

Question	Answer	Marks	Guidance
(a)	$a = P(1 \text{ head}) = 0.7 \times (0.5)^3 + 0.3 \times (0.5)^3 \times 3 = \frac{1}{5}$	<b>B1</b>	Clear statement of unevaluated correct calculation = $\frac{1}{5}$ . AG
	$b = 0.7 \times 0.5^3 \times 3 + 0.3 \times 0.5^3 \times 3 = \frac{3}{8}$	<b>M1</b>	Clear statement of unevaluated calculation for either $b$ or $c$
	$c = 0.7 \times 0.5^3 \times 3 + 0.3 \times 0.5^3 = \frac{3}{10}$	<b>A1</b>	For either $b$ or $c$ correct
	$\left[ \text{or } c = \frac{27}{40} - b \right]$	<b>B1 FT</b>	<i>their</i> $b + \text{their } c = \frac{27}{40}$
		<b>4</b>	
(b)	$\left[ E(X) = \frac{3 \times 0 + 16 \times 1 + 30 \times 2 + 24 \times 3 + 7 \times 4}{80} = \right] \frac{176}{80} \text{ or } 2.2$	<b>B1 FT</b>	Correct or accept unsimplified calculation using <i>their</i> values for $b$ and $c$ seen (sum of probabilities = 1)
		<b>1</b>	

Question	Answer	Marks	Guidance
(c)	$[P(0, 1, 2) = ]^{10}C_0 0.2^0 0.8^{10} + ^{10}C_1 0.2^1 0.8^9 + ^{10}C_2 0.2^2 0.8^8$	<b>M1</b>	One term $^{10}C_x p^x (1-p)^{10-x}$ , for $0 < x < 10, 0 < p < 1$
	$0.107374 + 0.268435 + 0.301989$	<b>A1</b>	Correct expression, accept unsimplified leading to final answer
	0.678	<b>B1</b>	$0.677 < p \leq 0.678$
	<b>Alternative method for question (c)</b>		
	$1 - [^{10}C_{10} 0.2^{10} 0.8^0 + ^{10}C_9 0.2^9 0.8^1 + ^{10}C_8 0.2^8 0.8^2 + ^{10}C_7 0.2^7 0.8^3 + ^{10}C_6 0.2^6 0.8^4 + ^{10}C_5 0.2^5 0.8^5 + ^{10}C_4 0.2^4 0.8^6 + ^{10}C_3 0.2^3 0.8^7]$	<b>M1</b>	One term $^{10}C_x p^x (1-p)^{10-x}$ , for $0 < x < 10, 0 < p < 1$
		<b>A1</b>	Correct expression, accept unsimplified
	0.678	<b>B1</b>	$0.677 < p \leq 0.678$
		<b>4</b>	
(d)	$0.8^6 \times 0.2 + 0.8^7 \times 0.2 = 0.0524288 + 0.041943$	<b>M1</b>	$p^l \times (1-p) + p^m \times (1-p)$ , $l = 6, 7$ $m = l + 1, 0 < p < 1$
	0.0944	<b>A1</b>	$0.09437 \leq p \leq 0.0944$
		<b>2</b>	