Question number	Scheme	Marks
9 a	$\left(ax^4 = 3x^4\right) \Rightarrow a = 3$	B1
	$\left(4c = 64\right) \Rightarrow c = 16$	B1
	$\left(bx^3 - 4ax^3 = 4x^3\right) \Rightarrow b - 4a = 4$ or $\left(4ax^2 - 4bx^2 + cx^2 = -36x^2\right)$ $\Rightarrow 4a - 4b + c = -36$ *or* $\left(4bx - 64x = 0x\right) \Rightarrow 4b - 64 = 0$	M1
	$b = 16$	A1 (4)
b	$\int_0^2 (x^3 + x^2 - 6x)\mathrm{d}x = \left[\frac{x^4}{4} + \frac{x^3}{3} - \frac{6}{2}x^2\right]_0^2$	B1 (M1 on ePen) M1
	$= \left("\frac{2^4}{4} + \frac{2^3}{3} - 3(2)^2"\right) - (0)$	M1 (A1 on ePen)
	$= \pm\frac{16}{3}$ oe	A1 (M1 on ePen)
	$\left(\left["\frac{x^4}{4} + \frac{x^3}{3} - 3x^2"\right]_x^0 = \pm\frac{16}{3} \Rightarrow\right)(0) - \left("\frac{x^4}{4} + \frac{x^3}{3} - 3x^2"\right) = \pm\frac{16}{3}$ oe	M1
	$3x^4 + 4x^3 - 36x^2 + 64 = 0$	A1
	$(x-2)^2(3x^2 + 16x + 16) = 0*$	A1* cso (7)
ALT	$\int_x^2 (x^3 + x^2 - 6x)\mathrm{d}x = \left["\frac{x^4}{4} + \frac{x^3}{3} - 3x^2"\right]_x^2$	B1 (M1 on ePen) M1
	$= \left("\frac{2^4}{4} + \frac{2^3}{3} - 3(2)^2"\right) - \left("\frac{x^4}{4} + \frac{x^3}{3} - 3(x)^2"\right)$	M1 (A1 on ePen)
	$\pm\left(-\frac{16}{3} - \frac{x^4}{4} - \frac{x^3}{3} + 3x^2\right) = 0$	A1 (M1 on ePen)
	$3x^4 + 4x^3 - 36x^2 + 64 = 0$	M1 A1
	$(x-2)^2(3x^2 + 16x + 16) = 0*$	A1
c	(When $(x-2) = 0$ $\quad x = 2$ and when $3x^2 + 16x + 16 = 0$) $(3x+4)(x+4) = 0$ so $x = -\frac{4}{3}$ and $x = -4$	M1 A1
	($x \neq -4$ as it is to the left of the point at $x = -3$) $x = -\frac{4}{3}$	M1
	When $"x = -\frac{4}{3}"$ $\quad y = \left("-\frac{4}{3}"\right)^3 + \left("-\frac{4}{3}"\right)^2 - 6\left("-\frac{4}{3}"\right) = \frac{200}{27}$	dM1
	So $A = \left(-\frac{4}{3}, \frac{200}{27}\right)$	A1 (5)
		Total 16 marks

Part	Mark	Notes
(a)	B1	$a = 3$
	B1	$c = 16$
	M1	For a clear process to equate coefficients to find either of the equations $b - 4a = 4$ or $4a - 4b + c = -36$ or $4b - 64 = 0$. Allow one error. For algebraic division: there must be a complete attempt to divide by $x^2 + px + q$ and reach an expression of the form $3x^2 + rx + 16,\ p,q,r \neq 0$
	A1	$b = 16$
Full marks may be awarded for all of *a*, *b* and *c* appearing correctly with no method shown. Embedded *a*, *b* and *c* should be awarded full marks.		
(b)	B1 (M1 on ePen)	Correct limits of $x = 0$ and $x = 2$ – or used later in working.
	M1	For a minimally acceptable attempt to integrate any 3 term cubic of the form $x^3 + fx^2 + gx$. Limits do not need to be present. See general guidance for the definition of a minimally acceptable attempt.
	M1 (A1 on ePen)	Substitution of their limits into any changed expression, the correct way round minimum 3 terms. Sub of 0 not needed. Allow this mark to be implied by a fully correct value.
	A1 (M1 on ePen)	Either for a fully correct substitution, or for $\pm\frac{16}{3}$
	M1	For $(0) - \left("\frac{x^4}{4} + \frac{x^3}{3} - 3x^2" \right) = \pm\frac{16}{3}$ oe. Allow use of their integrated expression and their $\pm\frac{16}{3}$ which can be in any equivalent form, including an unevaluated expression. Allow use of *n* rather than *x*. The limit of 0 need not be seen.
	A1	For $3x^4 + 4x^3 - 36x^2 + 64 = 0$ Allow use of *n* rather than *x*. $\frac{16}{3}$ must have been evaluated.
	A1* cso	For $(x-2)^2(3x^2 + 16x + 16) = 0$.No errors in working. Candidates can use *n* throughout.
ALT	B1 (M1 on ePen)	Correct limits of $x = x$ and $x = 2$ – seen on the integral or used later in working. These can be either way round.
	M1	For a minimally acceptable attempt to integrate any 3 term cubic of the form $x^3 + fx^2 + gx$. Limits do not need to be present. See general guidance for the definition of a minimally acceptable attempt.
	M1 (A1 on ePen)	For substitution of both of their limits into any changed expression. Minimum 3 terms
	A1 (M1 on ePen)	For $\pm\left(-\frac{16}{3} - \frac{x^4}{4} - \frac{x^3}{3} + 3x^2 \right) = 0$
	M1	For a valid attempt to multiply their equation throughout to arrive at integer coefficients.
	A1 A1	As main scheme. Candidates can use *n* throughout.
(c)	M1	For a complete and minimally acceptable attempt to solve $3x^2 + 16x + 16 = 0$ to give $x =$ See general guidance for definition of minimally acceptable. Some candidates may have factorised in part b), if used in part c), marks can be awarded
	A1	For $x = -\frac{4}{3}$ and $x = -4$
	M1	Chooses "$x = -\frac{4}{3}$" , can be stated explicitly or used later implicitly. Allow choice of their *x* coordinate for $-3 < x < 0$
	dM1	For substituting $x = "-\frac{4}{3}"$ into $y = x(x+3)(x-2)$ Allow substitution of their *x*, dependent on previous method mark
	A1	$A = \left(-\frac{4}{3}, \frac{200}{27} \right)$ students may list $x = -\frac{4}{3}, y = \frac{200}{27}$