FP1 Graphs Rational Functions Answers

4(a)	Asymptotes $x = 1$, $y = 6$	B1B1	2	
(b)	Curve (correct general shape)	M1		SC Only one branch:
	Curve passing through origin	A1		B1 for origin
	Both branches approaching $x = 1$	A1		B1 for approaching both asymptotes
	Both branches approaching $y = 6$	A1	4	(Max 2/4)
(c)	Correct method	M1		
	Critical values ± 1	B1B1		From graph or calculation
	Solution set $-1 < x < 1$	A1√	4	ft one error in CVs; NMS 4/4 after a good graph
	Total		**10**	

9(a)(i)	Intersections at $(-1, 0)$, $(3, 0)$	B1B1	2	Allow $x = -1$, $x = 3$
(ii)	Asymptotes $x = 0$, $x = 2$, $y = 1$	B1 $\times$ 3	3	
(b)(i)	$y = k \Rightarrow kx^2 - 2kx = x^2 - 2x - 3$	M1A1		M1 for clearing denominator
	$... \Rightarrow (k-1)x^2 + (-2k+2)x + 3 = 0$	A1√		ft numerical error
	$\Delta = 4(k-1)(k-4)$, hence result	m1A1	5	convincingly shown (AG)
(ii)	$y = 4$ at SP	B1		
	$3x^2 - 6x + 3 = 0$, so $x = 1$	M1A1	3	A0 if other point(s) given
(c)	Curve with three branches	B1		approaching vertical asymptotes
	Middle branch correct	B1		Coordinates of SP not needed
	Other two branches correct	B1	3	3 asymptotes shown
	Total		**16**	

5(a)	Asymptotes $y = 0$, $x = -1$, $x = 1$	B1 $\times$ 3	3	
(b)	Three branches approaching two vertical asymptotes	B1		Asymptotes not necessarily drawn
	Middle branch passing through O	B1		with no stationary points
	Curve approaching $y = 0$ as $x \rightarrow \pm \infty$	B1		
	All correct	B1	4	with asymptotes shown and curve approaching all asymptotes correctly
(c)	Critical values $x = -1$, 0 and 1	B1		
	Solution set $-1 < x < 0$, $x > 1$	M1A1	3	M1 if one part correct or consistent with c's graph
	Total		**10**	

7(a)	Asymptotes $x = -2$, $y = 3$	B1,B1	2	
(b)		B1		Curve approaching asymptotes
		B1,B1		Passing through $\left(\dfrac{1}{3}, 0\right)$ and $\left(0, -\dfrac{1}{2}\right)$
		B1,B1	5	Both branches generally correct B1 if two branches shown
(c)	Solution set is $x > \dfrac{1}{3}$	B2,1F	2	B1 for good attempt; ft wrong point of intersection
	Total		9	