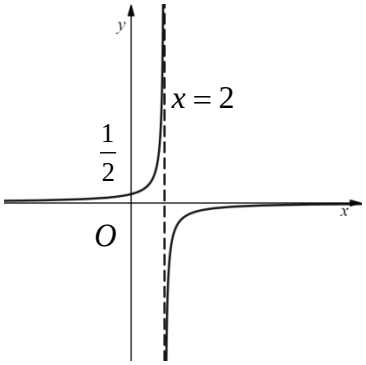
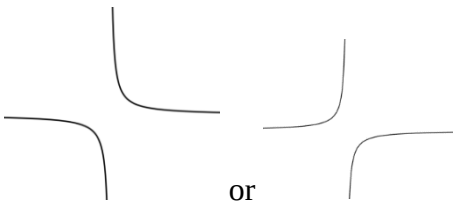
Question Number	Scheme	Marks
6.(a)	 1/*x* type shape Fully correct Correct equation of vertical asymptote and *y* intercept	M1 A1 B1 **(3)**
(b) (i)	Sets $kx-4=\dfrac{1}{2-x}\Rightarrow(kx-4)(2-x)=1$	M1
	$kx^2+(-4-2k)x+9=0$	A1
	Attempts use $b^2-4ac\ldots0\ \Rightarrow(-4-2k)^2-4k\times9\ldots0$	dM1
	$\Rightarrow 4k^2-20k+16\ldots0\Rightarrow k^2-5k+4\ldots0$ *	A1*
(ii)	$(k-1)(k-4)\ldots0\Rightarrow k\ ,,\ 1,\ k\ldots4$	M1, A1
		(6) **(9 marks)**

(a)

M1: Correct shape for a $\dfrac{1}{x}$ type graph. Look for  or

Must have two branches, be generous with curves that bend back on themselves if the intent is clear.

A1: Fully correct shape and position. Do not accept curves that clearly bend back on themselves, but "pen flicks" at the end of a curve can be condoned.

B1: Correct equation (must be an equation) of asymptote and *y* intercept. The graph must be asymptotic here and in the correct places (e.g. the equation must match the placement), though it need not be fully correct – as long as these features are shown. Information stated on the graph takes precedence but if coordinates or equation are missing, allow if they are stated in the text. Accept ½ labelled on the *y*-axis for the intercept. Condone (½ , 0) if it is in the correct position on the axis.

(b)(i)

M1: Sets $kx-4=\dfrac{1}{2-x}\Rightarrow(kx-4)(2-x)=1$

A1: $kx^2+(-4-2k)x+9=0$ with terms collected. This may be implied by later work, e.g. a = ..., b =…, c =… listed or used. The "=0" may be implied.

dM1: Attempts use $b^2-4ac\ldots0 \Rightarrow(-4-2k)^2-4k\times9\ldots0$ with their coefficients to set up a quadratic inequality in k. Must be the correct direction of inequality but allow > or …. Use of $b^2 - 4ac = 0$ will score dM0 unless clearly recovered before stating that answer.

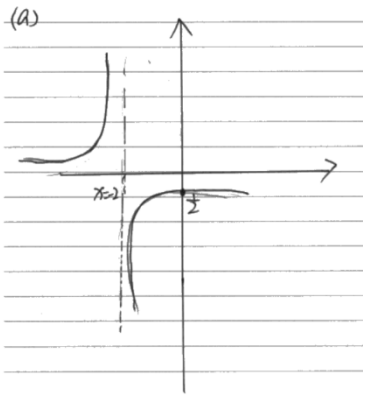
A1*: Achieves the given answer of $k^2-5k+4\ldots0$ with no errors and sufficient working shown – the bracket should be expanded before the final answer is reached. A0 if x used in place of k.

(b)(ii)

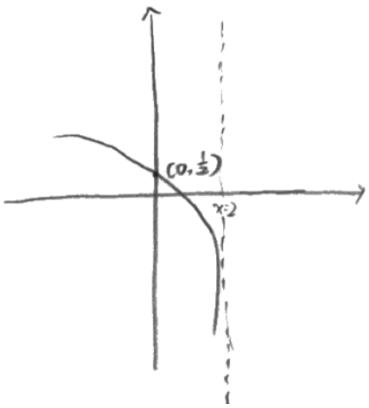
M1: Solves to find the critical values – may be implied by sight of 1 and 4 used in their answer but must have two values from a valid attempt to solve. Allow from attempts at their "b^2-4ac"...0 with any inequality or equality.

A1: k,, $1, k\ldots4$ Accept with "and" or "or" used. Accept interval notation $(k\in)\,(-\infty,1]\cup[4,\infty)$ - must be correct union if set notation used. Must be the final answer, but allow if recovery from "incorrect" inequalities when solving for the critical values. A0 if x used instead of k. Note 4,, k,, 1 is A0.

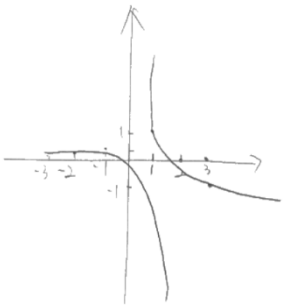
Some examples of graphs:



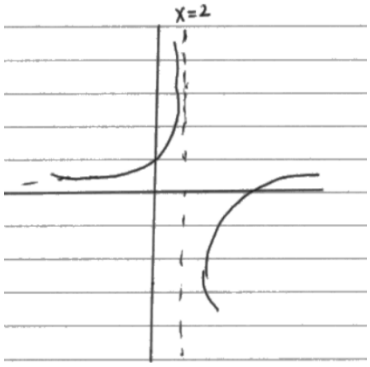
M1A0B0 intent clear for first M. Wrong position, A0, incorrect asymptote and intercept, B0.



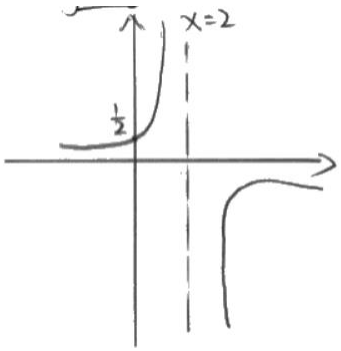
M0A0B1 Only one branch, but asymptote and intercept correct.



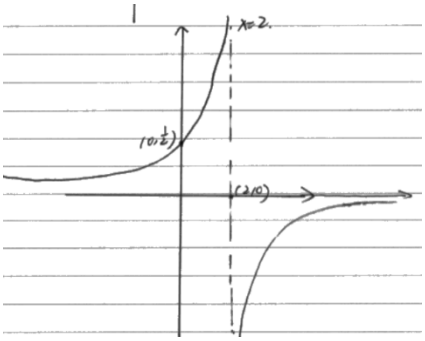
M1A0B0 this intent is acceptable for the shape, but not fully correct as "overlapping" so A0. Intercept/asymptotes incorrect.



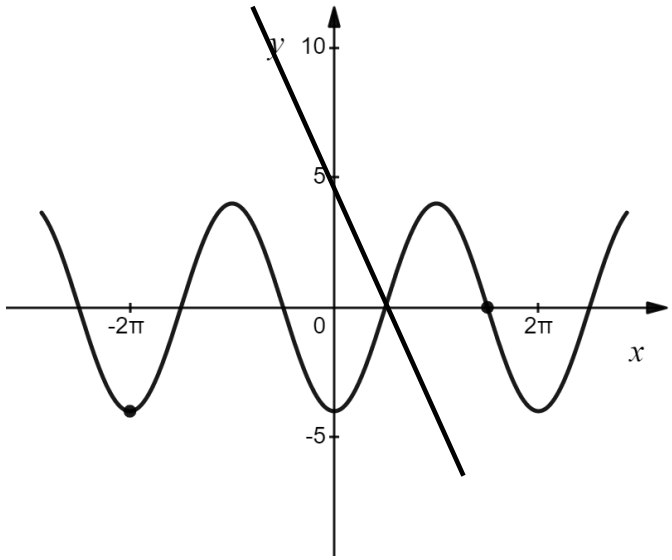
M1A0B0 Intent clear for the First M, but clearly bending back on itself, so A0. No intercept given.



M1A0B1 Intent clear for first M, clearly bends down in fourth quadrant, A0. Asymptote and intercept correct.



M1A1B1 Shape and position correct, the slight "pen flick" is condoned. Intercept and vertical asymptote correctly labelled.

Question Number	Scheme	Marks
7 (a)(i)	$P=(-2\pi,-4)$	B1, B1
(ii)	$Q=\left(\frac{3\pi}{2},0\right)$	B1 **(3)**
(b) (i)	$k=7$	B1
(ii)	$(2\pi,3)$	M1 A1 **(3)**
(c)	 One root as there is one point of intersection	M1A1 **(2)** **(8 marks)**

NB: Watch for the answers being stated next to the question rather than in the answer space.
(a)(i) Allow all marks in (a) if *P* and *Q* are mislabelled but the coordinates are correct.

B1: For one of $(-2\pi,-4)$ Condone/allow one of $(-360°,-4)$ Condone for this B mark if the coordinates are reversed.

B1: For both of $(-2\pi,-4)$ (in correct order).

(a)(ii)

B1: $(Q=)\left(\frac{3\pi}{2},0\right)$

(b)(i)

B1: For $k=7$

(b)(ii)

M1: For one of $(2\pi,3)$ **or** follow through on the negative of their *x* coordinate of *P* or their $-4+$ their *k* Condone/allow one of $(360°,3)$ and condone for the M if the coordinates are given in the wrong order.

A1: $(2\pi,3)$ Allow $(360°,3)$ if B marks in (a) were lost due solely due to working in degrees.