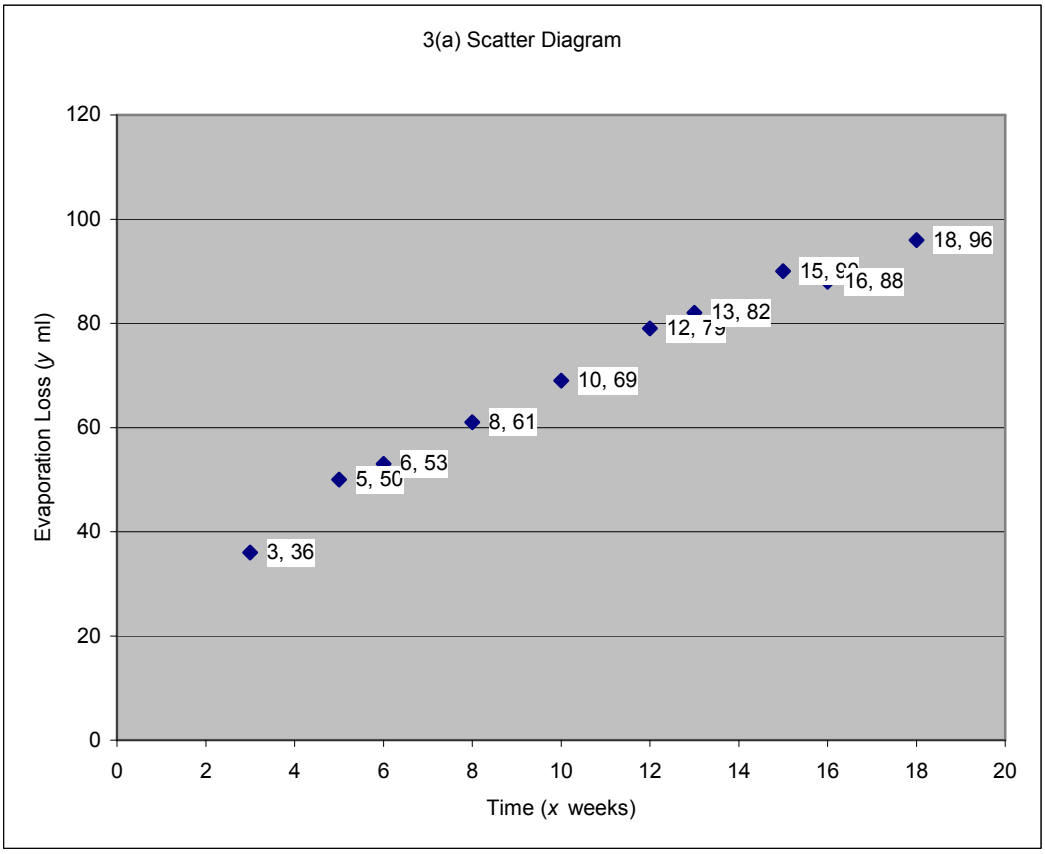
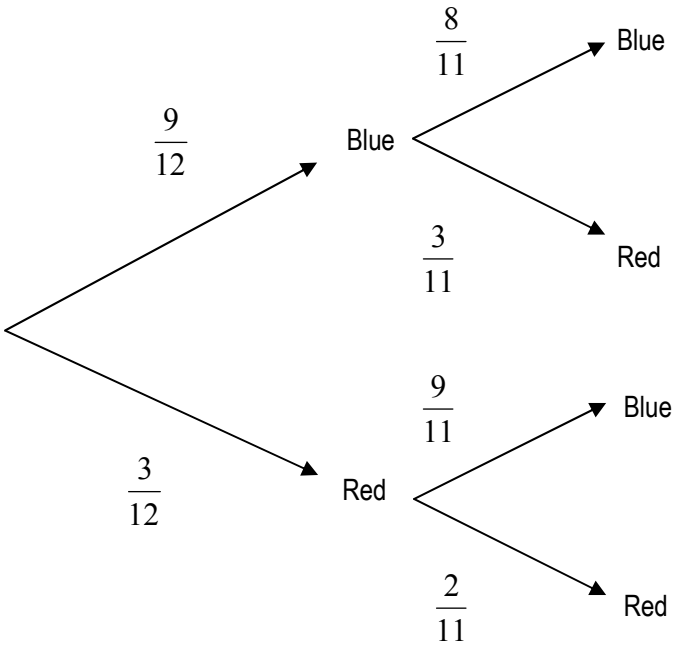
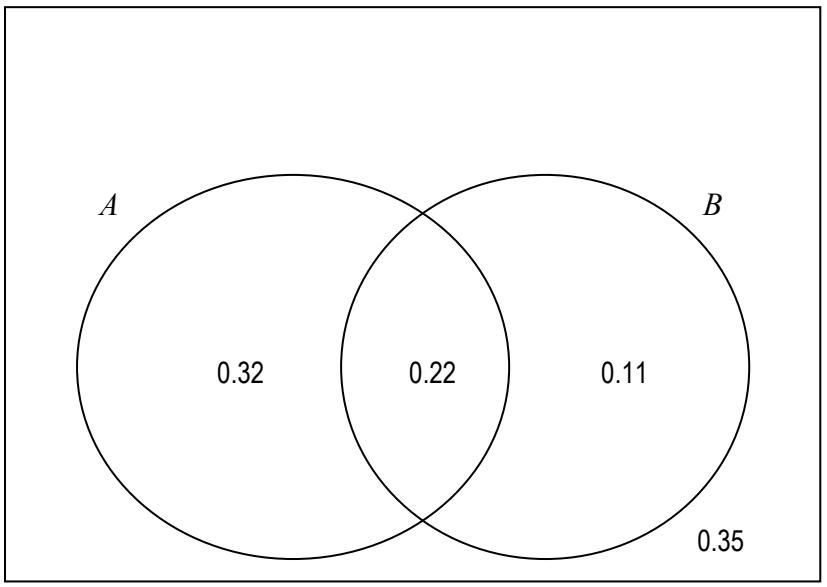
Question Number	Scheme	Marks
1. (a)	Mode is 56	B1 (1)
(b)	$Q_1 = 35, Q_2 = 52, Q_3 = 60$	B1,B1,B1 (3)
(c)	$\overline{x} = \frac{1335}{27} = 49.\dot{4}$ or $49\frac{4}{9}$ exact or awrt 49.4	B1
	$\sigma^2 = \frac{71801}{27} - \left(\frac{1335}{27}\right)^2 = 214.5432...$	M1A1ft
	$\sigma = 14.6$ or 14.9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

3. (a)	Sensible graph scales, labels, shape  	B1,B1,B1 (3)
(b)	Points lie close to a straight line	B1 (1)
(c)	$S_{xy} = 8354 - \frac{106 \times 704}{10} = 891.6$ $S_{xx} = 1352 - \frac{106^2}{10} = 228.4$ $b = \frac{891.6}{228.4} = 3.903677...$ awrt 3.9 $a = \frac{704}{10} - b\frac{106}{10} = 29.021015...$ awrt 29 29.02, 3.90	B1 B1 M1A1 M1A1 A1ft (7)
(d)	For every extra week in storage, another 3.90 ml of chemical evaporates	B1 (1)
(e)	(i) 103.12 (ii) 165.52	B1B1 (2)
(f)	(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	B1,B1 B1 B1 (4) **Total 18 marks**

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

6. (a)



Venn Diagram
0.32,0.11 & A,B
0.22,0.35 & box

M1
A1
A1
(3)

(b) $P(A) = 0.32 + 0.22 = 0.54; P(B) = 0.33$

M1A1ft;A1ft
(3)

(c) $P(A|B') = \frac{P(A \cap B')}{P(B')} = \frac{32}{67}$ awrt 0.478

M1A1
(2)

(d) 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

M1A1ft
A1ft
(3)
Total 11 marks

7. (a) Let H be rv height of athletes, so $H \sim N(180, 5.2^2)$

$P(H > 188) = P(Z > \frac{188-180}{5.2}) = P(Z > 1.54) = 0.0618$ ± stand. √, sq, awrt 0.062

M1A1A1
(3)

(b) Let W be rv weight of athletes, so $W \sim N(85, 7.1^2)$

$P(W < 97) = P(Z < 1.69) = 0.9545$ standardise, awrt 0.9545

M1A1
(2)

(c) $P(H > 188 \ \& \ W < 97) = 0.0618(1 - 0.9545)$ allow (a)x(b) for M
$= 0.00281$ awrt 0.0028

M1A1ft
A1
(3)

(d) Evidence suggests height and weight are positively correlated / linked
Assumption of independence is not sensible

B1
(1)
Total 9 marks