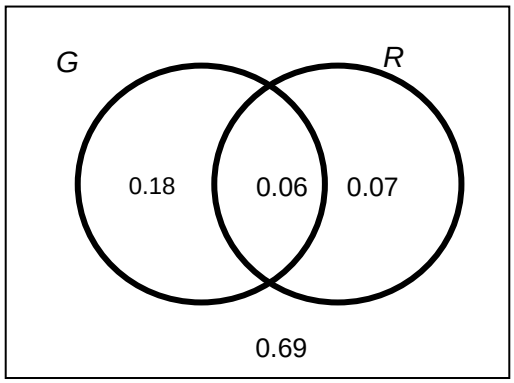
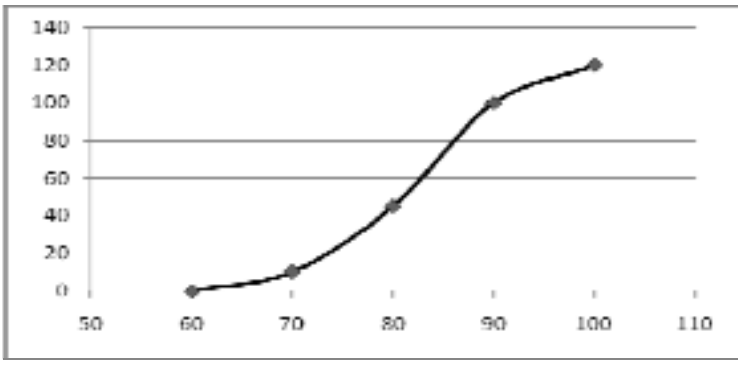
4766 Statistics 1

1	**(i)**	5 | 2 6 | 3 4 7 8 7 | 1 2 2 3 4 5 5 7 9 8 | 1 Key 6 | 3 represents 63 mph	G1 stem G1 leaves CAO G1 sorted G1 key	**[4]**
	(ii)	Median = 72 Midrange = 66.5	B1 FT B1 CAO	**[2]**
	(iii)	*EITHER:* Median since midrange is affected by outlier (52) *OR:* Median since the lack of symmetry renders the midrange less representative	E1 for median E1 for explanation **TOTAL**	**[2]** **[8]**
2	**(i)**	(*A*) P(X = 10) = P(5 then 5) = 0.4×0.25 = 0.1 (*B*) P(X = 30) = P(10 and 20) = 0.4×0.25 + 0.2×0.5 = 0.2	B1 **ANSWER GIVEN** M1 for full calculation A1 **ANSWER GIVEN**	**[1]** **[2]**
	(ii)	$E(X) = 10\times0.1+15\times0.4+20\times0.1+25\times0.2+30\times0.2 = 20$ $E(X^2) = 100\times0.1+225\times0.4+400\times0.1+625\times0.2+900\times0.2 = 445$ Var(X) = 445 – 20^2 = 45	M1 for Σrp (at least 3 terms correct) A1 CAO M1 for Σr^2p (at least 3 terms correct) M1 dep for – their $E(X)^2$ A1 FT their E(X) provided Var(X) > 0 **TOTAL**	**[5]** **[8]**
3	**(i)**		G1 for two labelled intersecting circles G1 for at least 2 correct probabilities G1 for remaining probabilities	**[3]**
	(ii)	P(G) × P(R) = 0.24 × 0.13 = 0.0312 ≠ P($G\cap R$) or ≠ 0.06 So not independent.	M1 for 0.24 × 0.13 A1	**[2]**

	(iii)	$P(R \mid G) = \dfrac{P(R \cap G)}{P(G)} = \dfrac{0.06}{0.24} = \dfrac{1}{4} = 0.25$	M1 for numerator M1 for denominator A1 CAO **TOTAL**	**[3]** **[8]**
4	**(i)**	P(20 correct) = $\binom{30}{20} \times 0.6^{20} \times 0.4^{10} = 0.1152$	M1 $0.6^{20} \times 0.4^{10}$ M1 $\binom{30}{20} \times p^{20} q^{10}$ A1 CAO	**[3]**
	(ii)	Expected number = 100 × 0.1152 = 11.52	M1 A1 FT (Must not round to whole number) **TOTAL**	**[2]** **[5]**
5	**(i)**	P(Guess correctly) = $0.1^4 = 0.0001$	B1 CAO	**[1]**
	(ii)	P(Guess correctly) = $\dfrac{1}{4!} = \dfrac{1}{24}$	M1 A1 CAO **TOTAL**	**[2]** **[3]**
6	**(i)**	20 × 19 × 18 = 6840	M1 A1	**[2]**
	(ii)	$20^3 - 20 = 7980$	M1 for figures – 20 A1 **TOTAL**	**[2]** **[4]**

7	**(i)**	$10 \times 2 = 20$.	M1 for 10×2 A1 CAO	**[2]**
	(ii)	Mean = $\frac{10\times65+35\times75+55\times85+20\times95}{120}=\frac{9850}{120}=82.08$ It is an estimate because the data are grouped.	M1 for midpoints M1 for double pairs A1 CAO E1 indep	**[4]**
	(iii)	$10 \times 65^2 + 35 \times 75^2 + 55 \times 85^2 + 20 \times 95^2$ (= 817000) $S_{xx} = 817000 - \frac{9850^2}{120}$ (= 8479.17) $s = \sqrt{\frac{8479.17}{119}} = 8.44$	M1 for Σfx^2 M1 for valid attempt at S_{xx} A1 CAO	**[3]**
	(iv)	$\bar{x} - 2s = 82.08 - 2\times8.44 = 65.2$ $\bar{x} + 2s = 82.08 + 2\times8.44 = 98.96$ So there are probably some outliers.	M1 FT for $\bar{x} - 2s$ M1 FT for $\bar{x} + 2s$ A1 for both E1 dep on A1	**[4]**
	(v)	Negative.	E1	**[1]**
	(vi)	Upper bound 60 70 80 90 100 Cumulative frequency 0 10 45 100 120 	C1 for cumulative frequencies S1 for scales L1 for labels 'Length and CF' P1 for points J1 for joining points dep on P1 All dep on attempt at cumulative frequency. **TOTAL**	**[5]** **[19]**

8	**(i)**	(*A*) P(Low on all 3 days) = $0.5^3 = 0.125$ or $^1/_8$	M1 for 0.5^3 A1 CAO	**[2]**
		(*B*) P(Low on at least 1 day) = $1 - 0.5^3 = 1 - 0.125 = 0.875$	M1 for $1 - 0.5^3$ A1 CAO	**[2]**
		(*C*) P(One low, one medium, one high) $= 6 \times 0.5 \times 0.35 \times 0.15 = 0.1575$	M1 for product of probabilities $0.5 \times 0.35 \times 0.15$ or $^{21}/_{800}$ M1 × 6 or × 3! or $^3P_3$ A1 CAO	**[3]**
	(ii)	X ~ B(10, 0.15) (*A*) P(No days) = $0.85^{10} = 0.1969$ Or from tables P(No days) = 0.1969	M1 A1	**[2]**
		(*B*) *Either* P(1 day) $= \binom{10}{1} \times 0.15^1 \times 0.85^9 = 0.3474$ *or* from tables P(1 day) $= P(X \le 1) - P(X \le 0)$ $= 0.5443 - 0.1969 = 0.3474$	M1 $0.15^1 \times 0.85^9$ M1 $\binom{10}{1} \times p^1 q^9$ A1 CAO OR: M2 for 0.5443 – 0.1969 A1 CAO	**[3]**
	(iii)	Let X ~ B(20, 0.5) *Either:* $P(X \ge 15) = 1 - 0.9793 = 0.0207 < 5\%$	*Either:* B1 for correct probability of 0.0207 M1 for comparison	
		Or: Critical region is {15,16,17,18,19,20} 15 lies in the critical region.	*Or:* B1 for CR, M1 for comparison	
		So there is sufficient evidence to reject H_0	A1 CAO dep on B1M1	
		Conclude that there is enough evidence to indicate that the probability of low pollution levels is higher on the new street.	E1 for conclusion in context	**[5]**
		H_1 has this form as she believes that the probability of a low pollution level is greater in this street.	E1 indep	
			TOTAL	**[17]**