8MA0/02: AS Paper 2 Part A Statistics Mark scheme

Question	Scheme	Marks	AOs
1(a)	$[Q_2 =]\ (5+)\ \frac{12}{15}\times 5$ **or** (use of $(n+1)$) $(5+)\frac{12.5}{15}\times 5$	M1	1.1a
	$= 9$ **or** 9.166… awrt 9.17	A1	1.1b
		(2)	
(b)	$[\sigma_x =]\ \sqrt{\frac{5675}{30}-\left(\frac{355}{30}\right)^2} = \sqrt{49.14...}$	M1	1.1a
	= **awrt 7.01**	A1	1.1b
	Accept $\left(s_x = \sqrt{\frac{5675-30\left(\frac{355}{30}\right)^2}{29}} = 7.1294... \right)$	**(2)**	
(c)	$x = \frac{t-15}{2}$ or $t = 2x+15$	M1	3.1b
	Median = 2¥ "9"+15 = 33 (allow awrt 33.3 from "9.17" in (a))	A1ft	1.1b
	Sd = 2¥ "7.01" = 14.02... (awrt 14.0) [allow awrt 14.3 if *s* used]	A1ft	1.1b
		(3)	
(d)	The median time is "33" and "33" < 35 so 50% (30) should finish in 35 minutes. ALT Probability of being < 35 mins is $\frac{18}{30}$ \ $\frac{18}{30}$¥ 60 = 36 applicants to choose from.	M1	2.4
	It is likely that they will fill all 25 positions [providing those offered accept]	A1	2.2b
		(2)	

Notes: **(9 marks)**

(a) M1: For a suitable fraction ×5 (ignore end points)
A1: For 9 or awrt 9.17 if using $n + 1$

(b) M1: For a correct expression for $\bar{x}$ and s_x or s_x
A1: For awrt $s_x = 7.01$ or $s_x =$ awrt 7.13

(c) M1: For realising $x = \frac{t-15}{2}$ and then rearranging to get a correct equation with *t* as the subject
May be implied by a correct answer for the median of *t*.
A1ft: ft their median
A1ft: ft their s_x or s_x. NB using *s* gives awrt14.3

(d) M1: For a suitable comparison following through their value for the median of *t*.
A1: A correct conclusion in context following through their value for the median of *t*.

Question	Scheme		Marks	AOs
2(a)	$P(5 \leq X < 12) = P(X \leq 11) - P(X \leq 4)$		M1	1.1b
	$= 0.8939 - 0.0495$ **= awrt <u>0.844</u>**		A1	1.1b
			(2)	
(b)	H_0: $p = 0.25$ H_1: $p > 0.25$ (both correct in terms of p or p)		B1	2.5
	$Y \sim B(40, 0.25)$		M1	3.3
	<u>Method 1</u>	**<u>Method 2</u>**		
	$P(Y \geq 16) = 1 - P(Y \leq 15)$	$P(Y \geq 17) = 0.0116$	M1	1.1b
	$= 1 - 0.9378$	$P(Y \geq 18) = 0.0047$		
	$= 0.0262$	CR: $Y \geq 18$	A1	1.1b
	$0.0262 > 0.01$ $16 < 18$ or 16 is not in the critical region or 16 is not significant, accept H_0. There is no significant evidence that the proportion of people who bought organic eggs has increased		A1 cso	2.2b
			(5)	
(c)	There is evidence that the proportion of people who bought organic eggs has increased [since $0.05 > 0.0262$ or 16 is in critical region]		B1ft	2.2b
			(1)	
				(8 marks)

Notes:

(a) **M 1:** For dealing with $P(5 \leq X < 12)$ they need to use the cumulative prob. Function on the calc.
A1: awrt 8.44 (from calculator).

(b) **B1:** Both hypotheses correct using p or p **and** 0.25

M1: Realising that the model B(40, 0.25) is to be used. This may be stated or used.

M1: Using or writing $1 - P(Y \leq 15)$ **or** $1 - P(Y < 16)$

a correct CR **or** $P(Y \geq 17) = 0.0116$ **and** $P(Y \geq 18) = 0.0047$

A1: awrt 0.0262 **or** CR $Y \geq 18$ **or** $Y > 17$

A1cso: A fully correct solution with a correct conclusion in context to include the idea of proportion and increased plus referring to organic

(c) **B1ft:** For $0.0262 < 0.05$ [ft their probability in part(b)] **or** a CR of $16 \geq 15$ (allow $16 > 14$)
and a correct contextual conclusion.

Question	Scheme	Marks	AOs
3(a)	Pressure outliers are <1004.75 and >1018.75 Rainfall outliers are (<-3.05) and >82.95	M1	2.1
	p = 1019 and 1022 are outliers w = 102.0 is an outlier	A1cso	1.1b
		(2)	
(b)	e.g. was a negative correlation, now no (zero) correlation	B1	2.2b
		(1)	
(c)	e.g. there are a lot of zeros for rainfall in Perth and there are none in the sample. **or** e.g. these are the highest figures and you are unlikely to get these if the sample was random.	B1	2.4
		(1)	
(d)	On average, an increase of 1 hPa in daily mean pressure results in a decrease of 0.223 mm in daily rainfall.	B1	3.4
		(1)	
(e)	Unreliable, as the large data set does not cover December.	B1	2.4
		(1)	
			(6 marks)

Notes:

(a) M1: At least one correct boundary point
A1: both upper boundary points and correct conclusions

(b) **B1ft:** A suitable description of correlation before and after.

(c) **B1:** For a comment that supports the idea that the sample is unlikely to be random.

(d) **B1:** For a suitable description of the rate : rainfall per number of hPa with reference to figures

(e) **B1:** For correct conclusion with a reason explaining why it would be extrapolation.
NB: B0 For out of range, extrapolation o.e. on their own without a reason.

Question	Scheme	Marks	AOs
4(a)	S and A since there is no intersection between A and S or the probability of S and A happening is zero	B1	1.2
		(1)	
(b)	$(0.1+p)¥\ 0.25=0.1$ $[p=0.3]$	M1	3.1b
	$q=0.15$ or $1-q=0.85$	M1	1.1b
	$r=1-"p"-"q"-0.25$	M1dd	3.1b
	$=0.3$	A1	1.1b
		(4)	
(c)	Independent since $0.25\times"0.2"=0.05$	B1	2.2a
		(1)	
(d)	The teacher's belief would appear not to be justified as D and S are independent	B1ft	2.4
		(1)	
			(7 marks)

Notes:

(a) B1: For S and A and a sensible reason

(b) M1: For forming a correct equation in terms of p using the information given.

M1: Writing or using $q=0.15$ or $1-q=0.85$

M1dd: dependent on both previous M marks being awarded. For using their values for p and q to form a correct equation to enable them to find r

A1: cao

(c) B1: Yes and a suitable reason to support their answer bringing together the two pieces of information to draw the correct conclusion

(d) B1: A correct comment following their answer to part (c) with reference to the teachers belief.

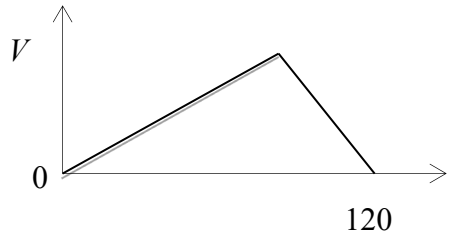
Question	Scheme	Marks	AOs
1(a)	Use of $s = vt - \frac{1}{2}at^2$	M1	2.1
	$19.6 = 4v - \frac{1}{2} \times 9.8 \times 4^2$	A1	1.1b
	$v = 24.5$ or 25 (m s^{-1})	A1	1.1b
		(3)	
(b)	$0 = 14.7^2 - 2 \times 9.8h$	M1	2.1
	$h = 11.0$ or 11 (m)	A1	1.1b
		(2)	
(c)	New value of speed would be lower.	B1	3.5a
		(1)	
			(6 marks)

Notes:

(a)
M1: Complete method to give equation in v only (could involve 2 or more *suvat* equations and then elimination) with usual rules
A1: Correct equation
A1: Correct answer

(b)
M1: Complete method to find h
A1: 11.0 or 11 (m)

(c)
B1: New value of speed will be lower

Question	Scheme	Marks	AOs
2(a)	 Shape	B1	1.1b
	V, 120	B1	1.1b
		(2)	
(b)	$\frac{1}{2}\times 120V = 1500$	M1	3.1b
	$V = 25$	A1	1.1b
		(2)	
(c)	Area of triangle = Distance travelled = $(\frac{1}{2}\times 120V) = 1500$	B1	2.4
	This does not depend on T so T can take any value where $0 < T < 120$	B1	2.4
		(2)	
(d)	Include a constant speed phase in the motion	B1	3.5c
		(1)	
			(7 marks)

Notes:

(a)
B1: Triangle, starting at the origin with base on axis and apex between $t = 0$ and $t = 120$
B1: V and 120 correctly marked (allow a delineator)

(b)
M1: Identifying correct strategy to solve problem to give equation in V only
A1: $V = 25$

(c)
B1: Area of triangle only depends on base and height
B1: So T can take any value $0 < T < 120$

(d)
B1: e.g. Include a *smooth* change from acceleration phase to deceleration phase.
e.g. Have a variable acceleration and/or deceleration phase

Question	Scheme	Marks	AOs
3(a)(i)	Equation of motion for P with usual rules	M1	3.3
	$T - 1.5 = 0.4 \times 2.5$	A1	1.1b
	$T = 2.5$ (N)	A1	1.1b
(ii)	Equation of motion for Q with usual rules	M1	3.3
	$10M - T = 2.5M$	A1	1.1b
	$M = 0.33$	A1	1.1b
		(6)	
(b)	$2 = \frac{1}{2} \times 2.5t^2$	M1	3.4
	$t = 1.3$ (s)	A1	1.1b
		(2)	
(c)	e.g. the mass of the rope	B1	3.5b
		(1)	
			(9 marks)

Notes:

(a) (i)
M1: Resolve horizontally for P
A1: Correct equation
A1: Correct answer. Ignore units

(a)(ii)
M1: Resolve vertically for Q
A1: Correct equation
A1: Correct answer

(b)
M1: Use $s = ut + \frac{1}{2}at^2$
A1: 1.3. Ignore units

(c)
B1: e.g. the pulley may not be smooth,
air resistance

Question	Scheme	Marks	AOs
4(a)	$s = \int_0^1 16 - 3t^2 \mathrm{d}t$	M1	1.1a
	$= \left[16t - t^3\right]_0^1$	A1	1.1b
	$= 15$ (m)	A1	1.1b
		(3)	
(b)	$16 - 3t^2 = 0$	M1	3.1b
	$t = \sqrt{\frac{16}{3}}$ oe	A1	1.1b
		(2)	
(c)	$16t - t^3 = 0$	M1	3.1b
	$t(16 - t^2) = 0$	M1	1.1b
	$t = 4$	A1	1.1b
		(3)	
			(8 marks)

Notes:

(a)
M1: Attempt to integrate, one power going up
A1: Correct integral and limits or indefinite integral with $C = 0$ and $t = 1$.
A1: 15 (m)

(b)
M1: Identifying correct strategy to solve problem of finding direction change by equating v to 0 and solving for t
A1: correct answer – any surd or decimal equivalent to at least 2 sf

(c)
M1: Identifying correct strategy to solve problem by using use $s = 0$ and equating their integral to 0
M1: Attempt to solve
A1: $t = 4$