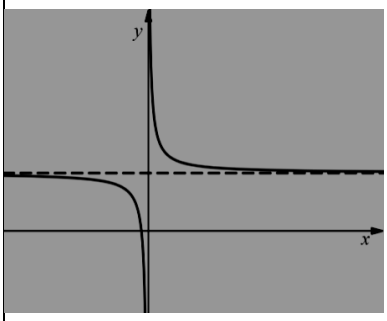
Question Number	Scheme	Marks
6. (a)	 Shape States asymptote as $y=k$ States intercept as $-\frac{4}{k}$	B1 B1 B1 **(3)**
(b)	$10-2x=\frac{4}{x}+k \Rightarrow 10x-2x^2=4+kx$	M1
	$\Rightarrow 2x^2+(k-10)x+4=0$	A1
	Attempts $"b^2-4ac"=0 \Rightarrow (k-10)^2-4\times2\times4=0$	M1
	$k=10\pm4\sqrt{2}$ oe	M1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

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Alt for 6(b)

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

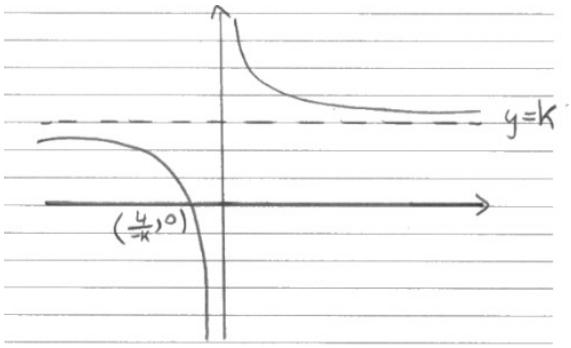
A1 Finds at least one value on the curve at which $\frac{dy}{dx}=-2 \Rightarrow -\frac{4}{x^2}=-2 \Rightarrow x=\pm\sqrt{2}$ (accept awrt ±1.41)

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

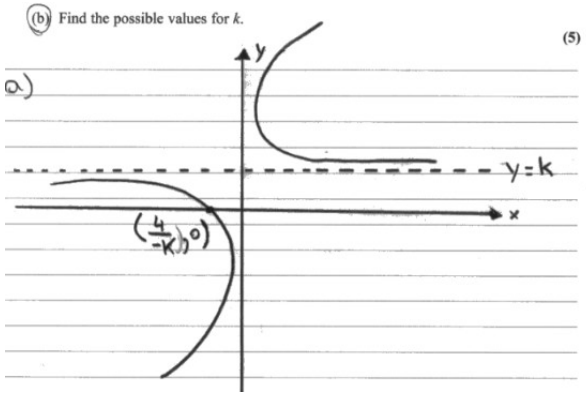
ddM1 Substitutes one of their (x,y) values into $y=\frac{4}{x}+k$ and proceeds to find one value for *k*.

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

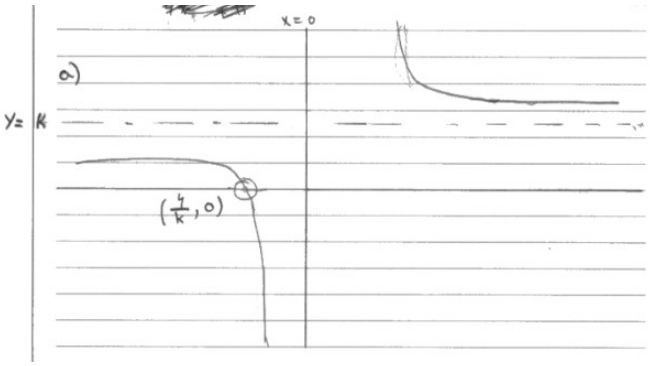
Examples for part (a)



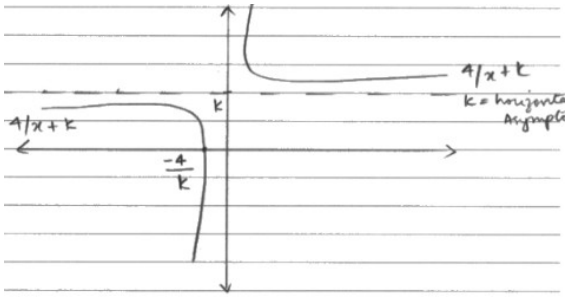
B1B1B1 Pen slip rather than turning back



B0B1B1 Turning back on itself



B1B1B0 Generous with a bit of gap between curve and asymptote



B0B0B1 All four approaches bend away from the asymptote

Question Number	Scheme	Marks
7.(a)	Attempts $\frac{dy}{dx} = 4x$ at $x = 2$	M1
	At $x = 2$ gradient of tangent = 8	A1 **(2)**
(b)	$\left(y_Q =\right)\ 2(2+h)^2 + 5$	B1
	Gradient $PQ = \frac{\text{their } y_Q - 13}{2+h-2}$	M1
	$\left(= \frac{8h + 2h^2}{h}\right) = 8 + 2h$	A1 **(3)**
(c)	States as $h \to 0$ Gradient $PQ \to 8$ = Gradient of tangent	B1 **(1)**
		(6 marks)

(a)

M1 Attempts to find the value of $\frac{dy}{dx} = ax, \quad a > 0$ at $x = 2$

A1 For 8. No need to state this is the gradient.

(b)

B1 $\left(y_Q =\right)\ 2(2+h)^2 + 5$

M1 Attempts $\pm\frac{y_Q - y_P}{x_Q - x_P}$ condoning slips, but must be a genuine attempt at y_Q

A1 Gradient is $8 + 2h$ (with no errors seen)

(c)

B1 States as $h \to 0$ Gradient $PQ \to 8$ = Gradient of tangent (oe)

There should be reference to "limit" or "as h tends to 0" (words or symbols) and linked to part (a) (so same gradient, or showing the answers agree). But be generous with the explanation beyond these constraints.