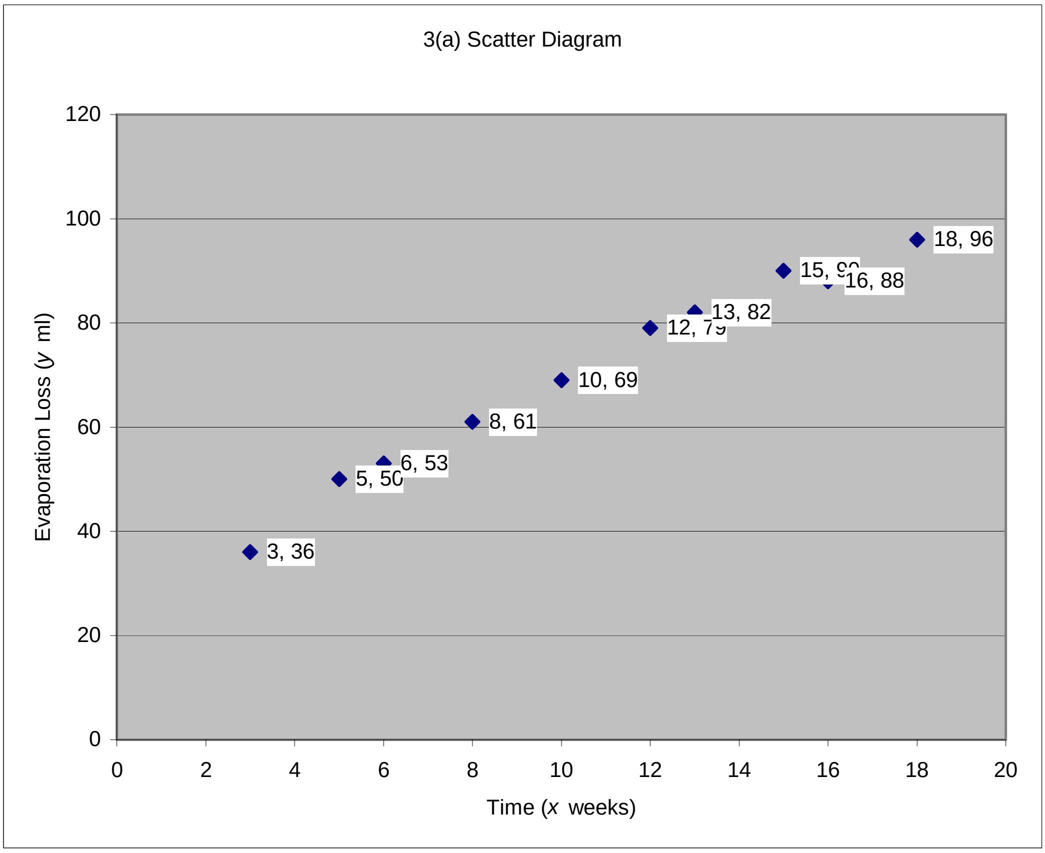
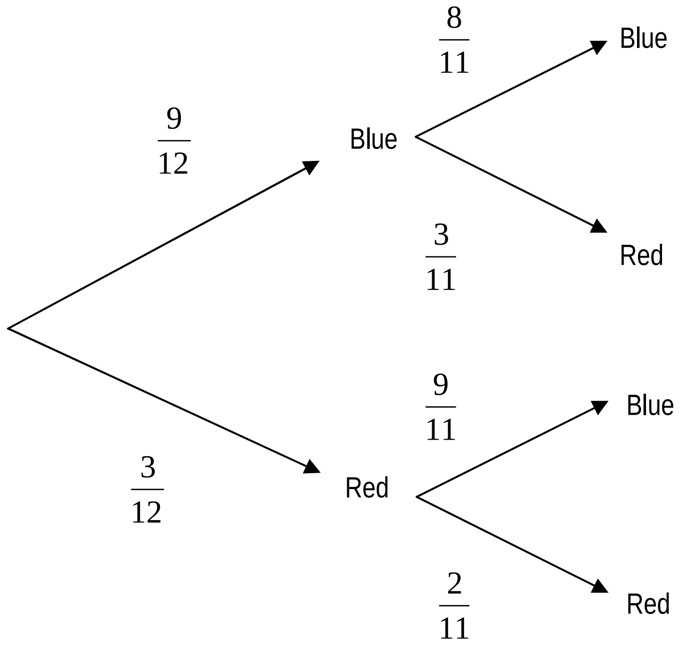
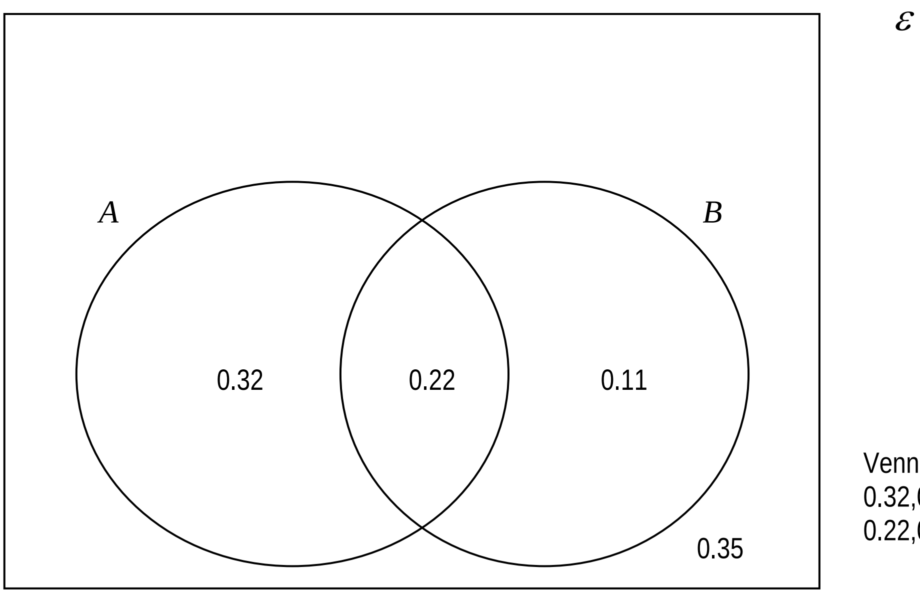
Question Number	Scheme	Marks
1. (a)	Mode is 56	B1 (1)
(b)	$Q_1 = 35, Q_2 = 52, Q_3 = 60$	B1,B1,B1 (3)
(c)	$\bar{x} = \frac{1335}{27} = 49.\dot{4}$ or $49\frac{4}{9}$ exact or awrt 49.4	B1
	$\sigma^2 = \frac{71801}{27} - \left(\frac{1335}{27}\right)^2 = 214.5432...$	M1A1ft
	$\sigma = 14.6$ or 14.9 awrt 14.6(5) or 14.9	A1 (4)
(d)	$\frac{49.4\text{-}56}{14.6} = -0.448$ awrt range -0.44 to -0.46	M1A1 (2)
(e)	For negative skew;	
	Mean<median<mode 2 compared correctly	M1
	(49.4<52<56 not required) 3 compared correctly	A1
	$Q_3\text{-}Q_2 < Q_2\text{-}Q_1$	M1
	8 and 17	A1 ft
	Accept other valid reason eg. 3(mean-median)/sd as alt for M1A1	(4)
		Total 14 marks
2. (a)	$p + q = 0.4$	B1
	$2p + 4q = 1.3$ Consider with (b).	M1A1 (3)
(b)	Attempt to solve	M1
	$p = 0.15, q = 0.25$ If both seen, award 3.	A1A1 (3)
(c)	$E(X^2) = 1^2 \times 0.10 + 2^2 \times 0.15 + ... + 5^2 \times 0.30 = 14$	M1A1ft
	$Var(X) = 14 - 3.5^2 = 1.75$	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)	$S_{xy} = 8354 - \dfrac{106 \times 704}{10} = 891.6$	B1
	$S_{xx} = 1352 - \dfrac{106^2}{10} = 228.4$	B1
	$b = \dfrac{891.6}{228.4} = 3.903677...$ awrt 3.9	M1A1
	$a = \dfrac{704}{10} - b\dfrac{106}{10} = 29.021015...$ awrt 29	M1A1
	29.02, 3.90	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	B1,B1
	(ii) Well outside range of x,	B1
	could be unreliable since no evidence that model will continue to hold	B1 (4)
		Total 18 marks

4. (a)	 Tree $\frac{9}{12}, \frac{3}{12}$ Complete & labels	M1 A1 A1 (3)
(b)	$\text{P(Second ball is red)} = \frac{9}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} = \frac{1}{4}$	M1A1 (2)
(c)	$\text{P(Both are red} \mid \text{Second ball is red)} = \frac{\frac{3}{12} \times \frac{2}{11}}{\frac{1}{4}} = \frac{2}{11}$ exact or awrt 0.182	M1A1 (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)	$\text{P}(A) = 0.32 + 0.22 = 0.54; \text{P}(B) = 0.33$	M1A1ft;A1ft (3)
(c)	$\text{P}(A \mid B') = \frac{\text{P}(\text{A} \cap B')}{\text{P}(B')} = \frac{32}{67}$ awrt 0.478	M1A1 (2)
(d)	For independence $\text{P}(\text{A} \cap B) = \text{P}(\text{A})\text{P}(B)$ For these data $0.22 \neq 0.54 \times 0.33 = 0.1782$ (OR $\text{P}(A \mid B') \neq \text{P}(\text{A})$ for M1A1ft OR $\frac{2}{3} = \text{P}(A \mid B) \neq \text{P}(\text{A}) = 0.54$ for M1A1ft) $\therefore$ NOT independent	M1A1ft A1ft (3) Total 11 marks
7. (a)	Let H be rv height of athletes, so $H \sim \text{N}(180, 5.2^2)$ $\text{P}(H > 188) = \text{P}(Z > \frac{188 - 180}{5.2}) = \text{P}(Z > 1.54) = 0.0618$ ± stand. √, sq, awrt 0.062	M1A1A1 (3)
(b)	Let W be rv weight of athletes, so $W \sim \text{N}(85, 7.1^2)$ $\text{P}(\text{W} < 97) = \text{P}(Z < 1.69) = 0.9545$ standardise, awrt 0.9545	M1A1 (2)
(c)	$\text{P}(H > 188 \;\&\; W < 97) = 0.0618(1 - 0.9545)$ 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