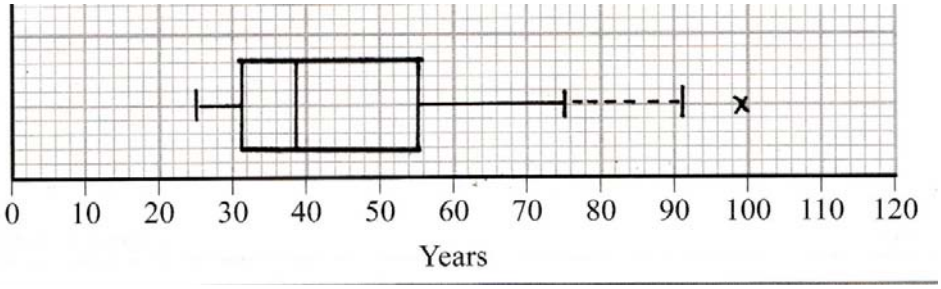
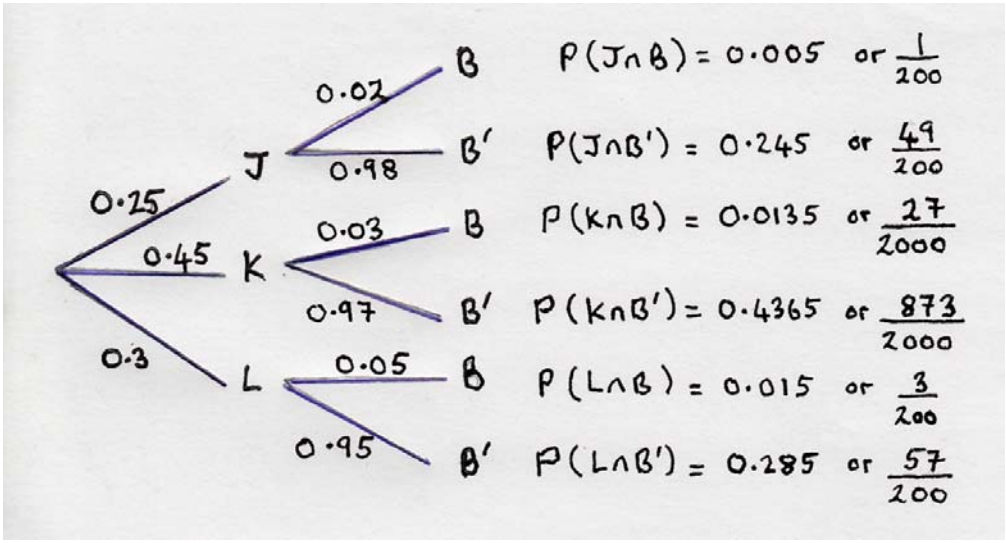
Question Number	Scheme		Marks
1. (a)	$a = 44$ $b = 76$	These answers may be in or near the table	B1 B1 **(2)**
(b)	$55+1.5(55-31)=91$ [and $31-1.5(55-31)=-5$] **Penville**  		M1 B1 B1 A1 **(4)**
(c)	Greenslax : $[Q_2-Q_1=20,\ Q_3-Q_2=12$ or $(Q_2-Q_1)>(Q_3-Q_2)]\Rightarrow$ −ve(skew) Penville: $[Q_2-Q_1=8,\ Q_3-Q_2=16$ or $(Q_3-Q_2)>(Q_2-Q_1)]\Rightarrow$ +ve (skew) Don't insist on seeing "skew" so just –ve and +ve will do. Treat "correlation" as ISW Justification that is consistent		B1 B1 ddB1 **(3)** **Total 9**
	Notes		
(b)	**A fully correct box plot scores 4/4. If <u>not</u> fully correct apply scheme and need evidence for M1** **If two box plots are seen ignore the one for Greenslax. If not on graph paper M1 max for (b)** M1 for sight of $55+1.5(55-31)$ <u>or</u> 91 seen (possibly implied by RH whisker of box plot) May be implied by a fully correct box plot 1st B1 box with whiskers (condone missing median) 2nd B1 25, 31, 39, 55, RH whisker to end at 75 or 91. Two RH whiskers is B0 Accuracy must be to within 0.5 of a square so e.g. lower quartile at 30 or 32 is OK		
(c)	A1 only one outlier plotted at 99. Allow cross to be vertically displaced If the RH whisker goes to 99 (2nd B0) <u>and</u> A0 even if outlier is identified since we require a horizontal "gap" between RH whisker and outlier. 1st B1 Greenslax − ve (skew) 2nd B1 Penville + ve (skew). We must be able to tell which is which but labels may be implied by their <u>values</u> but not simply from $Q_3-Q_2>Q_2-Q_1$ If there is just <u>one</u>, unlabelled comment assume Penville. 3rd ddB1 dependent on 1st and 2nd B marks being scored. Justification for <u>both</u> based on: quartiles, median relative to quartiles, or "tail" If only values for Q_3-Q_2 etc are <u>given</u> they should be correct ft for Greenslax and correct for Penville If values for Greenslax imply +ve skew then 1st B0 and 3rd B0		

Question Number	Scheme	Marks
2	mean $= \frac{60.8+20}{1.4}$ <u>or</u> $60.8 = 1.4x - 20$ (o.e.)	M1
	$= 57.7142\ldots$ awrt **57.7**	A1
	standard deviation $= \frac{6.60}{1.4}$ <u>or</u> $6.60 = 1.4x$	M1
	$= 4.7142\ldots$ awrt **4.71**	A1
		(4)
		Total 4
	Notes	
	1st M1 sub. 60.8 for *y* into a correct equation. Allow use of *x* or any other letter or expression for mean 1st A1 for awrt 57.7 or $\frac{404}{7}$ (o.e.). Correct answer only is 2/2 2nd M1 sub. 6.60 or 6.6 for *y* and ignoring the 20 Allow use of *x* or any other letter or expression for st. dev. $6.60^2 = 1.4^2 x^2$ is M0 until we see them take a square root. 2nd A1 for awrt 4.71 or $\frac{33}{7}$ (o.e.). Correct answer only is 2/2	

Question Number		Scheme	Marks
3	(a)	$r = \dfrac{31512.5}{\sqrt{42587.5 \times 25187.5}} = 0.962$ awrt **0.962**	M1 A1 **(2)**
	(b)	r is close to 1 <u>or</u> a **strong correlation**. ["points are close to a straight line" isB0] [Just "positive" correlation is B0] [Use of "relationship" or "skew" not "correlation" is B0]	B1 **(1)**
	(c)	$b = \dfrac{31512.5}{42587.5} = 0.739947... = 0.740$ (3 dp) **0.740** (only)	M1 A1cao **(2)**
	(d)	$a = 1326.25 - (0.7399\ldots \times 2423.75)$ [$= -467.2$ or awrt -467]	M1
		So $\boldsymbol{m = -467 + 0.74v}$	A1 **(2)**
	(e)	b is the <u>money (spent)</u> per <u>visitor</u>. (i.e. definition of a rate in words.)[ignore values]	B1
		So each 1000 visitors generates an extra £0.74 million <u>or</u> each visitor spends £740 oe	B1ft **(2)**
	(f)	$m = -467 + 0.74 \times 2500$	M1
		$m = 1383$ (£ million) awrt **1380**	A1 **(2)**
	(g)	As 2500 is within the range of the data set <u>or</u> it involves <u>interpolation</u>.	B1
		The value of money spent is reliable	dB1 **(2)**
			Total 13

	Notes
(a)	M1 for a correct expression for r. Ans only of 0.96 or awrt 0.96 is M1A0 Ans only of 0.962 or awrt 0.962 is M1A1. Do not allow fractions for A1
(b)	B1 for comment implying strong correlation. (e.g. big/high/clear etc) B0 if $\lvert r \rvert > 1$
(c)	M1 for a correct expression for b (may be implied by 0.74 or better in regression equation)
	A1 A1 for 0.740 only in (c) or $b = 0.740$ seen elsewhere (M1A0 for $\dfrac{2521}{3407}$ or awrt 0.74 here)
(d)	M1 for $1326.25 -$ ('their b' $\times$ 2423.75) Condone fractions or awrt 1330 for $\bar{m}$ and awrt 2420 for $\bar{v}$ A1 for a correct equation in m and v with a = awrt -467 and b = awrt 0.74 Condone $\frac{2521}{3407}$ for b and $\frac{-1591740}{3407}$ for a. [Equation in y and x is A0]
(e)	1st B1 for a correct definition of the rate in words. Must state or imply "money per visitor" Allow alternative words or symbols e.g. £ or "pounds" for money, "people" for visitors etc 2nd B1ft for a correct numerical rate (ft their value of b) e.g. "each <u>visitor</u> <u>spends</u> £740" is B1B1, "b is the extra <u>money</u> spent per <u>visitor</u>" is B1B0 [no values] "b is increase of <u>£0.74 million</u> in m as v increases <u>by 1000</u>" is B0B1[£ for money but no "visitors"] "increase in <u>m</u> as <u>v</u> increases" is B0B0 [Idea of rate but letters not words and no numerical value of rate]
(f)	M1 sub. $v = 2500$ into <u>their</u> equation. Simply substituting 2 500 000 is M0 (unless adjusted eqn) A1 awrt 1380 units (£ and million not required)
(g)	1st B1 for 2500 <u>or</u> 2 500 000 <u>or</u> visitors <u>or</u> v is in range. "it" is B0 unless v clearly implied 2nd dB1 for stating it <u>is</u> reliable. Dependent on previous B mark being awarded "both v and m in range" <u>or</u> "1380 in range" is B0 but use ISW so "interpolation since both in range" scores B1 for the "interpolation". "Not extrapolation" counts as "interpolation"

Question Number	Scheme	Marks
4 (a)		M1 A1 **(2)**
(b)	0.25×0.98, = **0.245** (or exact equiv. e.g. $\frac{49}{200}$)	M1A1 **(2)**
(c)	$0.25\times0.02+0.45\times0.03+0.3\times0.05$, = **0.0335** (or exact equiv. e.g. $\frac{67}{2000}$)	M1A1 **(2)**
(d)	$[\mathrm{P}(J\cup L\mid B)] = \frac{0.25\times0.02+0.3\times0.05}{0.0335}$ or $\frac{0.0335-0.45\times0.03}{0.0335}$ $=0.5970...$ awrt **0.597** (or $\frac{40}{67}$ or exact equiv.)	M1A1ft A1 **(3)**
	Notes	**Total 9**
	Allow fractions or percentages throughout this question	
(a)	Allow 3+6 tree diagram with the 6 correct "end" probs and labels to get 2/2 (1st, 3rd, 5th gets M1) M1 for (3+6) tree drawn with 0.25, 0.45, 0.02, 0.03, 0.05 on correct branches A1 for 0.3, 0.98, 0.97, 0.95 on the correct branches and labels, condone missing B's **Correct answer only scores full marks for parts (b), (c) and (d)** **When using "their probability p" for M1 and A1ft they must have $0 < p < 1$**	
(b)	M1 for $0.25\times$ 'their 0.98' o.e.	
(c)	M1 for $0.25\times$their $0.02+0.45\times$their $0.03+$their $0.3\times$their 0.05 Condone 1 transcription error. Or $1-(0.25\times\text{their } 0.98+0.45\times\text{their } 0.97+\text{their } 0.3\times\text{their } 0.95)$	
(d)	M1 for use of conditional probability with their (c) as denominator. Also exactly 2 products on num' and at least one correct (or correct ft) or their (c) – one of the products from their (c). Ignore an incorrect expression inside their probability statement A1ft for $\frac{0.25\times\text{their } 0.02+\text{their } 0.3\times\text{their } 0.05}{\text{their(c)}}$ or $\frac{\text{their (c)}-0.45\times\text{their } 0.03}{\text{their (c)}}$ or $\frac{0.02}{\text{their (c)}}$ A1 awrt 0.597 or exact fraction e.g. $\frac{40}{67}$	

Question Number		Scheme	Marks
6	(a)	70 – 80 group - width **0.5 (**cm)	B1
		1.5 cm^2 is 10 customers <u>or</u> 3.75cm^2 is 25 customers <u>or</u> $0.5c = 3.75$ <u>or</u> $\frac{2.5}{\frac{1}{3}}$	M1
		70 – 80 group - height **7.5 (**cm)	A1
			(3)
	(b)	Median $= (70) + \frac{13.5}{25} \times 10$ allow $(n+1) = (70) + \frac{14}{25} \times 10$	M1
		$=$ **75.4** (or if using $(n+1)$ allow 75.6)	A1
			(2)
	(c)	$\left[\text{Mean} = \frac{6460}{85}\right] =$ **76**	B1
		$\sigma = \sqrt{\frac{529400}{85} - 76^2}$	M1
		$= 21.2658\ldots\ldots$ $(s = 21.3920)$ **awrt 21.3**	A1
			(3)
	(d)	Coeff' of skewness $= \frac{3(76 - 75.4)}{21.2658...} = 0.08464\ldots$ **awrt 0.08** (awrt 0.06 for 75.6)	M1 A1
		There is (very slight) positive skew or the data is almost symmetrical (or both) <u>Any</u> mention of "correlation" is B0	B1ft
			(3)
			Total 11

	Notes
(a)	B1 for 0.5
	M1 for one of the given statements <u>or</u> any method where "their width" × "their height" = 3.75 Correct height scores M1A1 independent of width so B0M1A1 is possible.
(b)	M1 for a correct fraction: $+\frac{k}{25} \times 10$ where $k = 13.5$ or 14 for $(n+1)$ case.
	NB may work down so look out for $(80) - \frac{11.5}{25} \times 10$ etc **Beware:** $69.5 + \frac{13.5}{25} \times 11 = 75.44$ (but M0)
(c)	M1 for a correct expression with square root, ft their mean A1 for awrt 21.3 or, if clearly using *s* allow awrt 21.4. Must be evaluated...no surds.
(d)	M1 sub. their values into formula allow use of *s* but their σ or *s* must be > 0 A1 for awrt 0.08 but accept 0.085 No fraction B1ft for a correct comment compatible with their coefficient. Allow "symmetrical" for |coeff'| < 0.25 They may say it is "slightly skew" so omit "positive" but do not allow "negative" if coef' +ve Condone "strongly" positive skew.

Question Number	Scheme	Marks
8 (a)	$[\,P(A) = 1 - 0.18 - 0.22\,]$ = **0.6** (or exact equivalent)	B1 **(1)**
(b)	$P(A \cup B) = "0.6" + 0.22$ = **0.82** (or exact equivalent)	B1ft **(1)**
(c)	$x = P(A \cap B)$ | Use $P(B)P(A' \mid B) = P(A' \cap B)$ | **Establish** independence before or after 1st M1and score marks for (d) (RH ver)	M1
	$\frac{x}{x+0.22} = 0.6$ | $P(B) \times [1 - 0.6] = 0.22$ | **Find** $P(B)$	
	$x = 0.6x + 0.132$ | Use $P(A \cap B) = P(A \mid B)P(B)$ | Use $P(B)P(A) = P(A \cap B)$	dM1
	$0.4x = 0.132$ | $P(A \cap B) = 0.6 \times 0.55$ | $P(A \cap B) = 0.6 \times 0.55$	
	$x =$ **0.33** (or exact equivalent)	A1cso **(3)**
(d)	$P(B) = 0.55$	
	$P(B) \times P(A) = 0.55 \times 0.6$ $= 0.33$	**or** stating $P(A) = P(A\|B)$ [= 0.6]	M1
	$P(B) \times P(A) = P(A \cap B)$ therefore (statistically) independent	**or** $P(A) = P(A\|B)$ therefore (statistically) independent	A1cso **(2)**
		Total 7

	Notes
(b)	B1ft for their (a) + 0.22 or $1 - P(A' \cap B')$ Do not ft their (a) if it is > 0.78
	NB 3 versions for (c). Check carefully that Ms are genuinely scored.
	Look out for <u>assuming independence</u> and if you see P(*B*) = 0.55 check it is <u>derived</u> properly
(c)	1st M1 for a correct equation for x e.g. $\frac{x}{x+0.22} = 0.6$ <u>or</u> a correctly derived equation for $P(B)$
	2nd dM1 for solving to get in form $kx = L$ <u>or</u> <u>correct</u> use of $P(B)$ to find $P(A \cap B)$ [2nd or 3rd ver] <u>or</u> $P(A \cap B) = P(B) - 0.22$
	A1cso for 0.33 Dep. on <u>both</u> Ms and no incorrect working seen.
(d)	M1 for finding $P(B) \times P(A) = 0.33$ (values needed) <u>or</u> stating $P(A) = P(A\|B)$ (= 0.6 not needed)
	A1cso for a correct statement: $P(B) \times P(A) = P(A \cap B)$ or $P(A) = P(A\|B)$ <u>and</u> stating independent
	NB The M1 in (d) using $P(A \cap B)$ requires $P(B) = 0.55$ There is no ft of an incorrect $P(B)$ Full marks in (d) is OK even if 0/3 in (c)
	{This Venn diagram may be helpful.}