

Question		Scheme		Marks	AOs
1(a)(i)	$X \sim B(15, 0.48)$			M1	3.3
	$P(X = 3) = 0.019668...$ awrt 0.0197			A1	3.4
(ii)	$[P(X \geq 5) = 1 - P(X \leq 4)] = 0.92013...$ awrt 0.920			A1	1.1b
				(3)	
(b)	Y is the number of hits		M is the number of misses		
	$Y \sim N(120, 62.4)$		$M \sim N(130, 62.4)$	B1	3.3
	$P(X > 110) \approx P(Y > 110.5)$ $\left[=P\left(Z > \frac{110.5 - "120"}{\sqrt{"62.4"}}\right) \right]$		$P(X > 110) \approx P(M < 139.5)$ $\left[=P\left(Z < \frac{139.5 - "130"}{\sqrt{"62.4"}}\right) \right]$	M1	3.4
	$= 0.88544...$			A1	1.1b
				(3)	
(6 marks)					
Notes:					
(a)	M1	Writing or using the binomial distribution in (i) or (ii) Allow for sight of B(15, 0.48) or in words: <u>binomial</u> with <u>n = 15</u> and <u>p = 0.48</u> may be implied in (i) or (ii) by one correct answer to 3sf <u>or</u> sight of $P(X \leq 4) = 0.07986...$ i.e. awrt 0.0799. Allow for ${}^{15}C_3 \times 0.48^3 \times 0.52^{12}$ as this is "correct use" Condone B(0.48, 15)			
(i)	A1	awrt 0.0197			
(ii)	A1	awrt 0.920 (Allow 0.92)			
(b)	B1	Setting up a correct Normal model. Allow sight of N(120, 62.4) or N(130, 62.4) or $N\left(120, \frac{312}{5}\right)$ or $N\left(130, \frac{312}{5}\right)$ or may be awarded if used correctly in standardisation or in words: <u>Normal</u> with <u>mean = 120/130</u> and <u>variance = 62.4</u> or sd = $\sqrt{62.4}$ condone $N\left(120, \sqrt{62.4}\right)$ or $N\left(130, \sqrt{62.4}\right)$ or sd = 62.4 Look out for $\sigma = \frac{\sqrt{1560}}{5}$ or $\frac{2\sqrt{390}}{5}$ or awrt 7.90 (condone 7.9) This may be implied by sight of 0.897 or 0.8854...			
	M1	Sight of the continuity correction with a normal distribution			
		110.5 or 111.5 or 109.5	139.5 or 140.5 or 138.5		
		NB we will also allow 129.5 or 130.5 or 128.5	NB we will also allow 120.5 or 119.5 or 121.5		
		Continuity correction may be seen in standardisation NB No continuity correction(CC) gives awrt 0.897 which is M0 unless CC seen			
	A1	awrt 0.8854 or awrt 0.885 dependent on sight of >110.5 or <129.5 or <139.5 or >120.5 Allow \leq or \geq instead of $<$ or $>$ NB 0.885548... from B(250, 0.48) scores M0A0			