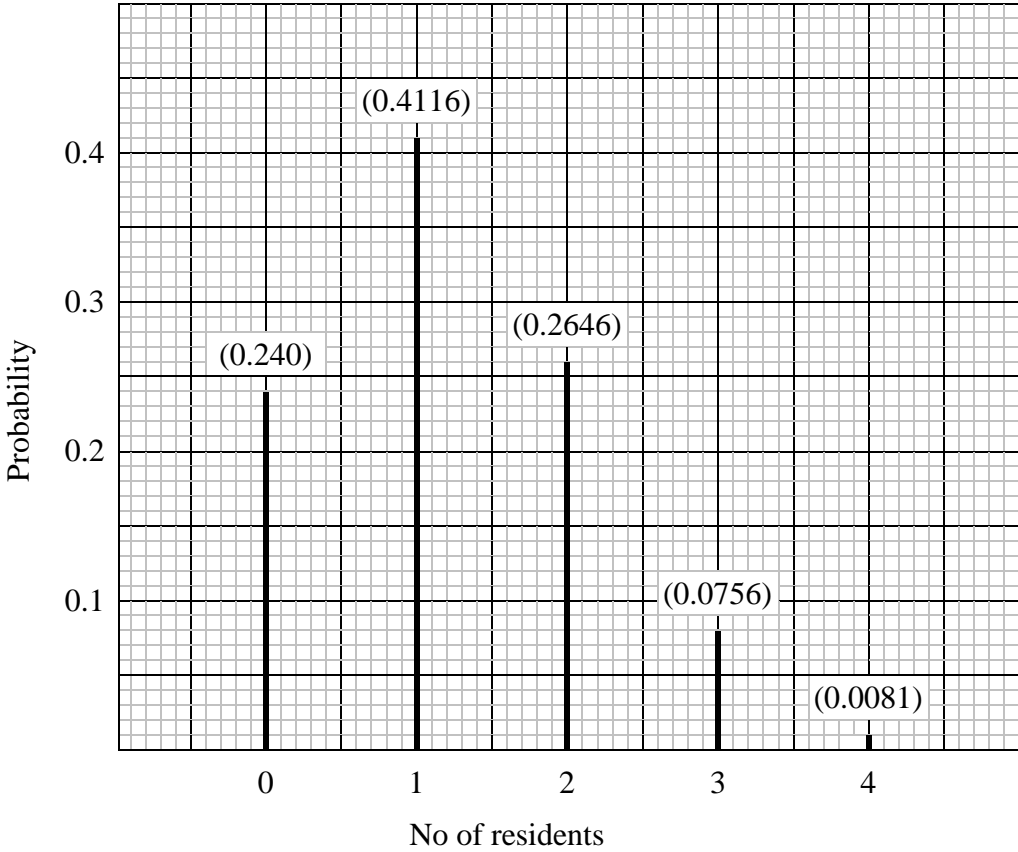
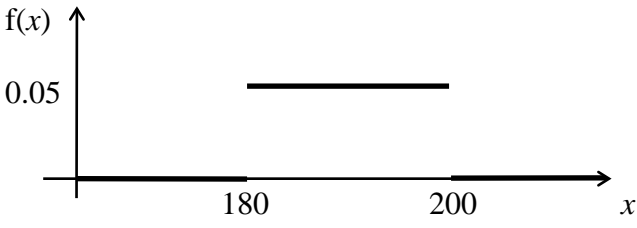


Question number	Mark scheme	Marks
1.	<p>(a) A random variable; that is, a function involving no unknown quantities</p> <p>(b) If all possible samples are taken; then their values will form a probability distribution called the sampling distribution</p>	<p>B1; B1 (2)</p> <p>B1; B1 (2)</p> <p><b>(4 marks)</b></p>
2.	<p>(a) <math>\lambda</math> is large or <math>\lambda &gt; 10</math></p> <p>(b) <math>Y \sim N(30, 30)</math> <span style="float: right;">may be implied</span></p> <p><math>P(Y &gt; 28) = 1 - P(Y \leq 28.5)</math></p> $= 1 - P\left(Z \leq \frac{28.5 - 30}{\sqrt{30}}\right)$ $= 1 - P(Z \leq -0.273)$ $= 0.607$	<p>B1 (1)</p> <p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>A1 (6)</p> <p><b>(7 marks)</b></p>

(ft = follow through mark; (\*) indicates final line is given on the paper)

Question number	Mark scheme	Marks
3.	(a) $X \sim B(4, 0.3)$	B1 B1 (2)
(b)	 <p style="text-align: center;">No of residents</p>	
	All probabilities correct	B1
	Scales and labels	B1
	Correct diagram	B1 (3)
(c)	1 resident	B1 (1)
(d)	$E(X) = np = 1.2$	B1
	$\text{Var}(X) = np(1 - p)$	
	= $4 \times 0.3 \times 0.7$	M1
	= 0.84	A1 (3)
		<b>(9 marks)</b>

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Question number	Mark scheme	Marks
4.	<p>(a) <i>Fixed number of independent trials</i> 2 outcomes Probability of success <i>constant</i></p> <p>(b) <math>P(X = 5) = \frac{2}{7}</math>; <math>P(X \neq 5) = \frac{5}{7}</math>      may be implied <math>P(5 \text{ on sixth throw}) = \left(\frac{5}{7}\right)^2 \times \left(\frac{2}{7}\right)</math>      <math>p^n(1-p)</math> <math>= 0.0531</math></p> <p>(c) <math>P(\text{exactly 3 fives in first eight throws}) = \binom{8}{3} \left(\frac{2}{7}\right)^3 \left(\frac{5}{7}\right)^5</math>      use of <math>{}^n C_r</math> needed <math>= 0.243</math></p>	<p>B1 B1 B1 B1 (4) B1; B1 ft M1 A1 ft A1 (5) M1 A1 ft A1 (3) <b>(12 marks)</b></p>
5.	<p>(a) <math>f(x) = \begin{cases} 0.05 &amp; 180 \leq x \leq 200 \\ 0 &amp; \text{otherwise} \end{cases}</math></p>  <p>(b)(i) <math>P(X \leq 183) = 3 \times 0.05</math> <math>= 0.15</math></p> <p>(ii) <math>P(X = 183) = 0</math></p> <p>(c) IQR = 10</p> <p>(d) <math>0.05(200 - x); = 0.05(x - 180) \times 2</math> <math>200 - x = 2x - 360</math> <math>x = 186\frac{2}{3}</math></p> <p>(e) <math>\frac{1}{3}</math> of all cups of lemonade dispensed contains <math>186\frac{2}{3}</math> ml or less (or <math>\frac{2}{3}</math> of all cups of lemonade dispensed contains <math>186\frac{2}{3}</math> ml or more)</p>	<p>B1 B1 labels B1 3 parts B1 (4) M1 A1 B1 (3) B1 (1) M1; A1 A1 (3) B1 B1 ft (2) <b>(13 marks)</b></p>

(ft = follow through mark; (\*) indicates final line is given on the paper)

Question number	Mark scheme	Marks
6.	(a) Po(1)	B1 B1
	Each patient seen singly <i>or</i> patients with disease seen randomly <i>or</i> seen constant rate of once per week <i>or</i> each patient assumed independent of the next	B1 (3)
	(b) $X \sim \text{Po}(4)$	B1
	$P(X > 3) = 1 - P(X \leq 3)$	M1
	= 1 - 0.4335	A1
	= 0.5665	A1 (4)
	(c) $H_0: \lambda = 6$	B1
	$H_1: \lambda < 6$	B1
	$P(X \leq 2) = 0.0620$ $\alpha = 0.05 \Rightarrow$ critical region $X \leq 1$	M1 A1
	0.0620 > 0.05    2 not in critical region	M1
	The number of patients with the disease seen by the doctor has not been reduced	A1 (6)
	(d) This does not support the model as the disease will occur in outbreaks; the patients seen by the doctor are unlikely to be independent of each other/don't occur singly	B1; B1 (2)
		<b>(15 marks)</b>

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Question number	Mark scheme	Marks
7. (a)	$\int_{-1}^0 k(x^2 + 2x + 1) \, dx = 1$ $\left[ k \left( \frac{x^3}{3} + x^2 + x \right) \right]_{-1}^0 = 1$ $k = 3 \quad (*)$	limits needed and =1 M1 attempt at integration M1 A1 A1 (4)
7. (b)	$E(X) = \int_{-1}^0 x.f(x) \, dx$ $= \int_{-1}^0 (3x^3 + 6x^2 + 3x) \, dx$ $= \left[ \frac{3x^4}{4} + 2x^3 + \frac{3x^2}{2} \right]_{-1}^0$ $= -\frac{1}{4}$	M1 limits needed A1 integration and substituting limits M1 A1 (4)
7. (c)	$\int_{-1}^{x_0} (3x^3 + 6x^2 + 3x) \, dx = \left[ x^3 + 3x^2 + 3x \right]_{-1}^{x_0}$ $= x_0 + 3x_0^2 + 3x_0 + 1$ $F(x) = \begin{cases} 0 & x < -1 \\ x^3 + 3x^2 + 3x + 1 & -1 \leq x \leq 0 \\ 1 & x > 0 \end{cases}$	M1 A1 B1 B1 (4)
7. (d)	$P(-0.3 < X < 0.3) = F(0.3) - F(-0.3)$ $= 1 - 0.343$ $= 0.657$	M1 A1 A1 (3) <b>(15 marks)</b>

(ft = follow through mark; (\*) indicates final line is given on the paper)