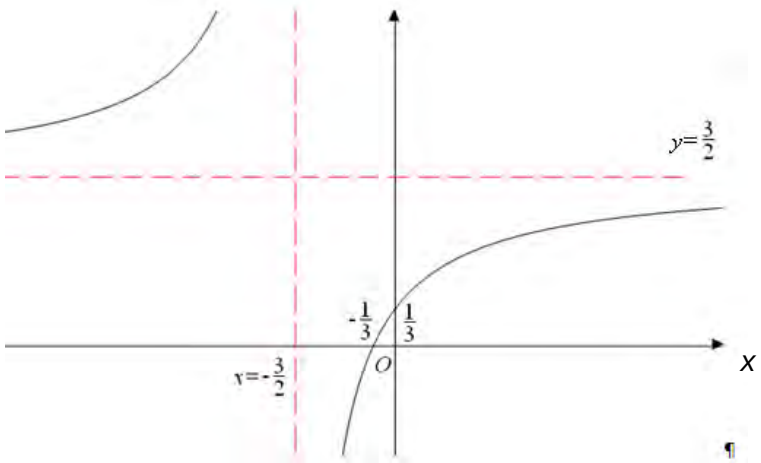
Question Number	Scheme	Marks
9 (a)	(i) $y=\frac{3}{2}$ (ii) $x=-\frac{3}{2}$	B1 B1 (2)
(b)	(i) $x=-\frac{1}{3}$ or $\left(-\frac{1}{3},0\right)$ (ii) $y=\frac{1}{3}$ or $\left(0,\frac{1}{3}\right)$	B1 B1 (2)
(c)	*Y*  	B1 shape B1 asymptotes B1 crossing points (3)
(d)	$\frac{dy}{dx}=\frac{3(2x+3)-2(3x+1)}{(2x+3)^2}$ $x=-\frac{1}{3}\ \frac{dy}{dx}=\frac{3\times\frac{7}{3}-2\times0}{\left(\frac{7}{3}\right)^2}=\frac{9}{7}$ Grad *l* = $-\frac{7}{9}$ Eqn*l*: $y=-\frac{7}{9}\left(x+\frac{1}{3}\right)$	M1A1 M1d A1 A1ft (5)

(e)	$y=-\frac{7}{9}\left(x+\frac{1}{3}\right)=\frac{3x+1}{2x+3}$	ALT:	M1
	$81x+27=-42x^2-77x-21$	$-\frac{7}{9}\times\frac{1}{3}=\frac{1}{2x+3}$	M1
	$42x^2+158x+48=0$	$-14x-21=27$	A1
	$(3x+1)(7x+24)=0$ (or use formula) solve linear eqn	solve linear eqn	M1
	x-coordinate of B is $-\frac{24}{7}$ $\left(\text{Accept } x=-\frac{24}{7}\right)$ correct answer		A1 (5) **[17]**

Notes

(a) (i) NOTE: If answers are transposed, award B0B1
If equations are on the graph, they must be written as equations.

B1 answer as shown. $y=\frac{3}{2}$

(ii)

B1 answer as shown $x=-\frac{3}{2}$

(b) (i)

B1 answer as shown $x=-\frac{1}{3}$ or $\left(-\frac{1}{3},0\right)$

(ii)

B1 answer as shown $y=\frac{1}{3}$ or $\left(0,\frac{1}{3}\right)$

(c)

B1 for a rectangular hyperbola with one with branches in the correct quadrants. Please be generous on the shape of the curves.

B1 for the correct asymptotes f t their answers to part (a) There must be at least one branch of their graph for the award of this mark.

B1 for the correct intersections, ft their answers to part (b)

(d)

M1 for attempting to differentiate $y=\frac{3x+1}{2x+3}$. When using quotient rule, there must be an attempt to differentiate and **subtract** the terms in the numerator; the denominator must be **squared**.

ALT (using product rule)

M1 for attempting to differentiate and add two terms.

$$\frac{dy}{dx} = 3(2x+3)^{-1} + (2x+3)^{-2}(-1)(3x+1)(2) \Rightarrow \frac{3}{2x+3} - \frac{2(3x+1)}{(2x+3)^2}$$

A1 for a fully correct differentiated expression

M1d for substituting $x = -\frac{1}{3}$ [ft their value from part (b) (i)] into their differentiated expression

Check the differentiation as they can achieve $\frac{9}{7}$ from incorrect calculus.

A1 for gradient of normal $m = -\frac{7}{9}$

A1ft uses $y - y_1 = m(x - x_1)$ to achieve an equation for the normal, where m is $-\frac{1}{f'(1/3)}$.

(e)

M1 for equating their straight line in the form $y = -\frac{7}{9}\left(x + \frac{1}{3}\right)$ with the equation of the curve. Simplification is not required for this mark.

M1 for simplifying their equation to form a 3TQ

A1 for the correct 3TQ

M1 for an attempt to solve their **3TQ** (please see General Guidance)

A1 for the coordinate of $B = -\frac{24}{7}$

ALT

M1 for equating their straight line in the form $y = -\frac{7}{9}\left(x + \frac{1}{3}\right)$ with the equation of the curve.

M1 for attempting to form a linear equation in x $-\frac{7}{9} \times \frac{1}{3} = \frac{1}{2x+3}$

A1 for the correct linear equation

M1 for attempting to solve their equation (moves at least one term correctly to the other side of the equality)

A1 for the coordinate of $B = -\frac{24}{7}$