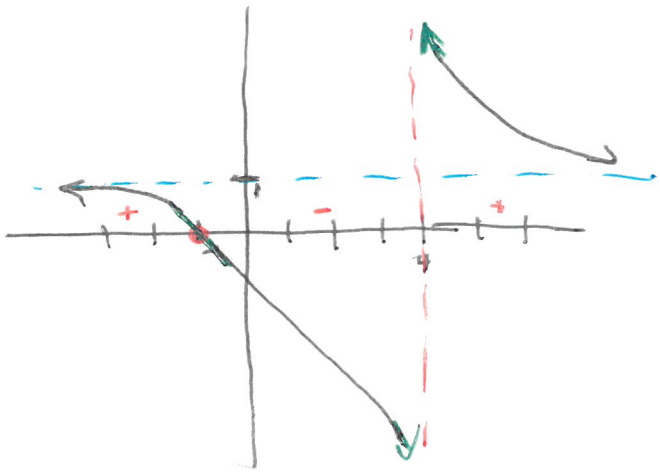
3.5 solutions

61. $f(x) = \dfrac{x+1}{x-4}$ → zero: $x+1=0$ → $x=-1$

→ v-asymp: $x-4=0$ → $x=4$

	$x<-1$	$-1<x<4$	$x>4$
$x+1$	$-2+1=-$	$0+1=+$	$+$
$x-4$	$-$	$3-4=-$	$5-4=+$
	$+$	$-$	$+$

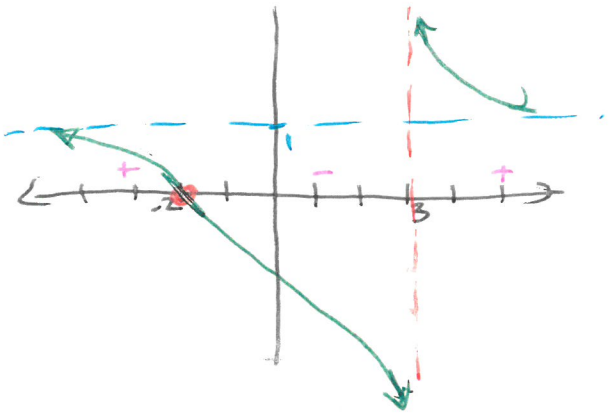


$f(x) \approx \dfrac{x}{x} = 1$: $y \to 1$ when $x \to \infty$, $x \to -\infty$

63. $f(x) = \dfrac{x+2}{x-3}$ → zero $x+2=0$ $x=-2$

→ v-asymp: $x-3=0$ $x=3$

	$x<-2$	$-2<x<3$	$x>3$
$x+2$	$-3+2=-$	$-1+2=+$	$+$
$x-3$	$-$	$2-3=-$	$4-3=+$
	$+$	$-$	$+$



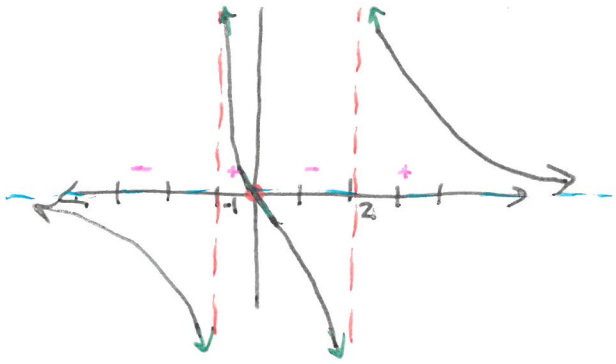
$f(x) \approx \dfrac{x}{x} = 1$: $y \to 1$ when $x \to \infty$, $x \to -\infty$

67. $f(x) = \dfrac{3x}{x^2 - x - 2} = \dfrac{3x}{(x-2)(x+1)}$

→ zeros: $3x = 0 \rightarrow x = 0$ mult 1

→ V-asymp: $x - 2 = 0 \rightarrow x = 2$ mult 1; $x + 1 = 0 \rightarrow x = -1$ mult 1

	−1	0	2	
$3x$	$3(-2)$ −	− $3(1)$ +	+	
$x-2$	$-2-2$ −	−	− $3-2$ +	
$x+1$	$-2+1$ −	+ $1+1$ +	+	
	−	+	−	+



$f \approx \dfrac{3x}{x \cdot x} = \dfrac{3x}{x^2} = \dfrac{3}{x} \rightarrow 0$

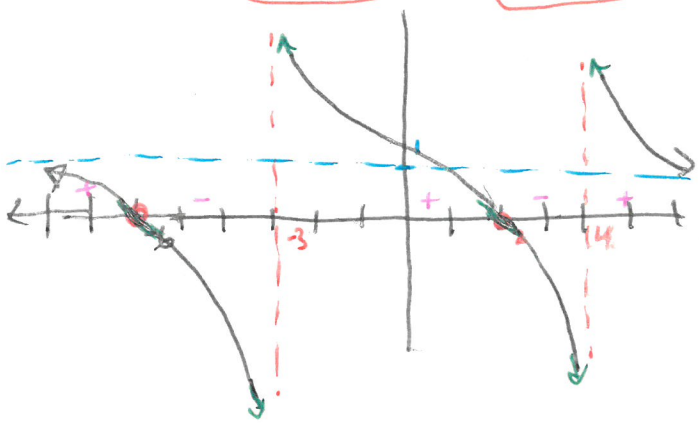
$y \rightarrow 0$ when $x \rightarrow \infty, x \rightarrow -\infty$

71. $f(x) = \dfrac{(x+6)(x-2)}{(x+3)(x-4)}$

→ zeros: $x + 6 = 0 \rightarrow x = -6$; $x - 2 = 0 \rightarrow x = 2$ all mult 1

→ V-asymp: $x + 3 = 0 \rightarrow x = -3$; $x - 4 = 0 \rightarrow x = 4$

	−6	−3	2	4	
$x+6$	$-7+6$ −	$-5+6$ +	+	+	+
$x-2$	−	−	$0-2$ −	$3-2$ +	+
$x+3$	−	$-4+3$ −	$0+3$ +	+	+
$x-4$	−	−	$0-4$ −	−	$5-4$ +
	+	−	+	−	+



$f \approx \dfrac{(x)(x)}{(x)(x)} = \dfrac{x^2}{x^2} = 1$ $y \rightarrow 1$ when $x \rightarrow \infty$ or $-\infty$

77. $f(x) = \dfrac{(x-3)(x+1)}{(x-1)^2}$

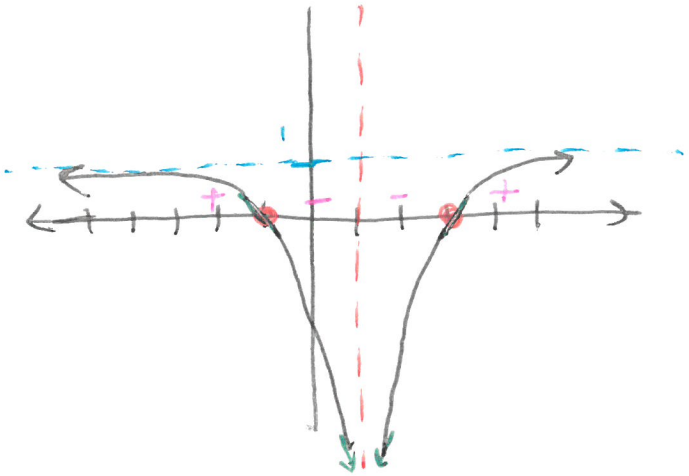
→ zeros! $x-3=0 \to x=3$ mult 1

$x+1=0 \to x=-1$ mult 1

→ V-asymp: $(x-1)^2=0$

$x-1=0 \to x=1$ mult 2

	−1	1	3
$x-3$	−	0−3 −	4−3 +
$x+1$	−2+1 −	0+1 +	+
$(x-1)^2$	+	+	+
	+	−	+



$f \approx \dfrac{(x)(x)}{(x)^2} = \dfrac{x^2}{x^2} = 1$

$y \to 1$ when $x \to \infty, -\infty$

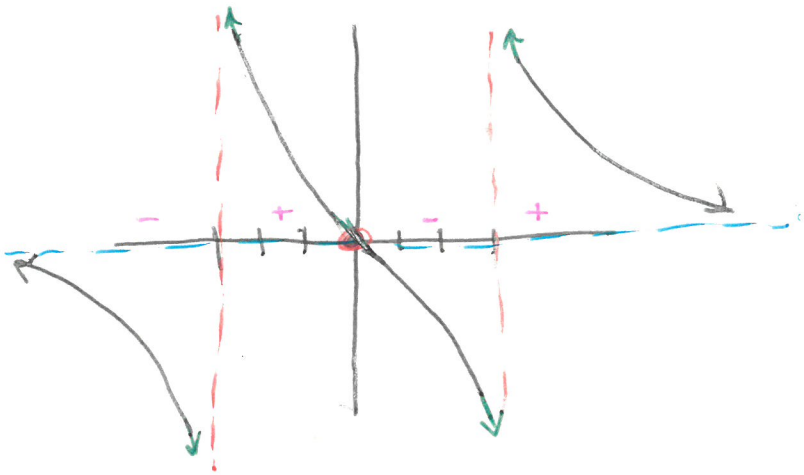
79. $f(x) = \dfrac{x}{x^2-9} = \dfrac{x}{(x-3)(x+3)}$

→ zeros $x=0$

→ V-asymptotes $x-3=0$ $x=3$ $\quad x+3=0$ $x=-3$

all mult 1

	−3	0	3
x	−	−1 +	+
$x-3$	−	1−3 −	4−3 +
$x+3$	−4+3 −	1+3 +	+
	−	+	−



$f \approx \dfrac{x}{(x)(x)} = \dfrac{x}{x^2} = \dfrac{1}{x} \to 0$

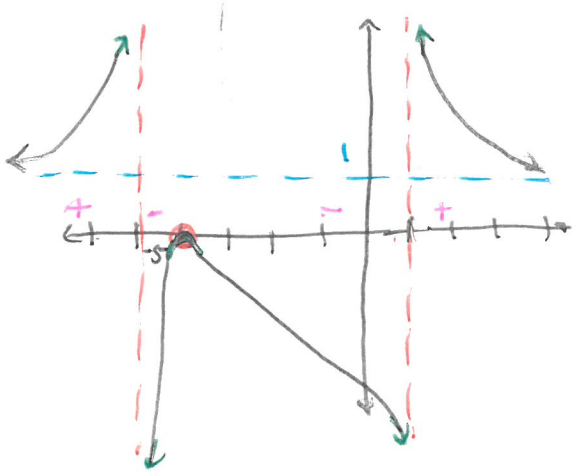
$y \to 0$ when $x \to \infty$ or $-\infty$

83. $f(x) = \dfrac{(x+4)^2}{(x-1)(x+5)}$

zeros: $(x+4)^2 = 0 \to x+4=0 \to x=-4$ mult 2

v-asymp: $x-1=0 \to x=1$, $x+5=0 \to x=-5$ both mult. 1

	-5	-4	1	
$(x+4)^2$	$(-6+4)^2$ +	+	+	+ (squared → +)
$(x-1)$	$-6-1$ −	−	$2-1$ +	
$(x+5)$	$-6+5$ −	+	$0+5$ +	+
	+	−	−	+



$f \approx \dfrac{(x)^2}{(x)(x)} = \dfrac{x^2}{x^2} = 1$

$y \to 1$ when $x \to \infty$ or $x \to -\infty$