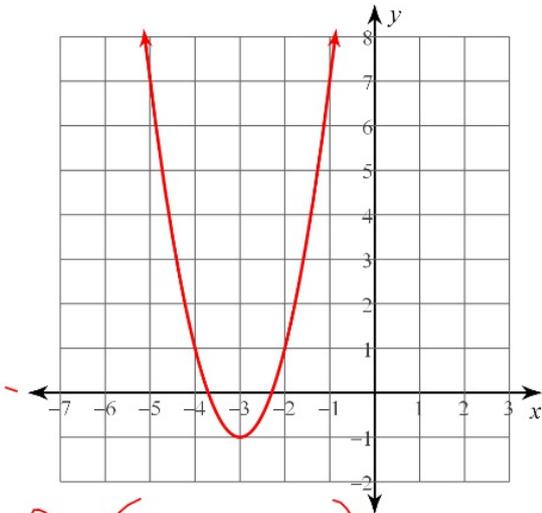
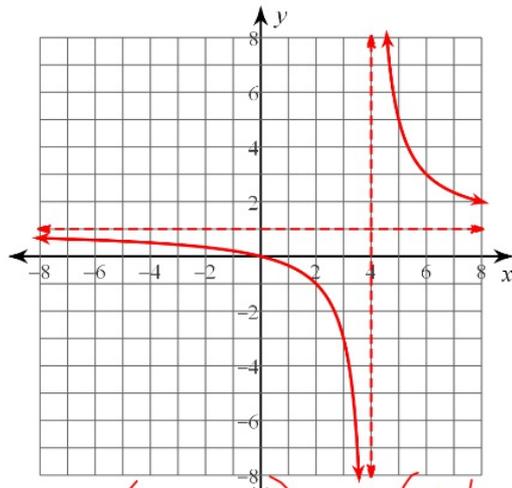


Warm-Up

State the Domain and Range of each in interval notation



$$D: (-\infty, \infty)$$
$$R: [-1, \infty)$$



$$D: (-\infty, 4) \cup (4, \infty)$$
$$R: (-\infty, 1) \cup (1, \infty)$$

Learning Targets

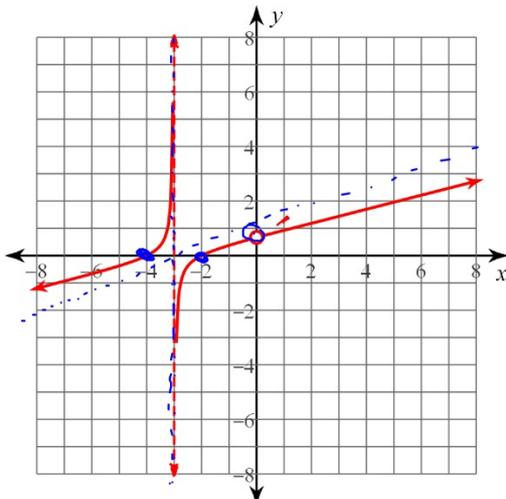
I can...

- State the **Domain** of a Rational Function
- Describe **Vertical Asymptotes** of a Rational
- Describe **Holes** of a Rational Function

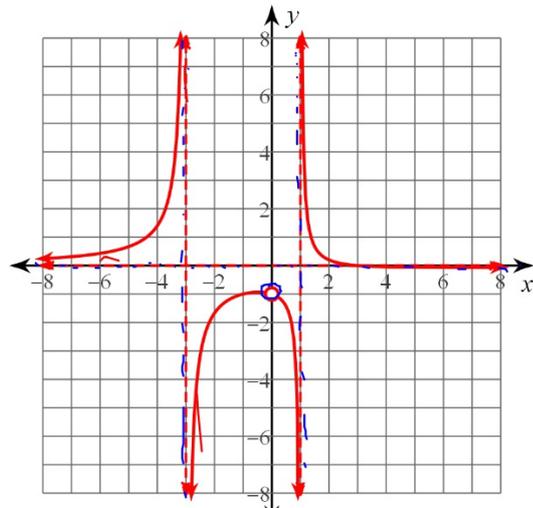
Unit 6

Graphing Rational Functions

$$f(x) = \frac{x^3 + 6x^2 + 8x}{4x^2 + 12x}$$



$$f(x) = \frac{-x^2 + 3x}{x^3 + 2x^2 - 3x}$$



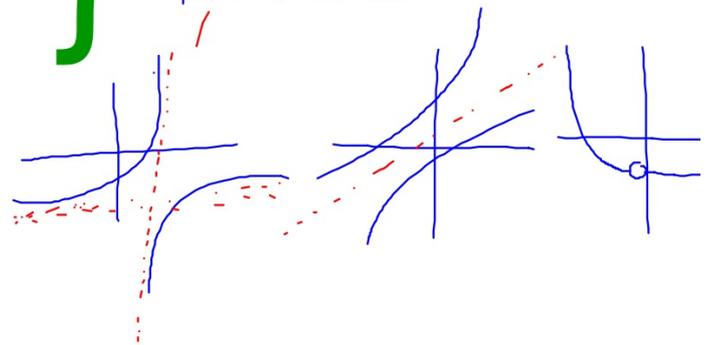
Discontinuity

"Gaps in the Function"

- Vertical Asymptotes
- Horizontal Asymptotes
- Slant Asymptotes

} lines

- Holes } point



Domain

Goes with Vertical Asymptotes and Holes

Steps

- Factor the denominator
- Set each factor equal to zero
- These values are NOT in the domain
(Because you can't divide by zero)

Ex. 1 $f(x) = \frac{-3x + 6}{x - 1}$

$D: (-\infty, 1) \cup (1, \infty)$

Ex. 2 $f(x) = \frac{x + 2}{3x - 12}$

$D: (-\infty, 4) \cup (4, \infty)$

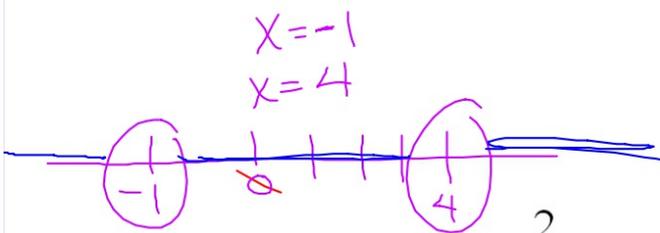
$3x - 12 = 0$
 $3x = 12$
 $x = 4$

Ex. 3 $f(x) = \frac{x^2 + 6x + 8}{4x}$

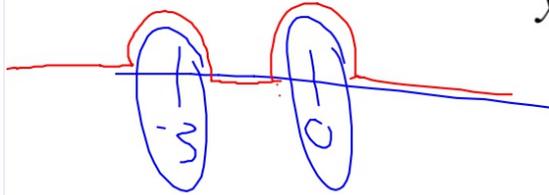
$D: (-\infty, 0) \cup (0, \infty)$

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

$D: (-\infty, -1) \cup (-1, 4) \cup (4, \infty)$



Ex. 5 $f(x) = \frac{x^2 - x - 2}{x^2 + 3x} = \frac{x^2 - x - 2}{x(x+3)}$



$D: (-\infty, -3) \cup (-3, 0) \cup (0, \infty)$

$$\frac{x^2 + x}{(x+1)(x-4)}$$

$$\frac{x \cancel{(x+1)}}{\cancel{(x+1)}(x-4)} = \frac{x}{x-4}$$

Ex. 6

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

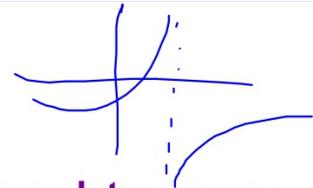
$$\frac{-x^2 + 3x}{(x+2)(x-2)}$$

$$D: (-\infty, -2) \cup (-2, 2) \cup (2, \infty)$$

/

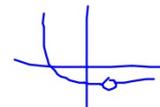
Vertical Asymptotes

1. Simplify Rational completely
2. Set simplified denominator equal to zero



Holes

1. As you simplify, canceled factors lead to holes
2. Set canceled factor equal to zero
3. Plug this x value into simplified rational
4. Resulting point (x,y) is the hole



Ex. 1

$$f(x) = \frac{x^2 - 2x - 8}{x^2 - 6x + 8} = \frac{\cancel{(x-4)}(x+2)}{\cancel{(x-4)}(x-2)}$$

$$= \frac{x+2}{x-2}$$

Domain:

$$(-\infty, 2) \cup (2, 4) \cup (4, \infty)$$

V.A. at $x=2$

(4,

$$\frac{4+2}{4-2} = \frac{6}{2} = 3$$

Holes: (4, 3)

Ex. 2

$$f(x) = \frac{x^2 + 3x + 2}{x^2 + 6x + 8} = \frac{\cancel{(x+2)}(x+1)}{\cancel{(x+2)}(x+4)}$$

Domain:

$$(-\infty, -4) \cup (-4, -2) \cup (-2, \infty)$$

V.A. at $x = -4$

Hole at $(-2, -\frac{1}{2})$

$$= \frac{x+1}{x+4} \text{ Simplified}$$

$$\frac{-2+1}{-2+4} = \frac{-1}{2}$$

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

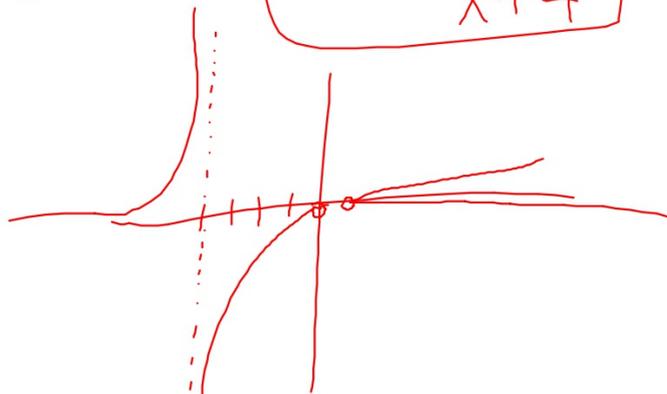
Domain

$(-\infty, -4) \cup (-4, 0) \cup (0, 1) \cup (1, \infty)$

V.A at $x = -4$

Hole $(0, \frac{1}{4})$
 $(1, \frac{1}{5})$

$$= \frac{-1}{x+4}$$
 Simplified



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

