

Question			Answer	Marks	AO	Guidance
11	(a)		Nina's, because hers is the largest sample size <b>oe</b>	<b>B1</b>	<b>2.2a</b>	allow eg Nina's, because with a larger sample size the probabilities get closer to the true probabilities <b>oe</b>
				[1]		
11	(b)		$11p + kp = 1$ $p = \frac{1}{11+k}$	<b>M1</b> <b>A1</b>	<b>3.1a</b> <b>1.1</b>	
				[2]		
11	(c)		<i>their</i> $\frac{1}{11+k} \times k$ or <i>their</i> $\frac{1}{11+k} \times 120$ $120 \times \textit{their} \frac{k}{11+k}$ $\frac{120k}{11+k}$ <b>oe</b>	<b>M1</b>  <b>M1</b>  <b>A1</b>	<b>2.1</b>  <b>1.2</b>  <b>1.1</b>	multiply by $k$ or by 120; may be embedded  multiplying by both $k$ and 120
				[3]		
11	(d)		$32 = \textit{their} \frac{120k}{11+k}$ <b>oe</b>  $k = 4$	<b>M1</b>   <b>A1</b>	<b>1.1</b>   <b>1.1</b>	
				[2]		

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			<i>Alternatively</i>  $11p = 1 - \frac{32}{120}$ may be implied by $p = \frac{1}{15}$ (from $(P(X \neq 12))$ )  $k = 4$	<b>M1</b>    <b>A1</b>		<b>or</b> $\frac{kf}{120} = \frac{32}{120}$  (from $11f = 120 - 32 = 88$ so $f = 8$ and so $kp = \dots$ )  $k = 4$
<b>11</b>	<b>(e)</b>		$Y \sim B\left(30, \text{their } \frac{4}{11+4}\right)$ or $Y \sim B\left(30, \frac{32}{120}\right)$ used to find $P(Y = 8)$  $0.16 - 0.163$ <b>BC</b>	<b>M1</b>    <b>A1</b>	<b>3.1a</b>    <b>1.1</b>	$Y$ is the number of 12s obtained in 30 rolls;    allow <b>B2</b> for $0.1628 - 0.163$ unsupported
				<b>[2]</b>		