

Question			Answer	Marks	AOs		Guidance
12	(a)		$2p + q + 0.2 + 0.3 = 1$ soi oe	B1	2.1		
			$2 \times p \times q = 0.06$ soi	M1	3.1a	allow M1 if 2 omitted	
			eliminate p or q with a correct substitution from one of <i>their</i> equations	M1	1.1		
			$q^2 - 0.5q + 0.06 = 0$ or $2p^2 - 0.5p + 0.03 = 0$ oe	A1	1.1	eg $2 \times \frac{0.03}{q} + q = 0.5$ or $2p + \frac{0.03}{p} = 0.5$	NB if 2 omitted, A0 for $2p^2 - 0.5p + 0.6 = 0$ or $2q^2 + q + 0.24 = 0$ which have no real roots
			$q = 0.2$ or 0.3 and $p = 0.15$ or 0.1	A1	1.1	may be implied by eg $q = 0.2$ or 0.3 and $2p = 0.3$ or 0.2	
			$(q < 2p \text{ so}) q = 0.2$ and $p = 0.15$	A1	3.2a		
			[6]				
12	(b)		$10 \times q \times (1 - q)^9$ soi	M1	1.1		
			0.27 or 0.268 or awrt 0.2684 isw	A1 [2]	1.1	FT <i>their</i> q where $0 < q < 1$	

Question			Answer	Marks	AOs		Guidance
12	(c)		$H_0: p = 0.2$ $H_1: p > 0.2$ p is the probability that the spinner shows a 1 (on any given spin) oe use of $X \sim B(100,0.2)$ where x is the number of 1s obtained in 100 spins to obtain $P(X \geq k)$ or $P(X \leq k)$ $P(X \leq 27) = \text{awrt } 0.97$ or $P(X \geq 28) = \text{awrt } 0.034$ $0.034 < 0.05$ or $0.97 > 0.95$ significant or reject H_0 or accept H_1 ; may be embedded in conclusion in context there is sufficient evidence to suggest (at 5% level) that the probability of a score of 1 is greater than 0.2	B1 B1 M1 A1 M1 A1 A1	1.1 2.5 3.3 1.1 3.4 1.1 2.2b	both hypotheses; allow equivalent in words or eg $P(1) = 0.2$ $k = 27, 28$ or 29 or critical region is $X \geq 28$ or 28 is in critical region must have the correct probability or correct critical region for the last two A marks	allow any parameter as long as clearly defined as probability M0 for $P(X = k)$ NB $P(X = 28) = 0.014\dots$ $P(X = 27) = 0.020168\dots$ FT <i>their</i> probability, dependent on award of first M1 do not allow eg conclude / prove / indicate or other assertive statement instead of suggest; A0 if answer spoiled
				[7]			