Question Number	Scheme	Marks
5.(a)	$\frac{dy}{dx} = \frac{1}{2}x^2 + 2x^{-\frac{1}{2}}$	M1A1 A1 **(3)**
(b)	$\left.\frac{dy}{dx}\right\|_{x=4} = \frac{1}{2}\times 4^2 + 2\times\frac{1}{\sqrt{4}} = (9)$	M1
	Gradient of normal is $-\frac{1}{9}$	dM1
	$y - \frac{11}{3} = -\frac{1}{9}(x-4) \Rightarrow x + 9y - 37 = 0$	M1 A1 **(4)** **(7 marks)**

(a)

M1 For reducing the power by one on any x term

A1 Two correct terms which may be unsimplified (but ignore spurious extra terms like −15 for this mark)

A1 Fully correct and simplified. Accept exact simplified equivalents. Eg $\frac{x^2}{2} + \frac{2}{\sqrt{x}}$

Withhold the final A mark if "+c" is included.

(b)

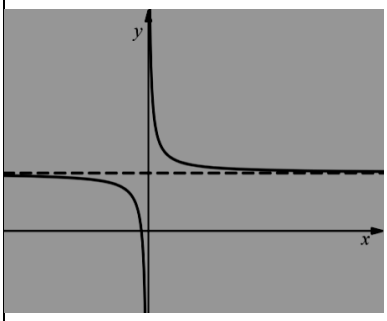
M1 For substituting $x = 4$ into their $\frac{dy}{dx}$

dM1 For the correct method of using the negative reciprocal to find the gradient of the normal.

M1 For an attempt at finding the equation of the normal. It is for using a changed gradient and the point $\left(4, \frac{11}{3}\right)$ If the form $y = mx + c$ is used they must proceed to c = ...

A1 $x + 9y - 37 = 0$ or any (positive or negative) integer multiple thereof.

Accept with terms in a different order, but must include "=0". ISW after a correct answer.

Question Number	Scheme	Marks
6. (a)	 Shape States asymptote as $y=k$ States intercept as $-\frac{4}{k}$	B1 B1 B1 **(3)**
(b)	$10-2x=\frac{4}{x}+k \Rightarrow 10x-2x^2=4+kx$	M1
	$\Rightarrow 2x^2+(k-10)x+4=0$	A1
	Attempts $"b^2-4ac"=0 \Rightarrow (k-10)^2-4\times2\times4=0$	M1
	$k=10\pm4\sqrt{2}$ oe	M1 A1
		(5) **(8 marks)**

(a)

B1 Correct shape for graph. Look for a $y=\frac{1}{x}$ curve translated in any direction. Be tolerant with slips of pen how close the approach to asymptotes are, but the curve must not bend back on itself.

B1 Curve has horizontal asymptote above the *x*-axis with asymptote **stated** as $y=k$ on diagram or in text. (Do not accept just *k* marked on the axis for this mark.)

B1 Curve crosses (not just touches) the negative *x*-axis, with intercept marked or stated as $-\frac{4}{k}$

(b)

M1 Equates and attempts to multiply by *x* obtaining terms in x^2, *x* and constant(s).

A1 $2x^2+(k-10)x+4=0$ This may be implied by a correct *a*, *b* and *c*

M1 Attempts $"b^2-4ac"=0 \Rightarrow (k-10)^2-4\times2\times4=0$ Withhold this mark if an inequality is applied.

M1 For a correct method of finding at least one value for *k* from this attempt at the discriminant which is quadratic in *k*. Allow this mark for attempts using inequalities rather than equality, e.g. $b^2-4ac<0$

A1 $k=10\pm4\sqrt{2}$ oe (Do not accept decimal approximations and do not isw if an inequality is later stated.)

.....

Alt for 6(b)

M1 Attempts to set $\frac{dy}{dx}=-2$ (usual rules for differentiation)

A1 Finds at least one value on the curve at which $\frac{dy}{dx}=-2 \Rightarrow -\frac{4}{x^2}=-2 \Rightarrow x=\pm\sqrt{2}$ (accept awrt ±1.41)

dM1 Substitutes one of their *x* values into $y=10-2x$ to find at least one *y* value. Eg $x=\sqrt{2}, y=10-2\sqrt{2}$

ddM1 Substitutes one of their (x,y) values into $y=\frac{4}{x}+k$ and proceeds to find one value for *k*.

A1 $k=10\pm4\sqrt{2}$