

(i)	$P(\text{Correct forecast}) = \frac{55 + 128 + 81}{365} = \frac{264}{365}$	M1 A1	Numerator
(ii)	$P(\text{Correct forecast given sunny forecast})$ $= \frac{55}{75} = 0.733$	M1 A1	Denominator
(iii)	$P(\text{Correct forecast given wet weather})$ $= \frac{81}{117} = 0.692$	M1 A1	Denominator
(iv)	$P(\text{Cloudy weather given correct forecast})$ $= \frac{128}{264} = 0.485$	M1 A1	Denominator

2	(i)	(B)	$P(\text{Exactly 20 cured}) = \binom{20}{20} \times 0.78^{20} \times 0.22^0 = 0.0069$ $P(\text{At most 18 cured}) = 1 - (0.0069 + 0.0392)$ $= 0.954 \text{ (0.95385)}$	M1	For 0.78^{20} oe	Allow M2 for 0.9488 for linear interpolation from tables or M1 for $1 - 0.9918 = 0.0082$ and second M1 for correct FT using answer to (i)(A) Zero for use of $p = 0.8$ here Not necessarily correct, but both attempts at binomial, including coefficient in (i) and no extra terms (such as $P(X=18)$) Condone use of $p = 0.8$ Allow 0.95 with working
		(C)	$E(X) = np = 20 \times 0.78 = 15.6$	M1	For $P(19) + P(20)$	
		(i)		A1 [3]	CAO	
				B1	CAO	Do not allow final answer of 15 or 16 even if correct 15.6 given earlier
	(ii)		Let $X \sim B(20, 0.78)$ Let $p =$ probability of a patient being cured (for population) $H_0: p = 0.78$ $H_1: p > 0.78$	B1	For definition of p	In context See below for additional notes No further marks if point probabilities
			B1 B1	For H_0 For H_1		

Question	Answer	Marks	Guidance
	$P(X \geq 19) = 0.0392 + 0.0069$ $= 0.0461$ $0.0461 > 1\%$ <p>So not significant. Conclude that there is not enough evidence to suggest that the new drug is more effective than the old one.</p>	<p>B1</p> <p>B1*</p> <p>M1* dep A1 E1</p> <p>[8]</p>	<p>For NOTATION $P(X \geq 19)$ or $P(X > 18)$ or $1 - P(X \leq 18)$ or $1 - P(X < 19)$</p> <p>CAO For 0.0461 allow 0.0462</p> <p>For comparison with 1%</p> <p>used Notation $P(X = 19)$ scores B0. If they have the correct $P(X \geq 19)$ then give B1 and ignore any further incorrect notation.</p> <p>FT answer to (i)B for following three marks provided based on $1 - (P(19) + P(20))$ Dep on sensible attempt at $P(X \geq 19)$</p> <p>Allow 'accept H_0' or 'reject H_1' Must include 'insufficient evidence' or something similar such as 'to suggest that' ie an element of doubt either in the A or E mark. Must be in context to gain E1 mark. Do NOT allow 'sufficient evidence to suggest proportion cured is 0.78' or similar <u>99% method:</u> $P(X \leq 18) = 0.9539$ B1B1* CAO $0.9539 < 99\%$ M1* then as per scheme</p>
	<p>ALTERNATIVE METHOD FOR FINAL 5 MARKS</p> $P(X \geq 19) = 0.0461 > 1\%$	<p>B1</p>	<p>If combination of methods used, mark both and give higher mark. For either probability</p> <p>No further marks if point probabilities used</p> <p>Do not insist on correct notation as candidates have to work out two probabilities for full marks.</p>

Question		Answer	Marks	Guidance	
		$P(X \geq 20) = 0.0069 < 1\%$ So critical region is $\{20\}$ (19 not in CR so) not significant. Conclude that there is not enough evidence to suggest that the new drug is more effective than the old one.	M1 B1* A1* dep E1* dep	For at least one comparison with 1% CAO dep on the two correct probabilities Dep on correct CR Ignore any work on lower critical region	Allow comparison in form of statement 'critical region at 1% level is ...' No marks if CR not justified Condone $X \geq 20$, $X = 20$, oe but not $P(X \geq 20)$, etc Allow 'accept H_0 ' or 'reject H_1 '
2	(iii)	With a 5% significance level rather than a 1% level, the null hypothesis would have been rejected. OR: 'there would be enough evidence to suggest that the new drug is more effective than the old one.' This is because $0.0461 < 5\%$	B1* B1* dep [2]	oe oe	FT their probability from (ii) but NO marks if point probabilities used There must be a sensible attempt to use $P(X = 19) + P(X = 20)$ or must have correct CR. Dep on correct answer of 0.0461 compared with 5% or 0.9539 compared with 95% or correct CR.

Question			Answer	Marks	Guidance	
3	(i)	(A)	$X \sim B(10, 0.35)$ $P(5 \text{ accessing internet}) = \binom{10}{5} \times 0.35^5 \times 0.65^5$ $= 0.1536$ OR from tables $= 0.9051 - 0.7515 = 0.1536$	M1 M1 A1 OR M2 A1 [3]	or $0.35^5 \times 0.65^5$ For $\binom{10}{5} \times p^5 \times q^5$ cao For $0.9051 - 0.7515$ cao	With $p + q = 1$ Also for 252×0.0006094 Allow 0.15 or better <u>NB 0.153 gets A0</u> See tables at the website http://www.mei.org.uk/files/pdf/formula_book_mf2.pdf
	(i)	(B)	$P(X \geq 5) = 1 - P(X \leq 4)$ $= 1 - 0.7515$ $= 0.2485$	M1 A1 [2]	For 0.7515 cao	Accept 0.25 or better – allow 0.248 or 0.249 Calculation of individual probabilities gets B2 if fully correct 0.25 or better, otherwise B0.
	(i)	(C)	$E(X) = np = 10 \times 0.35$ $= 3.5$	M1 A1 [2]	For 10×0.35 cao	If any indication of rounding to 3 or 4 allow M1A0

Question		Answer	Marks	Guidance
3	(ii)	<p>Let $X \sim B(20, 0.35)$ Let p = probability of a customer using the internet (for population)</p> <p>$H_0: p = 0.35$</p>	<p>B1</p> <p>B1</p>	<p>For definition of p in context</p> <p>For H_0</p> <p>Minimum needed for B1 is p = probability of using internet. Allow $p = P(\text{using internet})$ Definition of p must include word probability (or chance or proportion or percentage or likelihood but NOT possibility). Preferably as a separate comment. However can be at end of H_0 as long as it is a clear definition 'p = the probability of using internet', Do NOT allow 'p = the probability of using internet is different'</p> <p>Allow $p=35\%$, allow only p or θ or π or ρ. However allow any single symbol <u>if defined</u> (including x) Allow $H_0 = p=0.35$, Allow $H_0: p=7/20$ or $p=35/100$ Allow NH and AH in place of H_0 and H_1 Do not allow $H_0: P(X=x) = 0.35$ Do not allow $H_0: =0.35, =35\%, P(0.35), p(x)=0.35, x=0.35$ (unless x correctly defined as a probability) Do not allow H_0 and H_1 reversed For hypotheses given in words allow Maximum BOB1B1 Hypotheses in words must include probability (or chance or proportion or percentage) and the figure 0.35 or Thus eg $H_0: p(\text{using internet}) = 0.35$, $H_1: p(\text{using internet}) \neq 0.35$ gets BOB1B1</p>

Question	Answer	Marks	Guidance	
	<p>$H_1: p \neq 0.35$</p> <p>H_1 has this form because the test is to investigate whether the proportion is different, (rather than lower or higher). $P(X \geq 10)$</p> <p>$= 1 - 0.8782 = 0.1218$</p> <p>> 2.5</p> <p>So not significant. Conclude that there is not enough evidence to indicate that the probability is different. (Must state 'probability', not just 'p')</p> <p>ALTERNATIVE METHOD FOR FINAL 5 MARKS</p> <p>Critical region method LOWER TAIL $P(X \leq 2) = 0.0121 < 2.5\%$ $P(X \leq 3) = 0.0444 > 2.5\%$</p> <p>UPPER TAIL $P(X \geq 11) = 1 - P(X \leq 10) = 1 - 0.9468 = 0.0532 > 2.5\%$ $P(X \geq 12) = 1 - P(X \leq 11) = 1 - 0.9804 = 0.0196 < 2.5\%$</p>	<p>B1</p> <p>E1</p> <p>B1</p> <p>B1*</p> <p>M1*</p> <p>dep</p> <p>A1*</p> <p>E1*</p> <p>dep on A1</p> <p>B1</p> <p>B1</p>	<p>For H_1</p> <p>For notation $P(X \geq 10)$ or $P(X > 9)$ or $1 - P(X \leq 9)$ (as long as no incorrect notation)</p> <p>For 0.1218 Allow 0.12</p> <p>For comparison with 2.5%</p> <p>For either probability</p> <p>For either probability</p>	<p>Allow '$p < 0.35$ or $p > 0.35$' in place of $p \neq 0.35$ Do not allow if H_1 wrong.</p> <p>This mark may be implied by 0.1218 as long as no incorrect notation. No further marks if point probs used - $P(X = 10) = 0.0686$ (do not even give the notation mark for correct notation) DO NOT FT wrong H_1, but see extra notes Or for $1 - 0.8782$ Indep of previous mark</p> <p>Allow 'accept H_0' or 'reject H_1' Must include 'sufficient evidence' or something similar such as 'to suggest that' ie an element of doubt either in the A or E mark.</p> <p>Do not insist on correct notation as candidates have to work out two probabilities for full marks. If only upper tail of CR given (or only upper tail justified), allow max 4/5 for final 5 marks.</p>

Question		Answer	Marks	Guidance
		<p>So critical region is {0,1,2,12,13,14,15,16,17,18,19,20}</p> <p>So not significant Conclude that there is not enough evidence to indicate that the probability is different.</p>	<p>M1* dep</p> <p>A1* E1* dep on A1</p> <p>[9]</p>	<p>cao dep on at least one correct comparison with 2.5%</p> <p>No marks if CR not justified Condone {0,1,2, 12, ... 20}, $X \leq 2$, $X \geq 12$, oe but not $P(X \leq 2)$ etc</p> <p>NB If CR found correctly then $P(X = 10)$ subsequently found but cand says '10 not in CR' then allow up to all last five marks. If do not say '10 not in CR' allow none of last five marks</p>
3	(iii)	<p>$0.0022 < 2.5\%$ So reject H_0, Significant.</p> <p>Conclude that there is enough evidence to indicate that the probability is different.</p>	<p>B1</p> <p>E1* dep</p> <p>[2]</p>	<p>For either reject H_0 or significant, dep on correct comparison Dep on good attempt at correct hypotheses in part (ii)</p> <p>If they have $H_1: p > 0.35$, allow SC1 if all correct including comparison with 5%.</p>