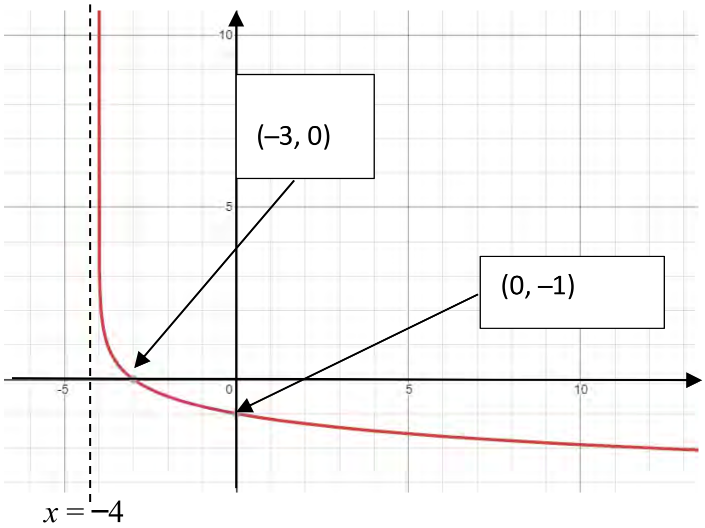
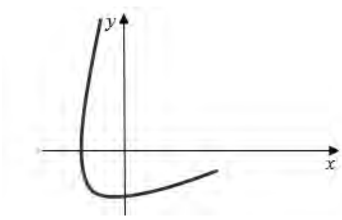
Question	Scheme	Marks
7(a)		B1 Shape and position B1 Intersection with x-axis B1 Intersection with y-axis B1 Asymptote [4]
(b)	$\log_{(x+4)} 256 - \log_4(x+4) = 0 \Rightarrow \dfrac{\log_4 256}{\log_4(x+4)} - \log_4(x+4) = 0$ $\Rightarrow 4 - (\log_4(x+4))^2 = 0 \Rightarrow (\log_4(x+4))^2 = 4$ $\Rightarrow \log_4(x+4) = \pm 2$ $x + 4 = 4^2 \Rightarrow x = 12$ $x + 4 = 4^{-2} \Rightarrow x = -\dfrac{63}{16}$ or -3.9375	M1 M1 M1 A1 A1 [5]
		Total 9 marks

Part	Mark	Notes
(a)	B1	For the correct shape in the correct position. Ignore intersections and the asymptote for this mark. Award as long as the curve is the correct way around in quadrants 2, 3 and 4. The ends must not turn back in themselves. Do Not accept for example:  If there are two or more lines, and candidates have not made clear which ONE they want marked– award B0
	B1	For a line/curve **passing** through $(-3, 0)$ or accept $x = -3$ Do not accept stopping at the axis.
	B1	For a line/curve passing through $(0, -1)$ or accept $y = -1$ Do not accept stopping at the axis.
	B1	For the correct **equation** only of the asymptote. If they also give a horizontal asymptote then do not isw – it is B0
(b)		**Method 1 - Works in log base 4**
	M1	For changing the base of the log to base 4
	M1	For forming a quadratic in terms of $(x + 4)$ Accept a substitution for the log
	M1	For taking the square root **and** undoing the log. Accept just the positive root for this mark.
	A1	For either $x = 12$ or $-\frac{63}{16}$
	A1	For both $x = 12$ and $-\frac{63}{16}$
		Method 2 – Works in log base $(x + 4)$
	M1	For changing the base of the log to base $(x + 4)$ $\log_{(x+4)} 256 - \frac{\log_{(x+4)}(x+4)}{\log_{(x+4)} 4} = 0 \Rightarrow$
	M1	Changes $\log_{(x+4)}(x+4) = 1$ and $\log_{(x+4)} 256 = 4\log_{(x+4)} 4$ And forming a quadratic equation with log base (x + 4) $\left(\log_{(x+4)} 4\right)^2 = \frac{1}{4}$ Accept a substitution for the log
	M1	Takes the square root (accept just the positive root) **and** undoes the log $\log_{(x+4)} 4 = \pm\frac{1}{2} \Rightarrow 4 = (x+4)^{\frac{1}{2}}$ and $4 = (x+4)^{-\frac{1}{2}}$
	A1	For either $x = 12$ or $-\frac{63}{16}$
	A1	For both $x = 12$ and $-\frac{63}{16}$

	Method 3 works in an unspecified base. If it is just log, assume base 10	
	M1	For changing the base $\frac{\log 256}{\log(x+4)} - \frac{\log(x+4)}{\log 4} = 0$
	M1	Forms a QE in terms of $(x + 4)$ $4(\log 4)^2 = (\log(x+4))^2$ oe
	M1	Takes square root (accept just the positive root) and undoes the log $\pm 2\log 4 = \log(x+4) \Rightarrow \log 4 = \pm\frac{1}{2}\log(x+4)$ $\Rightarrow \log 4 = \log(x+4)^{\pm\frac{1}{2}} \Rightarrow 4 = (x+4)^{\pm\frac{1}{2}}$ $\Rightarrow 16 = x+4, \quad \frac{1}{16} = x+4$
	A1	For either $x = 12$ or $-\frac{63}{16}$
	,A1	For both correct values $x = 12$ and $-\frac{63}{16}$