



STATISTICS

4040/13

Paper 1

October/November 2016

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M Method marks, awarded for a valid method applied to the problem.
- A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
- B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘dep’ is used to indicate that a particular M or B mark is dependent on an earlier, asterisked, mark in the scheme.

The symbol ∇ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only.

Abbreviations

- AG** answer given on question paper
- awrt** answer which rounds to
- cao** correct answer only
- dep** dependent
- ft** follow through after error
- oe** or equivalent
- SC** special case
- soi** seen or implied
- www** without wrong working

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- 1 (i) carbohydrates 198° proteins 54° fats 108°
(allow B1 for one correct) B2
- (ii) chart of radius 4 cm (± 1 mm) with three sectors labelled B1
their sector angles correct ($\pm 2^\circ$) with correct labels B1✓
[4]
- 2 (i) 0, 3 in correct place B1
(ii) 8, 12 in correct place B1
35 in correct place B1✓
(iii) 40 in correct place B1
10, 29 or 10, 6 in correct place B1✓
fully correct table B1
[6]
- 3 (i) correct method for mean of *d values*
($d = 12, 4, -4, -7, -1, 0, 10$ $\Sigma d = 14$) M1
mean = 1002 A1
correct method for SD or variance of *d values*
($\Sigma d^2 = 326$) M1
SD = 6.52 or 6.52 ... A1
(ii) mean = their 1002 – 80 (= 922) B1✓
range = 19 B1
[6]
- 4 (i) 17 B1
(ii) 19 B1
(iii) correct method (e.g. $11 + 7 + 8 + 5 + 1 + 3$) M1
35 A1
(iv) 9 B1
(v) 11 B1
[6]

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5	(i) 3/87 or 1/29	B1
	(ii) 64/87	B1
	(iii) 69/84 or 23/28	B1
	(iv) $(84/87) \times (3/86)$	M1
	× 2	M1
	504/7482 or 252/3741 or 84/1247	A1
		[6]
6	(i) indication of appropriate method by finding total of passengers boarding or alighting (e.g. $27 + 4 + 14 + 7 + 2$)	M1
	54	A1
	(ii) indication of appropriate method by finding numbers travelling between stops (27, 27, 30, 25, 34, 34, 37, 39, 30) implied by one correct answer	M1
	25	A1
	39	A1
	(iii) (a) comfort	B1
	(b) cost	B1
	(c) punctuality	B1
		[8]
7	(i) $48 + 68 + 20 + 11$ (=147)	M1
	$48 + 80 + 32 + 20$ (=180)	M1
	correct expression seen leading to given answer $(147/180) \times 100$	A1
	81.7% AG	
	(ii) correct method for very good, good or moderate group	M1
	100 85 62.5 55	A1

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(iii)	any one of very good, good or moderate group rate multiplied by standard population figure	M1
	sum of four such products	M1
	$(100 \times 0.20) + (85 \times 0.35) + (62.5 \times 0.30) + (55 \times 0.15)$	A1✓
	76.75% or 76.8%	A1
(iv)	$(45 \times 1) + (78 \times 0.833) + (44 \times 0.659) + (33 \times 0.606)$ (=159)	M1
	$((\text{their } 159)/(45 + 78 + 44 + 33)) \times 100$ (=159/2)	M1
	79.5%	A1
(v)	$(100 \times 0.20) + (83.3 \times 0.35) + (65.9 \times 0.30) + (60.6 \times 0.15)$	M1
	78.0%	A1
(vi)	higher standardised pass rate/ achieves greater success with less able students	M1
	Hale	A1✓
		[16]
8	(i) attempted use of class mid-points (17, 19, 21, 23, 26)	M1*
	correct method for mean ($\Sigma fx = 1277$)	M1dep
	21 or 21.2 or 21.3 or 21.28 ...	A1
	finding values of $f \times$ variable squared (e.g. 1445, 5054 ...)	M1
	correct method for SD or variance ($\Sigma fx^2 = 27545$)	M1dep
	2.5 or 2.47 – 2.50	A1
	21.3 and 2.47	A1
	(ii) 8, 17 in correct place	B1
	any indication of column area being proportional to frequency implied by any one correct answer for three non-standard width classes	M1
	4, 21, 10	A3

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	(iii) their $4 \times 26 + \text{their } 8 \times 29 + \text{their } 17 \times 31 + \text{their } 21 \times 33.5 + \text{their } 10 \times 37.5 (=1941.5)$	M1
	their $1277 + \text{their } 1941.5 (=3218.5)$	M1
	their $3218.5/60$ with $\Sigma f = 60$ from (ii)	M1
	54	
	ft only on their 1277	A1✓
		[16]
9	(i) 4, 15, 35, 60, 74, 80	B1
	(ii) horizontal plots at UCBs	B1
	their vertical plots at cfs	M1
	suitable curve	A1
	(iii) (a) 355 – 362.5 (litres)	B1
	(b) Q1 find consumption for cf = 20 (312 – 317 (litres))	M1
	Q3 find consumption for cf = 60 (400 (litres))	M1
	use of IQR = Q3 – Q1	
	with at least one of Q1, Q3 found properly from their curve	M1
	83 – 88 (litres)	A1
	(c) attempt to find cf at 375 litres (48) as a percentage of 80	M1
	58.75 – 61.25	A1
	(iv) $1 - (\text{their (iii)(c)}/100)$	B1✓
	(v) their median $\times 80$ ($360 \times 80 = 28800$)	M1
	their $28800/1000$ ($=28.8$)	M1
	(their $28.8 \times \$2.50$) + ($80 \times \0.25)	M1
	\$92	A1✓
		[16]
10	(i) 15 000	B1
	(ii) $15 \times 2500 - 5 \times 2500$	M1
	25 000	A1

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(iii)	$[(15 \times 2500 - 13 \times 2500)/(13 \times 2500)] \times 100$ oe	M1
	15% or 15.4% or 15.38 ...%	A1
(iv) (a)	3/6	B1
(b)	3/6	B1
(c)	3/5	B1
(v)	find decrease	
	for total $15000 - 12500$ (=2500) or	
	for Com $0.3 \times (15000 - 12500)$ (=4500 – 3750 = 750) or	
	for others $0.7 \times (15000 - 12500)$ (=10500 – 8750 = 1750)	M1
	find appropriate fraction	
	2500×0.14 or $(2500 - 750) \times 0.2$ or 1750×0.2	M1
	350	A1
(vi)	$0.3 (\times 1) + 0.7 \times (4/5)$	M1
	0.86	A1
(vii)	$(0.3)^3 (\times 1)$	B1
	$+ (0.14)^3 \times 2$	M1
	0.032 or 0.0325 or 0.0324 ...	A1
		[16]
11 (i)	correctly plotted points (allow B1 for 6 or 7 correct)	B2
(ii)	correct method for USA	M1
	(6.5, 62) plotted correctly	A1
	(4.5, 79) and (2.5, 96) plotted correctly	B1
(iii)	line through at least two of their plotted averages	B1
	correct method for gradient	M1
	correct method for c	M1
	$m = -8.60$ to -8.40 and $c = 116$ to 118	A1
(iv)	setting $y = 0$ in their equation, solving for x (and subtracting 8)	M1
	6 (accept decimal answer 5.8)	A1✓

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- (v) (substantial) extrapolation beyond range of data/
relationship established may change/
relationship may become non linear
(do not accept references to relapsing alone) B1
- (vi) (a) any indication that c only is determining factor M1
- George: highest c, highest y at the start where $x=0$
ft conclusion from their equation for Alfred A1✓
- (b) any indication that m only is determining factor M1
- Joseph: *magnitude* of m is largest, steepest negative gradient
ft conclusion from their equation for Alfred A1✓
- [16]