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Key to mark scheme and abbreviations used in marking

M	mark is for method		
m or dM	mark is dependent on one or more M marks and is for method		
A	mark is dependent on M or m marks and is for accuracy		
B	mark is independent of M or m marks and is for method and accuracy		
E	mark is for explanation		
✓ or ft or F	follow through from previous		
	incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	OE	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
-x EE	deduct x marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

Application of Mark Scheme

No method shown:

Correct answer without working

mark as in scheme

Incorrect answer without working

zero marks unless specified otherwise

More than one method / choice of solution:

2 or more complete attempts, neither/none crossed out

mark both/all fully and award the mean mark rounded down

1 complete and 1 partial attempt, neither crossed out

award credit for the complete solution only

Crossed out work

do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method

award method and accuracy marks as appropriate

Free-Standing Mathematics Qualification

Advanced Level: Using and Applying Statistics (6990/2)

Answers and Marking Scheme – June 2011

Question 1

(a)	18.3 – 14.3 (= 4) $\frac{\text{their 4}}{14.3} \times 100$ (= 27.97... %)	B1 B1	OE
(b)	$\frac{18.3}{70} \times 100$ 26.1 – 18.3 = 7.8(4...) million	M1 M1 A1	OE $\frac{18.3}{0.7}$ M2 7.8m or better, must have units
	TOTAL	5	

Question 2

(a)(i)	2008 Q4 and 2009 Q1	B1	
(a)(ii)	1422 – 1059.9 362.(1) thousand	M1ft A1	must have units
(b)(i)	positive gradient or increasing	B1	
(b)(ii)	recession or unemployment rising etc.	B1	
(c)	recognise compound reduction arriving at Q4 2011 = 1275.75 arriving at (Q3 2012) = 930.02 stating Q3 2012	M1 A1 A1 A1	$\times 0.9 \dots \times 0.9$ etc Correct answer without working \Rightarrow SC2
	TOTAL	9	

Question 3

(a)	Obtaining (9.6), 30.6, 51.7, 70.9, 86.9, 92.5, 95.0, 97.3, (100.1) Rounding errors	B1 B1	Or percentages are to 1 dp
(b)	plotting the percentage cumulative frequencies at upper cumulative boundaries their heights (± 1 sq) joined by curve or straight lines	M1 A1 A1	on boundaries must be an increasing function or cumulative bar chart \Rightarrow M1 A1 A0 fully correct
(c)(i)	median ≈ 4.9 km (≤ 5) For a correct graph accept any value 4.5 – 5	B1ft	part (c)(i) and (c)(ii) and (d)(i) must be from an increasing non-linear function allow tolerance $\pm \frac{1}{2}$ sq
(c)(ii)	their 12.5 (11 – 13) – their 1.75 (< 2) for correct graphs ≈ 10.75 (9 – 12)	M1 A1ft	correctly locating and attempting to subtract their quartiles
(d)(i)	Box and quartiles drawn ft correctly from their graph whiskers to 0 km and 80 km	B1ft B1	Can only ft drawn cumulative frequency curve (Not cumulative bar chart or single points) both whiskers correct $\pm \frac{1}{2}$ sq
(d)(ii)	Positive skew	B1	Or a good description of positive skew
(d)(iii)	(Median of England is greater than the median of Newcastle-upon-Tyne suggesting) people in Newcastle-upon-Tyne do not travel as far to work. The interquartile range of England is much greater than that for Newcastle-upon-Tyne which suggests that people in Newcastle-upon-Tyne are more consistent in their distances travelled to work.	B1 B2	Not ft. Do not allow if (c)(i) and (c)(ii) are vastly incorrect eg 50 and 39 km. B1 for just saying greater in England with nothing in context
	TOTAL	14	

Question 4

(a)	The mean number of days is +9 meaning that the Oak first leafed on average around the 29 th April each year	B2	B1 for +9
(b)	$\bar{x} = -12.3$ $\sum (x_i - \bar{x})^2 = 412.06$ $\sigma_n = 6.42$	B1 M1 A1 A1	accept $\sigma_{n-1} = 6.77$
(c)	<p>On average, the Oak is first leafing about April 8th in the 90s which is 3 weeks before it was first leafing in the 50s</p> <p>The sd is less in the 90s compared to the 50s</p> <p>The numbers are more consistent in the 90s than in the 50s</p>	B1 B1 B1	<p>Leaves appear much earlier in the 90s</p> <p>Or 21.(3) days difference</p> <p>Can imply second B1</p>
(d)	These data seem to support the idea of global warming in that the Oak first leaves are much earlier because of the warmer weather	B1	<p>OR The claim appears to be correct but it may not be correct it could just be natural variation</p> <p>OR There is not enough evidence</p>
	TOTAL	10	

Question 5

(a)(i)	$\bar{x} = 11.8$	B1	3sf or better
(a)(ii)	$\bar{y} = 75.5$	B1	
(b)(i)	$r = 0.996$	B1	3sf or better from 0.99557863
(b)(ii)	r is very high and positive suggesting that there is strong positive correlation between the foot length and height of these boys.	B1	Do not accept perfect positive correlation
(c)(i)	$y = 5.77x + 7.41$	B2	B1 if both correct but either not to 2dp a, b interchanged = SC1
(c)(ii)	$a = 5.77$ which is the regression coefficient it tells us the gradient of the regression line it means as foot length increases by 1 cm height increases by 5.77 cm	B1 B1ft	ft their a
(c)(iii)	calculate and plot two points within the grid using their equation (x -intercept $> 7.2, < 7.5$) if no x -intercept check for $(9, 59.3 - < 60)$ point draw line through their two points	M1 M1 A1ft	or use their (\bar{x}, \bar{y}) as one point correctly calculated points plotted incorrectly implies SC1 SC1 line drawn through (\bar{x}, \bar{y}) with positive gradient $\pm \frac{1}{2}$ sq
(d)	Use their equation with $x = 13.8$; " $y = 5.77 \times 13.8 + 7.41$ " 87 cm	M1 A1ft	can use the <u>correct</u> drawn line not an incorrectly drawn line NB 108.0 (a, b interchanged)
	TOTAL	13	

Question 6

(a)	$P(M > 27) \equiv P\left(Z < \frac{27 - 24.9}{1.05}\right) \text{ or } P(Z > 2)$ $1 - \Phi(2)$ $1 - 0.9772$ 0.0228	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>penalise 1 mark for incorrect standardising</p>
(b)	$P(22 < W < 25) = P\left(\frac{22 - 22.8}{0.89} < Z < \frac{25 - 22.8}{0.89}\right)$ $P(-0.899 < Z < 2.47)$ $\Phi(2.47) - [1 - \Phi(.899)]$ $(\equiv 0.9932 - [1 - 0.8156]) \times 100$ $82\% \text{ or } 81\%$	<p>M1</p> <p>A1,A1</p> <p>M1</p> <p>A1</p>	$\frac{22.8 - 22}{0.89} < Z < \frac{22.8 - 25}{0.89}$ $0.899, -2.47$ <p>penalise 1 mark for incorrect standardising</p> <p>allow no interpolation</p> $\Phi(2.47) - [1 - \Phi(0.90)]$ $(\equiv 0.9932 - [1 - 0.8159]) \times 100$ <p>from 81.88% or 80.91%</p>
	TOTAL	9	
	TOTAL MARK FOR PAPER	60	