

Qu 1	Scheme	Marks	AO
(a)	$X \sim B(10, \frac{1}{6})$ [Allow 0.167 or better for $\frac{1}{6}$]	M1	3.3
(i)	$[P(X = 3) =] 0.155045\dots$ awrt 0.155	A1	1.1b
(ii)	$[P(X < 3) = P(X \leq 2) =] 0.775226\dots$ awrt 0.775	A1	1.1b
		(3)	
(b)	[Let $D =$ no. of days when $X = 3$] $D \sim B(60, "0.155")$	M1	3.3
	$P(D \geq 12) = 1 - P(D \leq 11)$ [Allow $1 - P(D < 12)$]	M1	3.4
	$= 1 - 0.78819\dots$ awrt 0.212	A1	1.1b
		(3)	
(c)	$[n = 600, p = \frac{1}{6}]$ estimate = 100	B1	3.4
		(1)	
(d)	$[S =$ total no. of sixes over 60 days. $] S \approx T \sim N\left("100", \sqrt{\frac{5}{6} \times 100}^2\right)$	M1A1	3.3,1.1b
	$P(S > 95) \approx P([T >]95.5)$ or $P\left([Z >] \frac{95.5 - "100"}{"9.128\dots"}\right)$ or $P([Z >] -0.49\dots)$	M1	3.4
	$= 0.688976\dots$ awrt 0.689	A1	1.1b
		(4)	
		(11 marks)	

Notes

If you see any attempt using an n -sided die with n not equal to 6 please send to review.

(a) M1 for sight or use of the correct distribution. **Must** have B, or Bin or Bpd or Bcd **and** the correct value for n and p , just $n = 10, p = \frac{1}{6}$ is M0

Implied by one answer correct to 2dp or by sight of $\binom{10}{3} \left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^7$ or one of :

$[P(X = 0) =]$ **0.16**(1...), $[P(X = 1) =]$ **0.32**(3...), $[P(X = 2) =]$ **0.29**(0...), $[P(X \leq 3) =]$ **0.93**(0...)

(i) 1st A1 for awrt 0.155

(ii) 2nd A1 for awrt 0.775

(b) 1st M1 for selecting a correct model. Sight or use of correct binomial, ft their (a)(i)
 May be implied by sight of $[P(D \leq 11) =] 0.78\dots$ or 0.79 or $[P(D \leq 12) =] 0.87\dots$
 2nd M1 for correct interpretation of "at least 12" and writing or using $1 - P(D \leq 11)$
We are not attempting to ft their incorrect 0.155 on our calculators here.
 A1 for awrt 0.212 [Answer only 3/3]

(c) B1 for 100 but must be seen in part (c) i.e. between (b) and (d)

(d) 1st M1 for attempting normal **with mean = 100** or ft their answer to (c)
 May be implied by the correct mean and a correctly labelled s.d. (σ) or var (σ^2)
 1st A1 for correctly labelled standard deviation allow $\sqrt{\frac{250}{3}} = \sqrt{83.3\dots} = 9.1(28\dots)$ or correctly labelled variance. Implied by $N(\mu, \frac{250}{3})$ or correct answer.
 2nd M1 for attempt at continuity correction i.e. sight of 95 ± 0.5
 2nd A1 for awrt 0.689 [Answer only 4/4]

NB **If they don't state the model for 1st M1 but just give probabilities with probability statements (Y is any letter):**
 1st M1 implied by: $P(Y > 94.5) = 0.52(63\dots)$, $P(Y > 95) = 0.52(39\dots)$, $P(Y > 95.5) = 0.52(15\dots)$

No cc 1st M1 1st A1 implied by: $P(T > 95) = 0.70(805\dots)$
 1st M1 1st A1 2nd M1 implied by: $P(T > 94.5) = 0.72(657\dots)$

Exact binomial gives 0.68567... and will likely score 0/4