

Solutions

1a.

$P(X=x) = 1$ $2k + 4k + 6k + 6k = 1$ $18k = 1$	M1
$k = \frac{1}{18}$	M1

1b.

$F(5) = P(X \leq 5)$ $= P(X=2) + P(X=4)$ $= 6k$	M1
$= 6\left(\frac{1}{18}\right)$ $= \frac{1}{3}$	M1

2a.

As $F(3) = 1$	M1
$\frac{3^3+k}{40} = 1$ $27 + k = 40$	M1
$k = 13$	M1

2b.

$F(1) = P(X=1)$ $= \frac{1+13}{40} = \frac{14}{40} = \frac{7}{20}$	M1								
$F(2) = P(X=2) = F(2) - P(X=1)$ $= \frac{2^3+13}{40} - \frac{14}{40}$ $= \frac{7}{40}$	M1								
<table border="1" style="width: 100%; text-align: center;"><thead><tr><th>x</th><th>1</th><th>2</th><th>3</th></tr></thead><tbody><tr><td>P(X=x)</td><td>$\frac{7}{20}$</td><td>$\frac{7}{40}$</td><td>$\frac{19}{40}$</td></tr></tbody></table>	x	1	2	3	P(X=x)	$\frac{7}{20}$	$\frac{7}{40}$	$\frac{19}{40}$	M1
x	1	2	3						
P(X=x)	$\frac{7}{20}$	$\frac{7}{40}$	$\frac{19}{40}$						

Solutions

1a.

$\frac{9.5-7}{10-7}$	M1
$= \frac{5}{6}$ (or 0.833)	M1

1b.

$P(\text{Longest} > 9.5) = 1 - P(\text{all} < 9.5) = 1 - \left(\frac{5}{6}\right)^3$	M1
$= \frac{91}{216}$ (or, 0.421)	M1

1c.

$P(\text{a stick} < 7.6) = \frac{0.6}{3} = 0.2$	M1
Let Y = number of stick out of 6 < 7.6 $Y \sim B(6, 0.2)$	M1
$P(Y > 4) = 1 - P(Y \leq 4)$ $= 1 - 0.9984$	M1
$= 0.0016$	M1



Solutions

1ai.

Let X be the random variable the number of customers asking for water. $X \sim B(10, 0.6)$	M1
$P(X = 6) = (0.6)^6 (0.4)^4 \frac{10!}{6!4!}$	M1
$= 0.2508\dots$	M1

1aii.

$X \sim B(10, 0.6)$ $P(X < 9) = 1 - P(X = 10) + P(X = 9)$ $= 1 - (0.6)^{10} - (0.6)^9(0.4)^1 \frac{10!}{9!1!}$	M1
$= 0.9536$	M1

2a.

$P(X < 5) = 0.8424$	M1
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2b.

$P(X \geq 7) = 1 - P(X \leq 6)$ $= 1 - 0.9857$	M1
$= 0.0143$	M1



Solutions

Let X be the random variable the number of customers asking for water.	
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1ai.

$X \sim B(10, 0.6)$	M1
$P(X = 6) = (0.6)^6(0.4)^4 \frac{10!}{6!4!}$	M1
$= 0.2508\dots$	
$= 0.251$	M1

1aii.

$X \sim B(10, 0.6)$	M1
$P(X < 9) = 1 - P(X = 10) + P(X = 9)$	
$= 1 - (0.6)^{10} - (0.6)^9(0.4)^1 \frac{10!}{9!1!}$	M1
$= 0.9536\dots$	
$= 0.954$	M1

1b.

$X \sim B(50, 0.6)$	M1
$Y \sim B(50, 0.4)$	
$P(X < n) \geq 0.9$	
$P(Y > 50 - n) \geq 0.9$	M1
$P(Y \leq 50 - n) \leq 0.1$	
$50 - n \leq 15$	
$n \geq 35$	M1
$n = 35$	M1



Solutions

1a.

$P(X = 0) = 0.85^{10}$	M1
$= 0.1969$	M1

1b.

$P(X > 3) = 1 - P(X \leq 3)$	M1
$= 1 - 0.6477$	M1
$= 0.3523$	

1c.

$n \times 0.15 = 5$	M1
$n = 33$	M1

1d.

$1 - P(X = 0) > 0.95$	M1
$1 - (0.85)^n > 0.95$	M1
$0.85^n < 0.05$ $n > 18.4$ $n = 19$	M1

