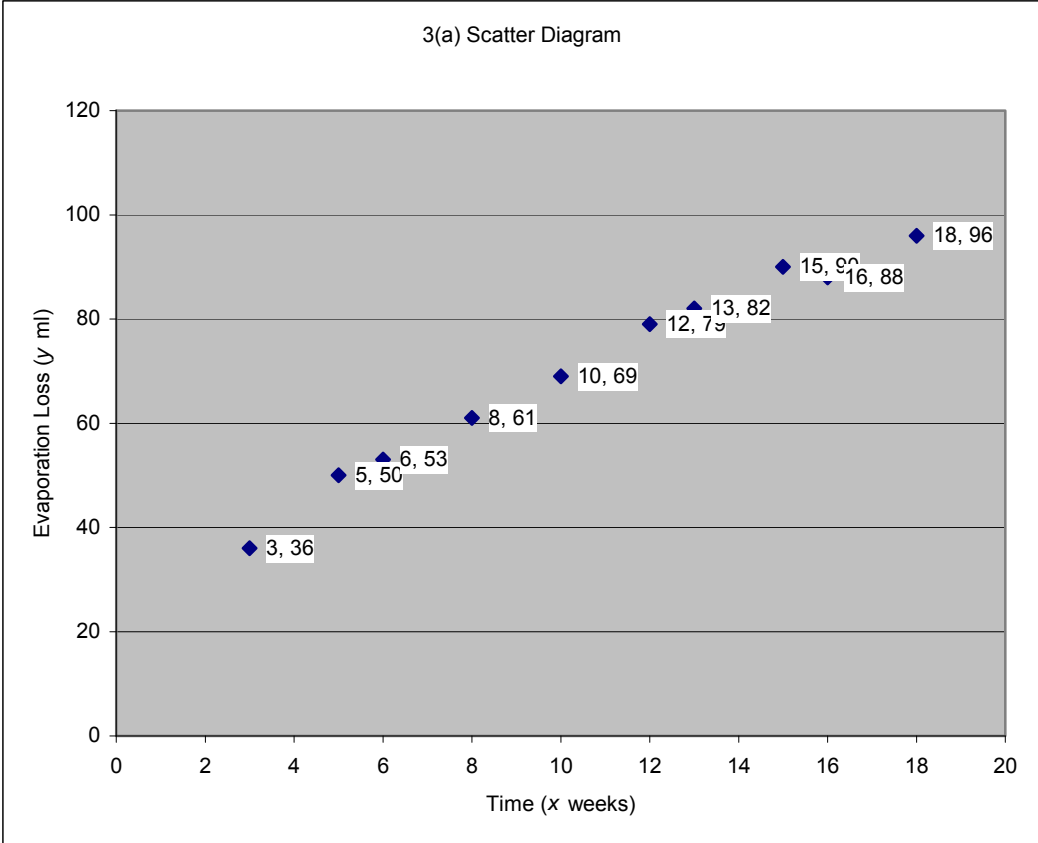


Question Number	Scheme	Marks
1. (a)	Mode is 56	B1 (1)
(b)	$Q_1 = 35, Q_2 = 52, Q_3 = 60$	B1,B1,B1 (3)
(c)	$\bar{x} = \frac{1335}{27} = 49.\dot{4}$ or $49\frac{4}{9}$	exact or awrt 49.4 B1
	$\sigma^2 = \frac{71801}{27} - \left(\frac{1335}{27}\right)^2 = 214.5432\dots$ $\sigma = 14.6$ or 14.9	M1A1ft awrt 14.6(5) or 14.9 A1 (4)
(d)	$\frac{49.4-56}{14.6} = -0.448$	awrt range -0.44 to -0.46 M1A1 (2)
(e)	For negative skew; Mean < median < mode (49.4 < 52 < 56 not required) $Q_3 - Q_2 < Q_2 - Q_1$ 8 and 17 Accept other valid reason eg. 3(mean-median)/sd as alt for M1A1	2 compared correctly 3 compared correctly M1 A1 M1 A1 ft (4)
Total 14 marks		
2. (a)	$p + q = 0.4$ $2p + 4q = 1.3$	B1 M1A1 Consider with (b). (3)
(b)	Attempt to solve $p = 0.15, q = 0.25$	M1 If both seen, award 3. A1A1 (3)
(c)	$E(X^2) = 1^2 \times 0.10 + 2^2 \times 0.15 + \dots + 5^2 \times 0.30 = 14$ $\text{Var}(X) = 14 - 3.5^2 = 1.75$	M1A1ft M1A1 (4)
(d)	$\text{Var}(3 - 2X) = 4\text{Var}(X) = 7.00$	M1A1ft (2) Total 12 marks

<p>3. (a)</p>	<p>Sensible graph scales, labels, shape</p> 	<p>B1,B1,B1</p>
<p>(b)</p>	<p>Points lie close to a straight line</p>	<p>B1 (3)</p>
<p>(c)</p>	$S_{xy} = 8354 - \frac{106 \times 704}{10} = 891.6$ $S_{xx} = 1352 - \frac{106^2}{10} = 228.4$ $b = \frac{891.6}{228.4} = 3.903677\dots$ $a = \frac{704}{10} - b \frac{106}{10} = 29.021015\dots$	<p>B1 (1)</p> <p>B1</p> <p>B1</p> <p>M1A1 awrt 3.9</p> <p>M1A1 awrt 29</p> <p>29.02, 3.90 A1ft (7)</p>
<p>(d)</p>	<p>For every extra week in storage, another 3.90 ml of chemical evaporates</p>	<p>B1 (1)</p>
<p>(e)</p>	<p>(i) 103.12 (ii) 165.52</p>	<p>B1B1 (2)</p>
<p>(f)</p>	<p>(i) Close to range of x, so reasonably reliable (ii) Well outside range of x, could be unreliable since no evidence that model will continue to hold</p>	<p>B1,B1 B1 (4)</p> <p>B1</p> <p>Total 18 marks</p>

4. (a)	<p style="text-align: right;">Tree</p> <p style="text-align: right;">$\frac{9}{12}, \frac{3}{12}$</p> <p style="text-align: right;">Complete & labels</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>(3)</p>
(b)	$P(\text{Second ball is red}) = \frac{9}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} = \frac{1}{4}$	<p>M1A1</p> <p>(2)</p>
(c)	$P(\text{Both are red} \mid \text{Second ball is red}) = \frac{\frac{3}{12} \times \frac{2}{11}}{\frac{1}{4}} = \frac{2}{11}$ <p style="text-align: right;">exact or awrt 0.182</p>	<p>M1A 1</p> <p>(2)</p> <p>Total 7 marks</p>
5. (a)	<p>To simplify a real world problem</p> <p>To improve understanding / describe / analyse a real world problem</p> <p>Quicker and cheaper than using real thing</p> <p>To predict possible future outcomes</p> <p>Refine model / change parameters possible</p> <p style="text-align: right;">Any 2</p>	<p>B1B1</p> <p>(2)</p>
(b)	<p>(i) e.g.s height, weight (ii) score on a face after tossing a fair die</p>	<p>B1B1</p> <p>(2)</p> <p>Total 4 marks</p>

<p>6. (a)</p>		<p>\mathcal{E}</p> <p>Venn Diagram 0.32, 0.11 & A, B 0.22, 0.35 & box</p>	<p>M1 A1 A1 (3)</p>
<p>(b)</p>	<p>$P(A) = 0.32 + 0.22 = 0.54; P(B) = 0.33$</p>		<p>M1A1ft; A1ft (3)</p>
<p>(c)</p>	<p>$P(A B') = \frac{P(A \cap B')}{P(B')} = \frac{32}{67}$</p>	<p>awrt 0.478</p>	<p>M1A1 (2)</p>
<p>(d)</p>	<p>For independence $P(A \cap B) = P(A)P(B)$ For these data $0.22 \neq 0.54 \times 0.33 = 0.1782$ (OR $P(A B') \neq P(A)$ for M1A1ft OR $\frac{2}{3} = P(A B) \neq P(A) = 0.54$ for M1A1ft) \therefore NOT independent</p>		<p>M1A1ft A1ft (3) Total 11 marks</p>
<p>7. (a)</p>	<p>Let H be rv height of athletes, so $H \sim N(180, 5.2^2)$ $P(H > 188) = P(Z > \frac{188 - 180}{5.2}) = P(Z > 1.54) = 0.0618$ \pm stand. $\sqrt{\cdot}$, sq, awrt 0.062</p>		<p>M1A1A1 (3)</p>
<p>(b)</p>	<p>Let W be rv weight of athletes, so $W \sim N(85, 7.1^2)$ $P(W < 97) = P(Z < 1.69) = 0.9545$</p>	<p>standardise, awrt 0.9545</p>	<p>M1A1 (2)</p>
<p>(c)</p>	<p>$P(H > 188 \text{ \& } W < 97) = 0.0618(1 - 0.9545)$ $= 0.00281$</p>	<p>allow (a)x(b) for M awrt 0.0028</p>	<p>M1A1ft A1 (3)</p>
<p>(d)</p>	<p>Evidence suggests height and weight are positively correlated / linked Assumption of independence is not sensible</p>		<p>B1 (1) Total 9 marks</p>