Warm up

Simplify the following:

1. $\dfrac{x^2+6x}{3x^2+6x-24} \bullet \dfrac{x^2+6x+8}{x+6}$

$\dfrac{x(\cancel{x+6})}{3(\cancel{x+4})(x-2)} \cdot \dfrac{(\cancel{x+4})(x+2)}{\cancel{x+6}}$

$\dfrac{x(x+2)}{3(x-2)}$ $x \neq -4, 2, -6$

2. $\dfrac{4}{x^2-25} + \dfrac{6}{x^2+6x+5}$

$\dfrac{4(x+1)}{(x+5)(x-5)} + \dfrac{6(x-5)}{(x+5)(x+1)}$

$4x+4+6x-30$

$\dfrac{10x-26}{(x+5)(x-5)(x+1)}$ $x \neq \pm 5, -1$

Factor:

3. $9x^2-1$

$(3x+1)(3x-1)$

y^2-x^2

$(y-x)(y+x)$

4. $125x^3+27$

$5x \quad 3$

$(5x+3)(25x^2-15x+9)$

$\rightarrow \dfrac{a \cdot a}{b \cdot a} - \dfrac{b \cdot b}{a \cdot b}$

$\rightarrow \dfrac{1}{a} - \dfrac{1}{b}$

$\dfrac{\dfrac{a^2-b^2}{ab}}{\dfrac{b-a}{ab}}$

$\dfrac{a^2-b^2}{\cancel{ab}} \cdot \dfrac{\cancel{ab}}{b-a}$

$\dfrac{(a+b)(a-b)}{b-a} = \dfrac{(\cancel{a+b})(a-b)}{-(\cancel{a+b})}$

$-(a-b)$

$b \neq a$

$b, a \neq 0$

2.6 Rational Functions and Asymptotes

Vertical Asymptotes

Horizontal Asymptotes

Zeros

Holes

Graph on your calculator:

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

VA: $x = 0$

HA: $y = 0$

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

VA: $x = 3$

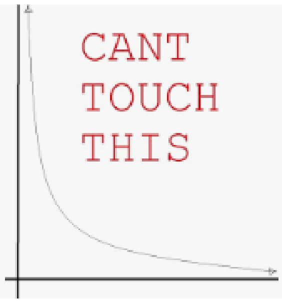
HA: $y = 0$

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

VA: $x = -6$

$x = 3$

HA: $y = 0$



The boundaries created are related to the restrictions on the domain.

They are called Vertical Asymptotes.

VA must be written as an equation in the form $x = a$

$f(x) = \frac{1}{x+1}$ has a horizontal asymptote at y = 0

"bottom heavy" $y = 0$

$f(x) = \frac{x-1}{x+1}$ has a HA at y = 1

"same heavy" $\frac{\text{coefficient top}}{\text{coefficient bot.}}$

$f(x) = \frac{x^2+1}{3x^2+x-1}$ has a HA at y = 1/3

What is the rule????

Finding zeros $g(x) = \dfrac{x^2 - 9}{x + 2}$

x intercepts
$(x, 0)$
$(3, 0)$ $(-3, 0)$

$0 = \dfrac{x^2 - 9}{x + 2}$

$x^2 - 9 = 0$
$x = \pm 3$

Find the zeros, VA and HA for $f(x) = 1 + \dfrac{3}{x^2 - 4}$

VA: $x^2 - 4 = 0$
$\boxed{x = \pm 2}$

HA: $y = 0 + 1$
$\boxed{y = 1}$

$0 = 1 + \dfrac{3}{x^2 - 4}$

$(x^2 - 4) \cdot -1 = \dfrac{3}{x^2 - 4} \cdot x^2 - 4$

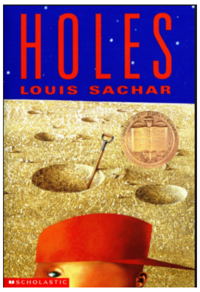
$-x^2 + 4 = 3$

$-x^2 = -1$

$x^2 = 1$

$x = \pm 1$

$(1, 0)$ $(-1, 0)$



$$f(x) = \frac{x^2 - 9}{x^3 + x^2 - 9x - 9}$$

$$\frac{(x+3)(x-3)}{x^2(x+1) - 9(x+1)}$$

hole@ $x = -3$

hole@ $x = 3$

$$\frac{(x+3)(x-3)}{(x+3)(x-3)(x+1)}$$

$$\frac{1}{x+1}$$

When a potential zero/VA is removed by canceling a factor, it leaves a hole in the graph!

To find the exact location of the hole:

plug canceled values into the simplified rational equation.

HOMEWORK

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5-17 odd, 23, 25, 31-39 odd, 43, 44

$a \quad b$

$2x-3 \quad 2$

$(2x-3-2)(2x-3+2)$

$(2x-5)\ (2x-1)$

$4x^2-6x-6x+9$

-4

$4x^2-12x+5$

Alternate assignment

p 153 23, 25, 39, 42, 43