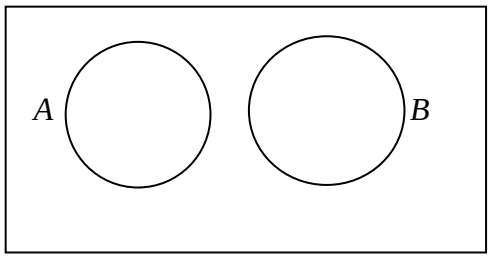
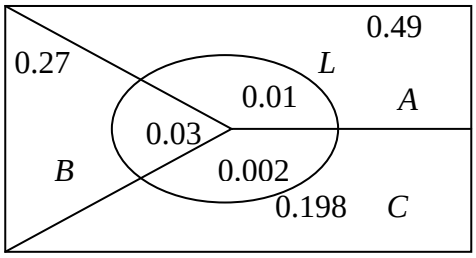
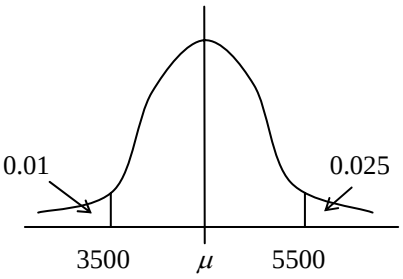
Question Number	Scheme	Marks
1.	P(Not 6) = $1 - \frac{1}{6} = \frac{5}{6}$	B1 **(1)**
	P(6 on third throw)= $\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6} = 0.116$ 3 probabilities multiplied	M1 A1ft
	$= \frac{25}{216} = 0.1157\ldots$ (accept 0.116)	A1 **(3)**
		(4 marks)
2.	Observe real world problem	B1
	Devise a statistical model and collect data	B1
	Compare observed against expected outcomes and test the model	B1
	Refine model if necessary	B1 **(4)**
		(4 marks)
3. (*a*)	P($B \mid A$) = Probability of B, given A has occurred	B1, B1 **(2)**
(*b*)		
	A & B	B1
	no overlap	B1 **(2)**
	P(Amber is late) = 0.5 × 0.02	M1
	= 0.01	A1 cao **(2)**
		
	complete diagram	M1
	0.49; 0.01	B1
	0.198; 0.002	B1
	0.27; 0.03	B1 **(4)**
(*e*)	P(Late) = 0.03 + 0.01 + 0.002 = 0.042 intersections, three of them added	M1
	= 0.042	A1 cao **(2)**
		(12 marks)

ft = follow-through mark; cao = correct answer only

Question Number		Scheme	Marks
4.	(*a*)	$\begin{array}{c\|cccccccc} x & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ \hline \mathrm{P}(X=x) & 0.1 & 0.1 & 0.05 & 0.15 & 0.1 & 0.1 & 0.15 & 0.25 \end{array}$	M1 A2 (–1 eeoo) **(3)**
	(*b*)	$\mathrm{E}(X) = (1 \times 0.1) + (2 \times 0.1) + \ldots + (8 \times 0.25)$	M1
		$= 5.2$	A1
		$\mathrm{E}(X^2) = (1^2 \times 0.1) + (2^2 \times 0.1) + \ldots + (8^2 \times 0.25)$	M1
		$= 32.8$	A1
		$\mathrm{Var}(X) = \mathrm{E}(X^2) - \{\mathrm{E}(X)\}^2$	M1
		$= 32.8 - (5.2)^2 = 5.76$ (❋)	A1 cso **(6)**
	(*c*)	$\mathrm{E}(Y) = 2\mathrm{E}(X) + 3 = 13.4$	B1
		$\mathrm{Var}(Y) = 2^2\,\mathrm{Var}(X)$	M1
		$= 4 \times 5.76 = 23.04$	A1 **(3)**
			(12 marks)
5.	(*a*)	Bell shaped curve; symmetrical about the mean; 95% of data lies within 2sd of mean; asymptotic etc (any 2).	B1; B1 **(2)**
	(*b*)		
		$\mathrm{P}(X < 3500) = 0.01 \Rightarrow \mu - 3500 = 2.3263\sigma$	M1 A1
		$\mathrm{P}(X < 5500) = 0.025 \Rightarrow 5500 - \mu = 1.96\sigma$	A1
		solving for μ and σ	M1
		$\sigma = 466.6028\ldots$ accept 466.6/467	A1
		$\mu = 4585.4583\ldots$ accept 4585.5/4590	A1 **(6)**
	(*c*)	$\mathrm{P}(X < 4000) = \mathrm{P}\left(Z < \dfrac{4000 - 4585.4583...}{466.6028...}\right)$	M1 A1ft
		$= \mathrm{P}(Z < -1.25)$	A1
		$= 0.1056$	A1 **(4)**
			(12 marks)

(❋) indicates final answer is given on question paper; ft = follow-through mark

Question Number	Scheme	Marks
6. (*a*)	Frequency densities – 5, 0, 10, 4, 110, 75, 1.7	B1
	Graph: scales and labels, shape, correct frequency densities	B1, M1, A1 **(4)**
(*b*)	$\Sigma fy = 2888.5$	B1
	Mean weight = $14 + \dfrac{2888.5}{50 \times 10}$	M1
	$= 19.777$ accept 19.78/19.8	A1
	$S_y = \sqrt{\dfrac{171503.75}{50} - \left(\dfrac{2888.5}{50}\right)^2}$	M1
	$= 9.62819\ldots$ awrt 9.63	A1
	Standard deviation of weight = $\dfrac{9.62819}{10} = 0.96219\ldots$ accept 0.963/0.96	A1ft **(6)**
	(NB: Using $n - 1$ gives 0.9725…)	
(*c*)	$Q_2 = 20.0 + \dfrac{(25-12)}{22} \times 0.2$	M1
	$= 20.118\ldots$ accept 20.1/20.12	A1 **(2)**
(*d*)	Median – data skewed	B1
	Mean – lower value; fewer complaints	B1 **(2)**
		(14 marks)

awrt = anything which rounds to

Question Number	Scheme	Marks
7. (*a*)	$\Sigma t = 169;\ \Sigma c = 357$	
	$S_{cc} = 14245 - \dfrac{357^2}{10} = 1500.1$	M1 A1
	$S_{tt} = 168.9,\ S_{ct} = 492.7$	A1, A1
	$r = \dfrac{492.7}{\sqrt{1500.1 \times 168.9}}$	M1 A1
	$= 0.97883\ldots$ accept 0.979	A1 **(7)**
(*b*)	Since *r* close to 1, value supports use of regression line	B1 B1 **(2)**
(*c*)	$b = \dfrac{S_{ct}}{S_{tt}} = \dfrac{492.7}{168.9} = 2.91711\ldots$	B1
	$a = \bar{c} - b\bar{t} = \dfrac{357}{10} - \dfrac{492.7}{168.9} \times \dfrac{169}{10} = -13.59917\ldots$	B1
	$c = -13.6 + 2.92t$	B1 **(3)**
(*d*)	3 extra ice-creams are sold for every 1 °C increase in temperature	B1 **(1)**
(*e*)	$c = -13.6 + 2.92 \times 16 = 33.12$	M1 A1
	i.e. 33 ice-creams	A1 **(3)**
(*f*)	Temperature likely to be outside range of validity	B1 **(1)**
		(17 marks)