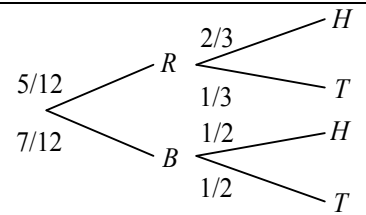


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Question Number	Scheme	Marks
Q1 (a)	$r = \frac{8825}{\sqrt{1022500 \times 130.9}}, \quad = \text{awrt } \underline{0.763}$	M1 A1 (2)
(b)	Teams with high attendance scored more goals (oe, statement in context)	B1 (1)
(c)	0.76(3)	B1ft (1)
Total 4		
(a)	M1 for a correct expression, square root required Correct answer award 2/2	
(b)	Context required (attendance and goals). Condone causality. B0 for 'strong positive correlation between attendance and goals' on its own oe	
(c)	Value required. Must be a correlation coefficient between -1 and +1 inclusive. B1ft for 0.76 or better or same answer as their value from part (a) to at least 2 d.p.	

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Question Number	Scheme	Marks
<p>Q2 (a)</p> <div style="text-align: center;">  </div> <p>(b) $P(H) = \frac{5}{12} \times \frac{2}{3} + \frac{7}{12} \times \frac{1}{2} = \frac{41}{72}$ or awrt 0.569</p> <p>(c) $P(R H) = \frac{\frac{5}{12} \times \frac{2}{3}}{\frac{41}{72}} = \frac{20}{41}$ or awrt 0.488</p> <p>(d) $\left[\frac{5}{12} \right]^2 + \left[\frac{7}{12} \right]^2 = \frac{25}{144} + \frac{49}{144} = \frac{74}{144}$ or $\frac{37}{72}$ or awrt 0.514</p>	<p style="text-align: center;">P(R) and P(B) 2nd set of probabilities</p> <p style="text-align: right;">B1 B1 (2) M1 A1 (2) M1 A1ft A1 (3) M1 A1ft A1 (3) Total 10</p>	
<p>(a)</p> <p>Formula seen</p> <p>Formula not seen</p> <p>(d)</p>	<p>1st B1 for the probabilities on the first 2 branches. Accept 0.416̇ and 0.583̇ 2nd B1 for probabilities on the second set of branches. Accept 0.6̇, 0.3̇, 0.5 and $\frac{1.5}{3}$ Allow exact decimal equivalents using clear recurring notation if required.</p> <p>M1 for an expression for P(H) that follows through their sum of two products of probabilities from their tree diagram</p> <p>M1 for $\frac{P(R \cap H)}{P(H)}$ with denominator their (b) substituted e.g. $\frac{P(R \cap H)}{P(H)} = \frac{\frac{5}{12}}{\text{(their (b))}}$ award M1.</p> <p>M1 for $\frac{\text{probability} \times \text{probability}}{\text{their } b}$ but M0 if fraction repeated e.g. $\frac{\frac{5}{12} \times \frac{2}{3}}{\frac{2}{3}}$.</p> <p>1st A1ft for a fully correct expression or correct follow through 2nd A1 for $\frac{20}{41}$ o.e.</p> <p>M1 for $\left[\frac{5}{12} \right]^2$ or $\left[\frac{7}{12} \right]^2$ can follow through their equivalent values from tree diagram 1st A1 for both values correct or follow through from their original tree and + 2nd A1 for a correct answer Special Case $\frac{5}{12} \times \frac{4}{11}$ or $\frac{7}{12} \times \frac{6}{11}$ seen award M1A0A0</p>	

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Question Number	Scheme	Marks
Q3 (a)	$2a + \frac{2}{5} + \frac{1}{10} = 1$ <p style="text-align: right;">(or equivalent)</p> $\underline{a = \frac{1}{4} \text{ or } 0.25}$	M1 A1 (2)
(b)	$E(X) = \underline{1}$	B1 (1)
(c)	$E(X^2) = 1 \times \frac{1}{5} + 1 \times \frac{1}{10} + 4 \times \frac{1}{4} + 9 \times \frac{1}{5} \quad (= 3.1)$ $\text{Var}(X) = 3.1 - 1^2, \quad = \underline{2.1 \text{ or } \frac{21}{10} \text{ oe}}$	M1 M1 A1 (3)
(d)	$\text{Var}(Y) = (-2)^2 \text{Var}(X), \quad = \underline{8.4 \text{ or } \frac{42}{5} \text{ oe}}$	M1 A1 (2)
(e)	$X \geq Y$ when $X = 3$ or 2 , so probability = " $\frac{1}{4}$ " + " $\frac{1}{5}$ " $= \underline{\frac{9}{20} \text{ oe}}$	M1 A1ft A1 (3)
Total 11		
(a)	M1 for a clear attempt to use $P(X = x) = 1$ Correct answer only 2/2. NB Division by 5 in parts (b), (c) and (d) seen scores 0. Do not apply ISW.	
(b)	B1 for 1	
(c)	1 st M1 for attempting $x^2 P(X = x)$ at least two terms correct. Can follow through. 2 nd M1 for attempting $E(X^2) - [E(X)]^2$ or allow subtracting 1 from their attempt at $E(X^2)$ provided no incorrect formula seen. Correct answer only 3/3.	
(d)	M1 for $(-2)^2 \text{Var}(X)$ or $4\text{Var}(X)$ Condone missing brackets provided final answer correct for their $\text{Var}(X)$. Correct answer only 2/2.	
(e)	Allow M1 for distribution of $Y = 6 - 2X$ and correct attempt at $E(Y^2) - [E(Y)]^2$ M1 for identifying $X = 2, 3$ 1 st A1ft for attempting to find their $P(X=2) + P(X=3)$ 2 nd A1 for $\frac{9}{20}$ or 0.45	

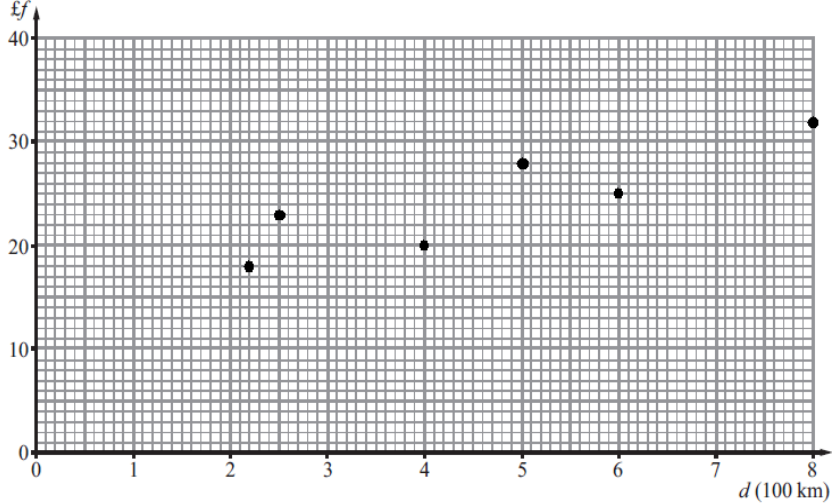
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Question Number	Scheme	Marks
Q4 (a)	$\frac{2+3}{\text{their total}} = \frac{5}{\text{their total}} = \frac{1}{6}$ (** given answer**)	M1 A1cso (2)
(b)	$\frac{4+2+5+3}{\text{total}}, = \frac{14}{30}$ or $\frac{7}{15}$ or 0.46	M1 A1 (2)
(c)	$P(A \cap C) = 0$	B1 (1)
(d)	$P(C \text{reads at least one magazine}) = \frac{6+3}{20} = \frac{9}{20}$	M1 A1 (2)
(e)	$P(B) = \frac{10}{30} = \frac{1}{3}, P(C) = \frac{9}{30} = \frac{3}{10}, P(B \cap C) = \frac{3}{30} = \frac{1}{10}$ or $P(B C) = \frac{3}{9}$ $P(B) \times P(C) = \frac{1}{3} \times \frac{3}{10} = \frac{1}{10} = P(B \cap C)$ or $P(B C) = \frac{3}{9} = \frac{1}{3} = P(B)$ So yes they are statistically independent	M1 M1 A1cso (3)
	Total 10	
(a)	M1 for $\frac{2+3}{\text{their total}}$ or $\frac{5}{30}$	
(b)	M1 for adding at least 3 of "4, 2, 5, 3" and dividing by their total to give a probability Can be written as separate fractions substituted into the completely correct Addition Rule	
(c)	B1 for 0 or 0/30	
(d)	M1 for a denominator of 20 or $\frac{20}{30}$ leading to an answer with denominator of 20 $\frac{9}{20}$ only, 2/2	
(e)	1 st M1 for attempting all the required probabilities for a suitable test 2 nd M1 for use of a correct test - must have attempted all the correct probabilities. Equality can be implied in line 2. A1 for fully correct test carried out with a comment	

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Question Number	Scheme	Marks
Q5	(a) 23, 35.5 (may be in the table)	B1 B1 (2)
	(b) Width of 10 units is 4 cm so width of 5 units is <u>2 cm</u> Height = $2.6 \times 4 = \underline{10.4 \text{ cm}}$	B1 M1 A1 (3)
	(c) $\left \begin{array}{l} fx = 1316.5 \diamond \bar{x} = \frac{1316.5}{56} = \text{awrt } \underline{23.5} \\ \\ \text{So } \sigma = \sqrt{\frac{37378.25}{56} - \bar{x}^2} = \text{awrt } \underline{10.7} \end{array} \right.$ allow $s = 10.8$	M1 A1 B1 M1 A1 (5)
	(d) $Q_2 = (20.5) + \frac{(28-21)}{11} \times 5 = 23.68\dots$ awrt <u>23.7 or 23.9</u>	M1 A1 (2)
	(e) $Q_3 - Q_2 = 5.6, Q_2 - Q_1 = 7.9$ (or $\bar{x} < Q_2$) [7.9 > 5.6 so] <u>negative skew</u>	M1 A1 (2)
		Total 14
(b)	M1 for their width x their height=20.8. Without labels assume width first, height second and award marks accordingly.	
(c)	1 st M1 for reasonable attempt at $\left \begin{array}{l} x \text{ and } /56 \\ \\ 2^{\text{nd}} \text{ M1 for a method for } \sigma \text{ or } s, \sqrt{\quad} \text{ is required} \\ \text{Typical errors } \left \begin{array}{l} (fx)^2 = 354806.3 \text{ M0, } \left \begin{array}{l} f^2x = 13922.5 \text{ M0 and } \left(\left \begin{array}{l} fx \end{array} \right)^2 = 1733172 \text{ M0} \end{array} \right. \end{array} \right. \end{array} \right.$ Correct answers only, award full marks.	
(d)	Use of $\left \begin{array}{l} f(x - \bar{x})^2 = \text{awrt } 6428.75 \text{ for B1} \\ \\ \text{lcb can be } 20, 20.5 \text{ or } 21, \text{ width can be } 4 \text{ or } 5 \text{ and the fraction part of the formula correct for M1 - Allow } 28.5 \text{ in fraction that gives awrt } 23.9 \text{ for M1A1} \end{array} \right.$	
(e)	M1 for attempting a test for skewness using quartiles or mean and median. Provided median greater than 22.55 and less than 29.3 award for M1 for $Q_3 - Q_2 < Q_2 - Q_1$ without values as a valid reason. SC Accept mean close to median and no skew oe for M1A1	

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Question Number	Scheme	Marks
<p>Q6 (a)</p>		<p>B1 B1</p> <p>(2)</p>
(b)	<p>The points lie reasonably close to a straight line (o.e.)</p>	<p>B1</p> <p>(1)</p>
(c)	<p>$d = 27.7$, $f = 146$ (both, may be implied)</p>	<p>B1</p>
(d)	<p>$S_{dd} = 152.09 - \frac{(27.7)^2}{6} = 24.208\dots$ awrt <u>24.2</u></p>	<p>M1 A1</p>
(d)	<p>$S_{fd} = 723.1 - \frac{27.7 \times 146}{6} = 49.06\dots$ awrt <u>49.1</u></p>	<p>A1</p> <p>(4)</p>
(d)	<p>$b = \frac{S_{fd}}{S_{dd}} = 2.026\dots$ awrt <u>2.03</u></p>	<p>M1 A1</p>
(d)	<p>$a = \frac{146}{6} - b \times \frac{27.7}{6} = 14.97\dots$ so <u>$f = 15.0 + 2.03d$</u></p>	<p>M1 A1</p> <p>(4)</p>
(e)	<p>A flight costs £2.03 (or about £2) for every extra 100km or about 2p per km.</p>	<p>B1ft</p> <p>(1)</p>
(f)	<p>$15.0 + 2.03d < 5d$ so $d > \frac{15.0}{(5-2.03)} = 5.00 \sim 5.05$</p> <p>So $t > 500 \sim 505$</p>	<p>M1</p> <p>A1</p> <p>(2)</p>
		<p>Total 14</p>

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- (a) 1st B1 for at least 4 points correct (allow \pm one 2mm square)
2nd B1 for all points correct (allow \pm one 2 mm square)
- (b) Ignore extra points and lines
Require reference to points and line for B1.
- (c) M1 for a correct method seen for either - a correct expression
1st A1 for S_{dd} awrt 24.2
2nd A1 for S_{fd} awrt 49.1
- (d) 1st M1 for a correct expression for b - can follow through their answers from (c)
2nd M1 for a correct method to find a - follow through their b and their means
2nd A1 for $f = \dots$ in terms of d and all values awrt given expressions. Accept 15 as rounding from correct answer only.
- (e) Context of cost and distance required. Follow through their value of b
- (f) M1 for an attempt to find the intersection of the 2 lines. Value of t in range 500 to 505 seen award M1.
Value of d in range 5 to 5.05 award M1.
Accept t greater than 500 to 505 inclusive to include graphical solution for M 1A1

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Question Number	Scheme	Marks
Q7 (a)	$P(D > 20) = P\left[Z > \frac{20-30}{8}\right]$ $= P(Z > -1.25)$ $= \underline{\underline{0.8944}} \qquad \qquad \qquad \underline{\underline{\text{awrt } 0.894}}$	M1 A1 A1 (3)
(b)	$P(D < Q_3) = 0.75 \text{ so } \frac{Q_3 - 30}{8} = 0.67$ $Q_3 = \underline{\underline{\text{awrt } 35.4}}$	M1 B1 A1 (3)
(c)	$35.4 - 30 = 5.4 \text{ so } Q_1 = 30 - 5.4 = \underline{\underline{\text{awrt } 24.6}}$	B1ft (1)
(d)	$Q_3 - Q_1 = 10.8 \text{ so } 1.5(Q_3 - Q_1) = 16.2 \text{ so } Q_1 - 16.2 = h \text{ or } Q_3 + 16.2 = k$ $h = \underline{\underline{8.4 \text{ to } 8.6}} \text{ and } k = \underline{\underline{51.4 \text{ to } 51.6}} \qquad \qquad \qquad \text{both}$	M1 A1 (2)
(e)	$2P(D > 51.6) = 2P(Z > 2.7)$ $= 2[1 - 0.9965] = \underline{\underline{\text{awrt } 0.007}}$	M1 M1 A1 (3)
	<p>(a) M1 for an attempt to standardise 20 or 40 using 30 and 8. 1st A1 for $z = \pm 1.25$ 2nd A1 for awrt 0.894</p> <p>(b) M1 for $\frac{Q_3 - 30}{8} =$ to a z value M0 for 0.7734 on RHS. B1 for (z value) between 0.67~0.675 seen. M1B0A1 for use of $z = 0.68$ in correct expression with awrt 35.4</p> <p>(c) Follow through using their of quartile values.</p> <p>(d) M1 for an attempt to calculate 1.5(IQR) and attempt to add or subtract using one of the formulae given in the question - follow through their quartiles</p> <p>(e) 1st M1 for attempting $2P(D > \text{their } k)$ or $(P(D > \text{their } k) + P(D < \text{their } h))$ 2nd M1 for standardising their h or k (may have missed the 2) so allow for standardising $P(D > 51.6)$ or $P(D < 8.4)$ Require boths Ms to award A mark.</p>	<p style="text-align: right;">Total 12</p>