

$$\frac{ax+b}{cx+d}$$

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Investigate

cool Vertical Asymptotes related to "d" and "c"

Peep Peep  
or like 4  
No 4.5

For  $\frac{ax+b}{cx+d} \rightarrow cx+d=0$   
 $cx = -d$   
 $x = \frac{-d}{c}$

Horizontal Asymptotes related to "a" and "c"

$y = \frac{a}{c}$  But why?

for  $y = \frac{ax+b}{cx+d}$  as  $x \rightarrow \infty$

$= \frac{a(\infty)+b}{c(\infty)+d} \rightarrow$  ~~Not Helpful~~

divide ALL terms by x

$= \frac{\frac{ax}{x} + \frac{b}{x}}{\frac{cx}{x} + \frac{d}{x}} \rightarrow \frac{a + \frac{b}{x}}{c + \frac{d}{x}}$

Now let  $x \rightarrow \infty$

$$\underline{x\text{-int}} = -\frac{b}{a}$$

$$\underline{y\text{-int}} = \frac{b}{a}$$

$$y = \frac{ax+b}{cx+d}$$

$$x \cdot 0 = \frac{ax+b}{\textcircled{cx+d}}$$

$$0 = ax + b$$

$$-b = ax$$

$$\frac{-b}{a} = x$$

## Horizontal Asymptotes

How do we find them?

$$\frac{1}{3x+5}$$

as  $x \rightarrow \infty$

$$\frac{1}{3x+5} \rightarrow 0$$

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

Determine the asymptotes for  $f(x)$ .

H.A.

$$y = \frac{3}{1}$$

$$\frac{3x + 0}{1x - 2}$$

as  $x \rightarrow \pm\infty$

$$y = \frac{3x}{x-2}$$

V.A.

$$x - 2 = 0$$

$$x = 2$$

Determine the x and y intercepts

x-int

$$0 = \frac{3x}{x-2}$$

$$0 = 3x$$

$$0 = x$$

$$y = \frac{3x}{x-2}$$

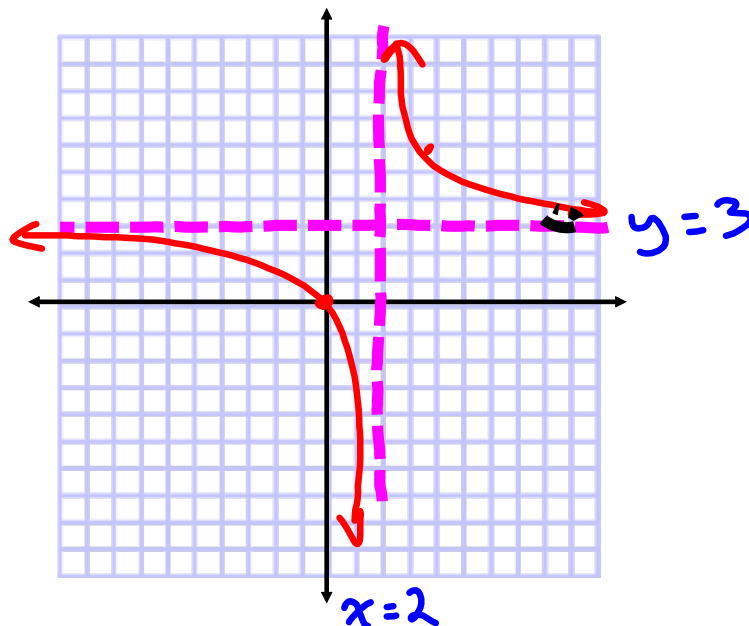
y-int

$$y = \frac{3(0)}{0-2}$$

$$= \frac{0}{-2}$$

$$y = 0$$

Graph  $f(x)$



$$\text{Given } f(x) = \frac{x-1}{2x-5}$$

Determine the asymptotes for  $f(x)$ .

V.A.

$$2x - 5 = 0$$

$$2x = 5$$

$$x = \frac{5}{2}$$

H.A.

$$\frac{x-1}{2x-5}$$

$$\text{as } x \rightarrow \pm\infty$$

$$\text{H.A. at } y = \frac{1}{2}$$

Determine the x and y intercepts

x-int

$$0 = \frac{x-1}{2x-5}$$

$$0 = x-1$$

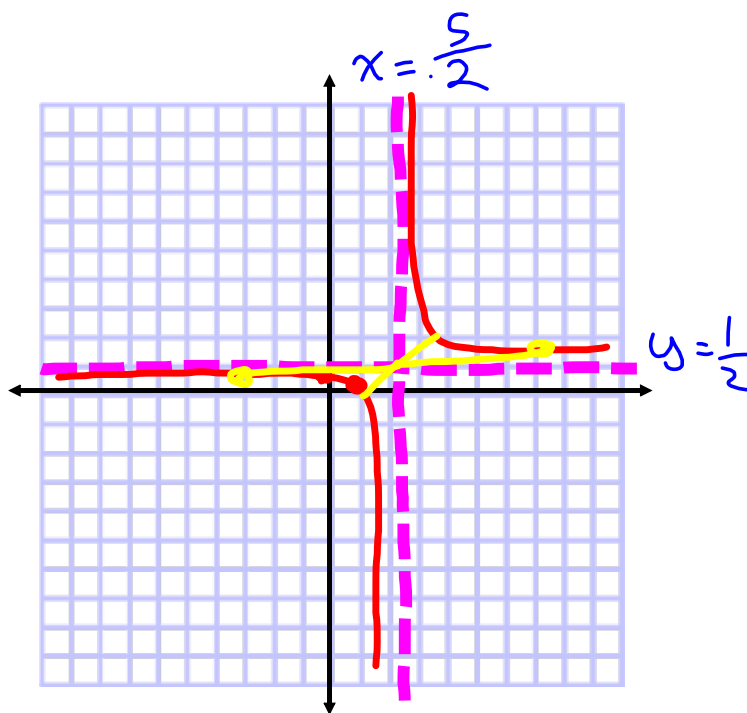
$$x = 1$$

y-int

$$y = \frac{0-1}{2(0)-5}$$

$$y = \frac{1}{5}$$

Graph  $f(x)$



## In General

$$f(x) = \frac{ax + b}{cx + d}$$

Vertical  
Asymptote

$$cx + d = 0$$

$$x = -\frac{d}{c}$$

Horizontal  
Asymptote

~~$$\frac{ax + b}{cx + d}$$~~

~~$$\frac{cx + d}{cx + d}$$~~

$$y = \frac{a}{c}$$

Stretch /  
Compression

as "b"  
changes the  
graph is  
stretched /  
compressed.

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# 3 (sketch), 5, 6, 7