Question Number	Scheme	Marks
5(a)	$f'(x) = 12x^{-\frac{1}{2}} + \frac{x}{3} - 4$	
	One of $x^{-\frac{1}{2}} \to x^{\frac{1}{2}}$, $-4 \to -4x$, $x \to x^2$	M1
	$f(x) = \int 12x^{-\frac{1}{2}} + \frac{x}{3} - 4\,dx = 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x + c$	A1A1
	$8 = 24(9)^{\frac{1}{2}} + \frac{(9)^2}{6} - 4(9) + c \Rightarrow c = ...$	dM1
	$\left(f(x) =\right)\ 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x - \frac{83}{2}$	A1
		(5)
(b)	$f'(9) = \frac{12}{\sqrt{9}} + \frac{9}{3} - 4 \quad (=3)$	M1
	$3 \to -\frac{1}{3}$	dM1
	$y - 8 = "-\frac{1}{3}"(0-9)$	M1
	$(0, 11)$	A1
		(4)
		(9 marks)

(a)

M1 Integrates by raising the power on one of the terms (ie $x^{-\frac{1}{2}} \to x^{\frac{1}{2}}$, $-4 \to -4x^1$, $x \to x^2$). The index does not need to be processed.

A1 Two terms correct of $24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x$ or unsimplified equivalent which may appear as a list. The indices must be processed. Allow x^1

A1 $24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x\ (+c)$ or unsimplified equivalent. Condone the lack of +*c* for this mark. Allow x^1 and ignore any spurious notation including = 0

dM1 Attempts to substitute $x = 9, y = 8$ into their f(*x*) and proceeds to find *c*. It is dependent on the previous method mark. If they have no + *c* then this mark cannot be scored.

A1 $\left(f(x) =\right)\ 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x - \frac{83}{2}$ or simplified equivalent. Withhold this mark if they attempt to make the coefficients integers. Do not accept rounded decimals such as $0.166x^2$. Also withhold this mark if spurious notation around the answer is seen such as the integral and d*x* or an = 0

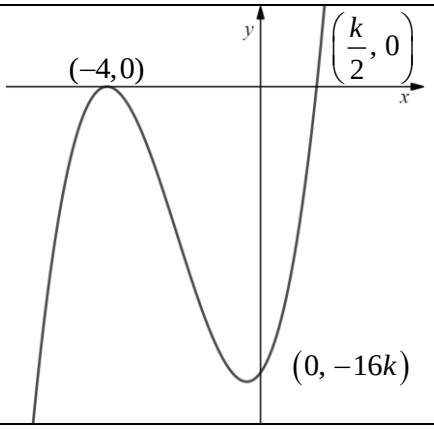
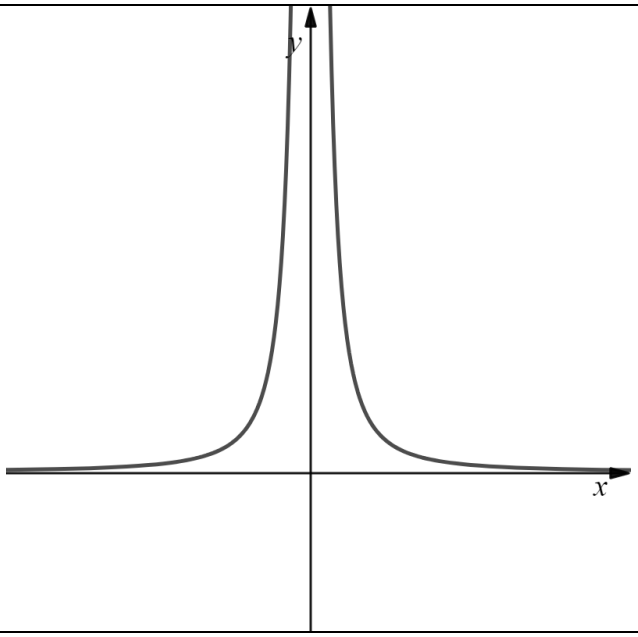
(b)

M1 Attempts to substitute $x = 9$ to find a value for $f'(9)$

dM1 Attempts to find the negative reciprocal to find the gradient of the normal. It is dependent on the previous method mark.

M1 It is for the attempt to find the normal line passing though $(9,8)$, using a changed gradient from $f'(9)$ and substituting $x = 0$. Alternatively, they may just use their gradient of the normal to determine where the line crosses the *y*-axis knowing that for every "3 units to the left it is 1 up". Condone a changed gradient from finding $f''(9)$ instead of from $f'(9)$ for this mark.

A1 $(0, 11)$ or allow it to be written as $x = 0,\ y = 11$

Question Number	Scheme	Marks
6(a)(i)		B1B1B1
		(3)
(a)(ii)		B1B1
		(2)
(b)	One root because the two graphs intersect each other once	B1
		(1)
		(6 marks)

(a)(i) If multiple attempts are made then mark the last attempt. Condone if (i) and (ii) are drawn on the same set of axes

B1 A positive cubic shape with a local maximum and a local minimum drawn anywhere on a set of axes. Do not be concerned regarding the location of the minimum. Mark of the intention to draw a cubic so condone aspects which may appear linear or slips of the pen.

B1 Intersects (not just meet) the *x*-axis at $x = \frac{k}{2}$ to the right of the *y*-axis and has a local maximum (or minimum) on $x = -4$ which must be to the left of the *y*-axis. If there is a contradiction between the labelling on the graph and values stated separately then the graph labels take precedence. Condone for example $(-4, 0)$ labelled as $(0, -4)$ as long as it is in the correct position on the axis

B1 *y*-intercept is $-16k$ (which must be below the *x*-axis) If there is a contradiction between the labelling on the graph and the *y*-intercept stated separately then the graph label takes precedence. Condone for example $(0, -16k)$ labelled as $(-16k, 0)$ as long as it is in the correct position on the axis