ or $\frac{6}{18} \times \frac{6}{18}$ or $\frac{8}{18} \times \frac{8}{18}$ M1 for $\frac{4}{18} \times \frac{4}{18} + \frac{6}{18} \times \frac{6}{18} + \frac{8}{18} \times \frac{8}{18}$ A1 for $\frac{29}{81}$ or 0.35 - 0.36 oe
14	(a)		normal distribution drawn	3	M1 for normal distribution A1 for symmetry about 24.5 A1 for sketch between ± 3 sd, ie 10 - 40
	(b)		0.239	3	M1 for $28 - 24.5 \div 4.9 (=0.71...)$ or 0.7611 or 0.7642 seen M1 for $1 - P(x < '0.71...')$ A1 for 0.235 - 0.239

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Question		Working	Answer	Mark	Notes
15	(a)		80.1*	2	M1 for $393.7 - 56^2 \div 10$ oe A1 for 80.1
	(b)(i)		-0.987	3	M1 for $\pm 71.56 \div \sqrt{(65.58 \times 80.1)}$ A1 for -0.98 to -0.99
	(ii)		negative correlation		A1 ft for negative (correlation)
16	(a)		0.201	3	B1 for 0.8 (may be seen in part b) or ${}^{10}C_3$ or 120 M1 for $120 \times 0.2^3 \times 0.8^7$ A1 for 0.201(3)
	(b)		0.893	2	M1 for $1 - ({}^{10}C_0 \times 0.2^0 \times) 0.8^{10}$ A1 for 0.892(6)
17			Two comparisons	2	B2 for two different correct comparisons, eg 1. mean B > mean A 2. std B < std A 3. area under both = 1 (B1 for one correct comparison)

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