2.1 Key Features of Rational Functions - Part I
Reciprocal Functions

A reciprocal function is a function that can be expressed as

$f(x)=\dfrac{1}{g(x)}$ where g(x) is a polynomial function, $g(x)\neq 0$.

Example 1

For the following functions state the reciprocal.

a) $f(x)=x-3$ b) $f(x)=(x-1)(x+4)$ c) $f(x)=16-x^2$

$g(x)=\dfrac{1}{x-3}$ $g(x)=\dfrac{1}{(x-1)(x+4)}$ $g(x)=\dfrac{1}{16-x^2}=\dfrac{1}{(4+x)(4-x)}$

Relating the graphs of functions and their reciprocals.

Complete the **Investigation** on pages 248-249

Handout

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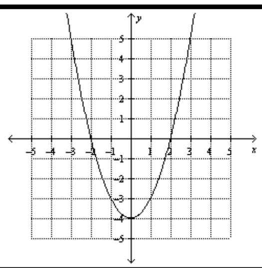
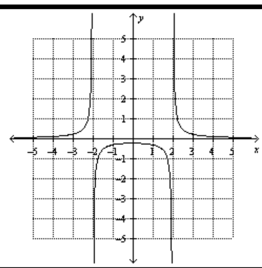
Example 2

Taken from the Investigation

	$f(x)=x^2-4$	$g(x)=\dfrac{1}{x^2-4}$
		
zeros/ asymptotes	Z: x = -2, 2 Asym: none	Z: none Asym: x = -2, x = 2
f(x)<0	(-2, 2)	(-2, 2)
f(x)>0	(-∞, −2) (2, ∞)	(-∞, −2) (2, ∞)
f(x)= -1	$\pm\sqrt{3}$	$\pm\sqrt{3}$
f(x)=1	same $\pm\sqrt{5}$	~~same~~ $\pm\sqrt{5}$
decreasing	(-∞, 0)	(0, ∞), $x\neq 2$
increasing	(0, ∞)	(-∞, 0), $x\neq -2$
max/min values	min at x = 0	max at x=0

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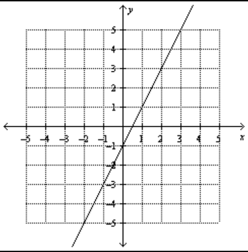
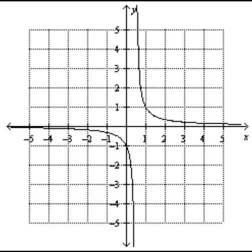
Example 3	$f(x) = 2x - 1$	$g(x) = \frac{1}{2x-1}$
		
zeros/ asymptotes	Z: x = 1/2 Asym: none	Z: none Asym: x = 1/2
f(x)<0	(-∞, 0.5)	(-∞, 0.5)
f(x)>0	(0.5, ∞)	(0.5, ∞)
f(x)= -1	x = 0	x = 0
f(x)=1	x = 1	x = 1
decreasing	n/a	(-∞, ∞) , x≠ 0.5
increasing	(-∞, ∞)	n/a
max/min values	n/a	n/a

Invariant

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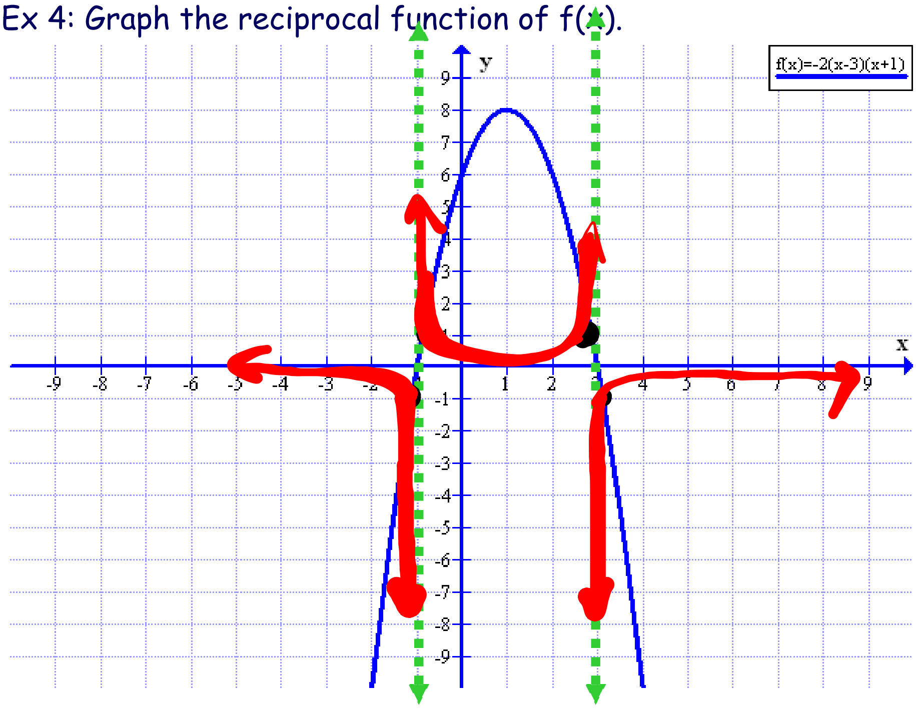
Ex 4: Graph the reciprocal function of f(x).



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SUMMARY

Function	Reciprocal Function
Intercepts	become asymptotes
Asymptotes	become zeros
Negative y-values	stay negative
Postive y-values	stay positive
f(x)= -1	x value remains the same
f(x)= 1	x value remains the same
Increasing	becomes decreasing
Decreasing	becomes increasing
Max/Min Values	switch
The reciprocal function of a linear or quadratic function will always have a horizontal asymptote at y=0.	

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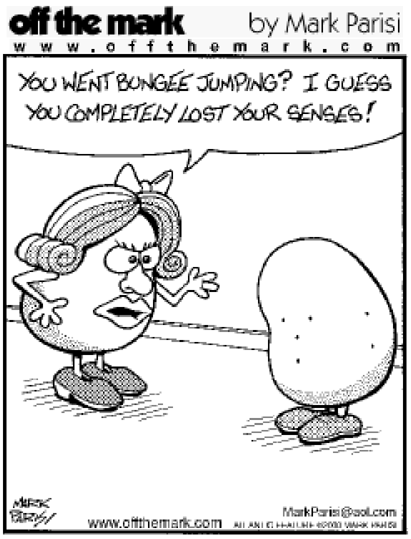

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Homework

p.254 # 1,2cd,3,6cd,7a, 8f,10,11,13,16

+factoring worksheet

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