# Warm Up 10/29

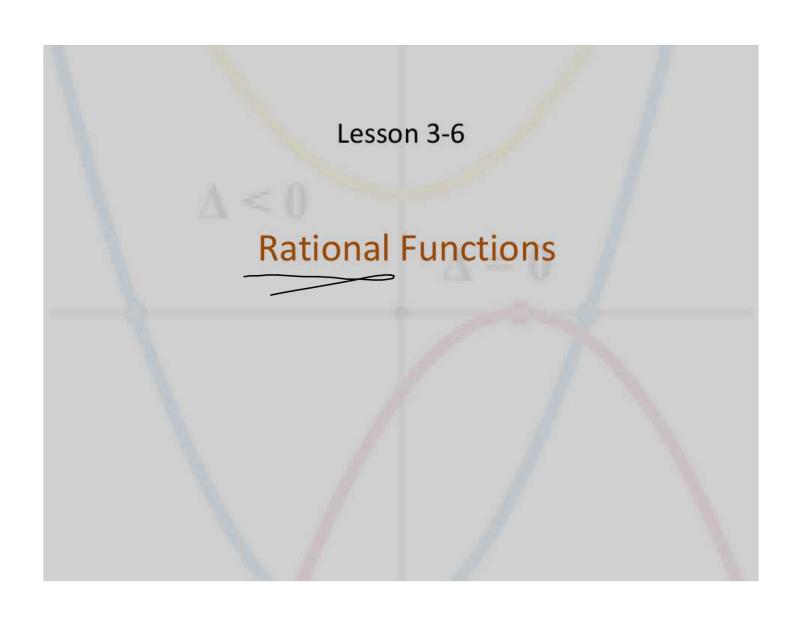
Evaluate the expression 
$$(x - (i-2))(x - (i+2))$$

True or false?

3. 
$$\frac{1}{87} > \frac{1}{86}$$



4. 
$$\underbrace{x+3}_{x+1} > \underbrace{x+2}_{x+1}$$



## Objective

#### Students will...

- Be able to understand what rational functions are and their behaviors.
- Be able to find the x and the y intercepts of rational functions.

#### **Rational Functions**

Whenever we hear the word "rational" in mathematics, it'd be safe to say many of us think of fractions. Hence, a rational function would be most commonly described as a "fractional" function. This is in essence true!

A rational function is a function of the form  $r(x) = \frac{P(x)}{Q(x)} \quad \text{ex. } \frac{3}{5} = \frac{3x^2}{5x^2} = \frac{3x}{5x^2}$ 

where P and Q are polynomials. We are also assuming that P(x) and Q(x) have no factor in common, i.e. they are completely reduced.

#### **Behaviors of Rational Functions**

Rational functions are often given special attention because, while they fit the standard definition of a function (one output for every input), they are quite unique in terms of their behaviors and structure. Consider the following rational function,

$$f(x) = \frac{1}{x}$$

We can already see that there is something we need to make sure of, and that is the fact that  $x \neq 0$ , since a fraction is not defined when the denominator is a zero.

### **Behaviors of Rational Functions**

Also, as x or the denominator <u>increases</u>, the overall function <u>decreases</u>, and as x or the denominator <u>decreases</u>, the overall function <u>increases</u>

function increases.  

$$|D = 0.000|$$
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So, the behavior of this rational function  $f(x) = \frac{1}{x}$  can be written as,

$$\lim_{x\to\infty} f(x) = 0 \qquad \text{and} \qquad \lim_{x\to0} f(x) = \infty$$

"The limit of f(x) as x approaches infinity is 0"

"The limit of f(x) as x approaches 0 is infinity."

#### X and the Y-Intercepts of Rational Functions

Although we have observed how rational functions behave in a unique way, the concept of finding the x and the y intercepts remain the same for all functions.

Ex. Find the x and the y-intercepts of the function  $f(x) = \frac{x-2}{3}$ 

Y-int:  $f(\delta) = \frac{\delta - 2}{3} = -\frac{2}{3}$ 

 $\frac{X-int}{3} = \frac{X-2}{3}$  0 = X-2 2X + 2 2X + 2 2X + 3

### **Examples**

Find the x and the y intercepts of the following rational functions

1. 
$$f(x) = \frac{1}{x}$$

2.  $r(x) = \frac{x}{2}$ 

3.  $g(x) = \frac{x-5}{x-2}$ 

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4 - int:  $f(0) = \frac{1}{x}$ 

(0) -  $f(0) = \frac{1}{x}$ 

(1) - int:  $f(0) = \frac{1}{x}$ 

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(2) - int:  $f(0) = \frac{1}{x}$ 

(3) - int:  $f(0) = \frac{1}{x}$ 

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(5) - int:  $f(0) = \frac{1}{x}$ 

(6) -  $f(0) = \frac{1}{x}$ 

(7) - int:  $f(0) = \frac{1}{x}$ 

(9) - int:  $f(0) = \frac{1}{x}$ 

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(7) - int:  $f(0) = \frac{1}{x}$ 

(9) - int:  $f(0) = \frac{1}{x}$ 

### **Examples**

Find the x and the y intercepts of the following rational functions

$$1. f(x) = \frac{x^{2} - 3x - 18}{x + 4}$$

$$2 - 10 + 10 - 10 = \frac{x^{2} - 3x - 18}{x + 4}$$

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$$2. r(x) = \frac{x^2 + 6}{2}$$

$$y - int : \left(0, 3\right)$$

$$x - int : x^2 + b = 0$$

$$x - int : x^2 + b = 0$$

## Homework 10/29

TB pg. 313 #5-14 (Just find the intercepts)