

# A-LEVEL STATISTICS

Statistics 2 – SS02

Mark scheme

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6380  
June 2014

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Version/Stage: 1.0 Final

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

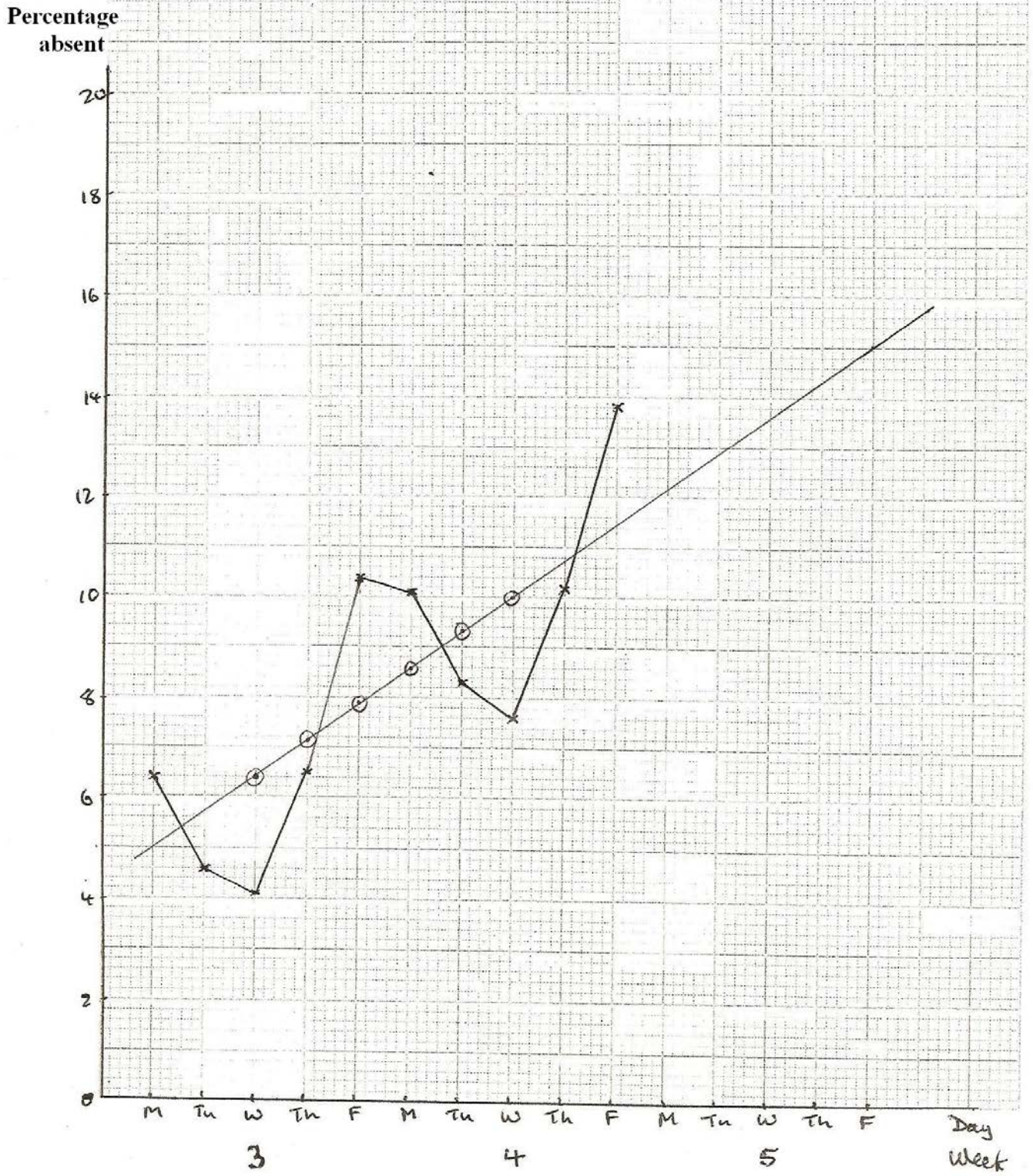
Further copies of this Mark Scheme are available from [aqa.org.uk](http://aqa.org.uk)

Q	Solution	Marks	Total	Comments
<b>1(a)(i)</b>	0.57	B1	<b>1</b>	CAO
<b>(ii)</b>	$360 \times 0.57, 0.32$ and $0.11$ $= 205.2^\circ, 115.2^\circ, 39.6^\circ$	M1 A1		<b>2</b>
<b>(b)</b>	Mean = $20 \times 0.57 + 50 \times 0.32 + 210 \times 0.11$ $= 50.5$ $20^2 \times 0.57 + 50^2 \times 0.32 + 210^2 \times 0.11 - 50.5^2$ $= 3328.75$ s.d = £57.70	M1 A1 M1 A1	<b>4</b>	
<b>(c)(i)</b>	Mean = $10 \times 0.57 + 50 \times 0.32 + 210 \times 0.11$ $= £44.80$	B1		<b>3</b>
<b>(ii)</b>	$1.2 \times 90 \times 44.80 - (50.5 \times 90)$ $= £293.40$	M1 A1	Accept £293	

Q	Solution	Marks	Total	Comments
<b>2(a)(i)</b>	$P(< 4) = P(\leq 3) = 0.558(4)$	B1	<b>1</b>	AWFW 0.558 to 0.559
<b>(ii)</b>	Using Po(13)  Use of $P(\leq 19) = 0.9573$ for top value subtract $P(\leq 10) = 0.2517$ for bottom value  giving 0.7056  SC Stating that $P(\leq 19) - P(\leq 10)$ is required but using wrong value of $\lambda$ earns a single M1	B1  M1 M1  A1		<b>4</b>
<b>(b)(i)</b>	$P(\text{at least } 1) = 1 - P(0)$ $= 1 - 0.0183 = 0.9817$ (or 0.982)	M1 A1	<b>2</b>	
<b>(ii)</b>	$0.9817^2 \times 0.0183$ $\times 3$ $= 0.0529$	M1 m1 A1		<b>3</b>
<b>(c)</b>	Mean = 100 Standard deviation = $\sqrt{100} = 10$	B1 B1	<b>2</b>	
<b>(d)</b>	Because we can no longer assume independence.	E1		<b>1</b>

Q	Solution	Marks	Total	Comments
<b>3(a)</b>	Division by 5	B1	<b>3</b>	CAO
	Addition of correct 5 values	M1		
	$(4.6 + 4.1 + 6.5 + 10.4 + 10.1) \div 5 = 7.14$	A1		
<b>(b)(i)</b>	Correct plot	B1	<b>2</b>	
	Reasonable trend line	B1		
<b>(ii)</b>	Seasonal variation	B1	<b>2</b>	
	about an upward linear trend	B1		
<b>(c)</b>	Friday effect = $[(10.4 - 7.9) + (13.8 - 11.5)] \div 2$	M1	<b>5</b>	Complete method 2.3 to 2.7 $\pm 0.5$ Dep on M1 AWFW 17 to 18 Dep on all previous marks having been gained
	= 2.4	A1		
	Trend line predicts 15.0	B1		
	Friday effect + trend line prediction	M1		
	= 17.4%	A1		
<b>(d)</b>	Less than forecast so some success.	E1	<b>2</b>	OE Max of 2 marks.
	Still more than week 4 so limited success.	E1		
	Any changes may have had nothing to do with incentives (trend must change some time)	E1		

Figure 1



Q	Solution	Marks	Total	Comments	
<b>4(a)</b>	The sample must be a <b>random</b> sample.	E1	<b>1</b>		
<b>(b)</b>	$H_0: \mu = 9.0$ $H_1: \mu \neq 9.0$ $z_{\text{crit}} = \pm 1.9600$ $z_{\text{test}} = (9.2 - 9.0) \div (1.3 \div \sqrt{120})$ $= 1.6853$ $z_{\text{test}} < z_{\text{crit}}$ so accept $H_0$ Insufficient evidence that the mean power of the batch is different from 9.0 watts.	B1 B1 B1 M1,m1 A1 A1 E1			<b>8</b>
<b>(c)(i)</b>	$H_1$ becomes $\mu > 9.0$	B1	<b>4</b>	PI by context statement. Dep on both B1s in (i) and (ii)	
<b>(ii)</b>	$z_{\text{crit}}$ becomes 1.6449	B1			AWFW 1.64 to 1.65
<b>(iii)</b>	Now we reject $H_0$ and say that there is sufficient evidence that the mean power of the batch is more than 9.0 watts.	B1 E1			

Q	Solution	Marks	Total	Comments
<b>5(a)</b>	Total for school = 750 Bronwyn needs $\frac{50}{750} = \frac{1}{15}$ of population Attempt to divide each cell by 15 Integer answers Boys 4 5 5 6 6 Girls 4 5 5 5 5	B1 M1 m1 A1	<b>4</b>	Possibly implied At least two $\neq 5$ seen
<b>(b)(i)</b>	All the boys followed by all the girls	B1		
<b>(ii)</b>	Choose a number between 1 and 15 at random using random numbers, calculator, etc Select every fifteenth pupil after that	B1 B1 B1	<b>4</b>	Any valid method suggested, dep on previous B1
<b>(c)</b>	Advantage – does not need to find particular pupils, quicker or easier. Disadvantage – groups arriving together are likely to have travelled together.	E1 E1		
			<b>2</b>	



Q	Solution	Marks	Total	Comments
<b>6(a)</b>	1964	B1	<b>1</b>	
<b>(b)</b>	The trend is downwards (decreasing or negative) from 1961 to 1977 and then upwards (increasing or positive) to 2010.	M1 A1	<b>2</b>	For the downwards then upwards For details of the years.
<b>(c)</b>	$(86746 - 40591) = 46155$ $\div 86746 \times 100$ (completion of method) $= 53.2\%$	M1 m1 A1	<b>3</b>	For both correct and subtraction Or $100 - (40591 \times 100/86746)$ Accept 53% from correct working.
<b>(d)(i)</b>	Evidence of 40,591, 177,903, 377,136, 579,593, 695,434 and 723,165 being used. Accurately plotted	M1 A1 A1	<b>3</b>	At least 4 accurate (2 s.f.) Completely correct
<b>(ii)</b>	Attempt to read at ~360,000 25.5 to 26, 29.5 to 30 Median age in 2010 is 4 years higher.	M1 A1 A1	<b>3</b>	AWRT 4. Not simply “higher”
<b>(e)</b>	Omitting 88, 86, 95 Omitting second 81 or 00 Completely correct list 20, 80, (0)9, 13, 28, 49, 74, 81, (0)3	M1 M1 A1	<b>3</b>	Either of these. Indep of previous M1 SC If neither of M1 marks are earned but 2-digit numbers from the correct column are given then award B1

