Question Number	Scheme	Notes	Marks
9(a)	$mx = x - x^2 \Rightarrow m = 1 - x \Rightarrow x = ...$ Or $y = \frac{y}{m} - \frac{y^2}{m^2} \Rightarrow m^2 = m - y \Rightarrow y = ...$	Attempts to eliminate either *x* or *y* and factors out or cancels *x*/*y* to get a linear equation and solve.	M1
	$x = 1 - m$ **and** $y = m(1-m)$	Both correct	A1
			(2)
(b)	$\int x - x^2 \left(-mx\right) \mathrm{d}x = \frac{x^2}{2} - \frac{x^3}{3}\left(-m\frac{x^2}{2}\right)$	$x^n \to x^{n+1}$ in at least one term	M1
	$\text{Area of } R_1 = \int_0^{"1-m"} \left\{x - x^2\left(-mx\right)\right\} \mathrm{d}x$ $= \frac{(1-m)^2}{2} - \frac{(1-m)^3}{3}\left(-m\frac{(1-m)^2}{2}\right) - 0$	Uses the limits "1 – *m*" and 0 in their integrated expression and subtracts (condone the omission of the "– 0")	M1
		Correct expression in *m* with/without the area under line subtracted.	A1
	$\text{Area of } R_1 = \int_0^{"1-m"} \left\{x - x^2 - mx\right\} \mathrm{d}x = \frac{(1-m)^2}{2}(1-m) - \frac{(1-m)^3}{3}(-0)$ Correct strategy for the area (may be scored for finding separate areas and subtracting)		dM1
	$= \frac{(1-m)^3}{6}$ *	Correct expression	A1*
			(5)
(c)	$\text{Area of } \left(R_1 + R_2\right) = \int_0^1 \left(x - x^2\right) \mathrm{d}x = \left[\frac{x^2}{2} - \frac{x^3}{3}\right]_0^1 = ...$ $\left(= \frac{1}{6}\right)$	Correct method for finding the area of $R_1 + R_2$ Alternatively, a correct method for finding the area of R_2	M1
	Alt: $\text{Area of } R_2 = \int_{1-m}^1 \left(x - x^2\right) \mathrm{d}x + \frac{1}{2}("1-m") \times m(1-m)$ $= \left[\frac{x^2}{2} - \frac{x^3}{3}\right]_{1-m}^1 + \frac{1}{2}m(1-m)^2 = ...\left(= \frac{1}{6} - \frac{(1-m)^2}{2} + \frac{(1-m)^3}{3} + \frac{1}{2}m(1-m)^2\right)$		
	$R_1 = R_2 \Rightarrow \frac{(1-m)^3}{6} = \frac{1}{12} \Rightarrow m = ...$	Sets up a correct equation using the answer to part (b) and solves for *m*	dM1
	Alt: $\frac{(1-m)^3}{6} = \frac{1}{6} - \frac{(1-m)^2}{2} + \frac{(1-m)^3}{3} + \frac{1}{2}m(1-m)^2 \Rightarrow m = ...$		
	$m = 1 - \frac{1}{\sqrt[3]{2}}$	Correct exact value in any form	A1
			(3)
			Total 10

Notes

(a)

M1: Attempts to eliminate either *x* or *y* and factors our or cancels *x*/*y* to get a linear equation and solves the resulting equation. May be implied by one correct coordinate of the two.

A1: Both coordinates correct. Accept $y = m - m^2$

(b)

M1: Attempts to integrate equation for curve *C* to find the area, may be part of integrating a difference of curve and line, or may be done separately.

M1: Applies the limits of 0 (may be implied) and their *x* from (a) (which must be in terms of *m*) to the integral (which must a changed function), and subtracts the correct way round. Again, may or may not be including the line at this point.

A1: Correct expression in *m* for the area under *C* between 0 and 1 – *m*. If the line equation has been subtracted and combined already, then it is for an unsimplified correct overall expression, but if it is separate then the A1 can be scored just the for area under *C*. If combined it is $\text{Area} = \frac{(1-m)^2}{2}(1-m) - \frac{(1-m)^3}{3}(-0)$

dM1: Depends on previous M. Correct overall strategy for the area. Can be scored if they have attempted curve – line, or may be scored for finding separate areas and subtracting the triangle area from area under curve. For the area under line, if not as part of integral, look for $\frac{1}{2} \times \text{their } x \times \text{their } y$ from part (a) subtracted from the curve.

A1: Fully correct work leading to the given answer with sufficient evidence of combination of terms before the given answer. Look for reaching an expression of the form $\frac{(1-m)^2}{2}(1-m) - \frac{(1-m)^3}{3}$ with $(1-m)^3$ terms before the final answer. Going from $= \frac{(1-m)^2}{2} - \frac{(1-m)^3}{3} - m\frac{(1-m)^2}{2}$ to the given answer with no intermediate step is A0.
Alternatively, they may fully expand their expression and factorise, or fully expand their expression and the given answer and compare and conclude it is the same – check carefully that all working is correct.

(c)

M1: Correct method for finding the area of $R_1 + R_2$. Look for the integral of *C* with limits 0 to 1 applied, the subtraction of 0 may be implied. Allow for $\frac{1}{6}$ from a correctly set up integral if the integration is not shown.
Alternatively score for a correct method for finding the area of R_2. Look for the integral of *C* from 1 – *m* to 1 with the area of the triangle added.

dM1: Sets up a correct equation using the answer to part (b) and reaches a value for *m*.

A1: $m = 1 - \frac{1}{\sqrt[3]{2}}$ Correct exact value in any form

Question Number	Scheme	Notes	Marks
10(i)	E.g. $p = 7 \Rightarrow 2p+1 = 15$ Which is not a prime number (so the statement is not true)	Identifies a counter example and makes a conclusion/shows it is not prime.	B1
			(1)
(ii)	$n \text{ odd} \Rightarrow n = 2k+1$ $\Rightarrow 5n^2+n+12 = 5(2k+1)^2+2k+1+12$ **or** $n \text{ even} \Rightarrow n = 2k$ $\Rightarrow 5n^2+n+12 = 5(2k)^2+2k+12$	Starts the proof by considering *n* odd **or** *n* even and substituting into the expression (see notes for logical approach)	M1
	$n \text{ odd} \Rightarrow n = 2k+1$ $\Rightarrow 5n^2+n+12 = 5(2k+1)^2+2k+1+12$ **and** $n \text{ even} \Rightarrow n = 2k$ $\Rightarrow 5n^2+n+12 = 5(2k)^2+2k+12$	Considers *n* odd **and** *n* even (as above)	M1
	n odd: $20k^2+22k+18$ which is even and n even: $20k^2+2k+12$ which is even	Attempts both with **at least one correct** expression that is stated to be even	A1
	n odd: $2(10k^2+11k+9)$ and n even: $2(10k^2+k+6)$ These are both even so $5n^2+n+12$ must be even for all integers *n*	Fully correct proof that considers both *n* odd and *n* even, shows the resulting expressions are even and makes a suitable conclusion	A1
			(4)
			Total 5

Notes

(i)

B1: For any correct counter example shown with calculation and suitable conclusion.
Another common suitable example is $p = 13$, as $2\times13+1 = 27 = 3^3$ so not prime.
Accept "not prime" or showing not prime by indicating a factor as conclusion.
E.g. a minimal acceptable answer is "$2\times7+1=15$ not prime", or "$2\times7+1=15=5\times3$ "

(ii) **Note** No marks if all they do is try a few cases.

M1: Considers the case of *n* being odd or *n* being even by setting it up algebraic substituting *n* = 2*k* or $n = 2k \pm 1$ into the quadratic expression. Allow with variables other than *k* – including *n*.

M1: Considers both odd and even cases, same criteria for each as in the first M.

A1: Both cases attempted with at least one correct expression (allow with *n*) simplified to a point where all coefficients are even integers with deduction made that the expression is even.
Note for $n = 2k-1$ it is $20k^2-18k+16 = 2(10k^2-9k+8)$

A1: Complete proof with all work correct and with factor 2 seen extracted in both expressions or explanation that all terms are multiples of 2/even hence it is even, and conclusion that the given expression is even for all integers. **Must be using a variable other than *n* for this mark.**

For approaches via "logic" a maximum of M1M1A0A0 is possible unless all relevant "odd × odd = odd" properties are also proved (which is unlikely to occur).

M1: Attempts logic reasoning that builds by term and gets at least as far as explaining a product of two terms, so "if *n* is odd/even then n^2 is odd/even" or equivalent if they have