Learning Target(s): I can find the VA and HA of rational functions. I can graph rational functions including translations and state the domain & range

8.3 Graph General Rational Functions

Ex. 1 Graph $y = \frac{3}{x^2+2}$ deg: 0, deg: 2

0 < 2

top < bottom HA: $y = 0$

top doesn't have variable

$x^2 + 2 = 0$

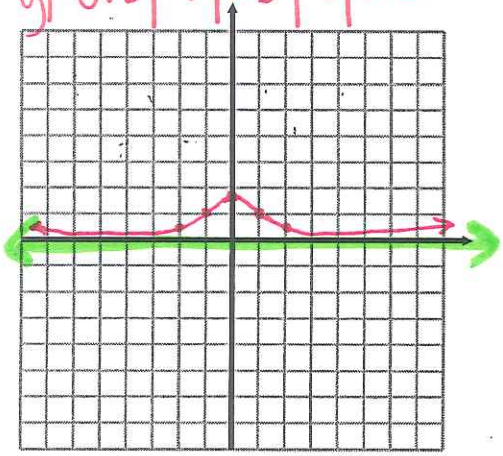
$\sqrt{x^2} = \sqrt{-2}$ imaginary

VA: none HA: $y = 0$

x-intercepts: none

D: $\mathbb{R}$ R: $0 < y \leq 1.5$

x	-2	-1	0	1	2
y	0.5	1	1.5	1	0.5



$$f(x) = \frac{p(x)}{q(x)} = \frac{a_m x^m + a_{m-1} x^{m-1} + \cdots + a_1 x + a_0}{b_n x^n + b_{n-1} x^{n-1} + \cdots + b_1 x + b_0}$$

1. The x-intercepts of the graph are the real zeros of p(x).

   *set numerator (top) = 0

2. The graph of f has a vertical asymptote at each real zero of q(x).

   *set denominator (bottom) = 0

3. The graph of f has at most one horizontal asymptote determined by the degrees m and n of p(x) and q(x).

   *Case 1 (m < n) → HA $y = 0$ (top < bottom)

   *Case 2 (m = n) → HA $y = \frac{a_m}{b_n}$ (top = bottom)

   *Case 3 (m > n) → HA none (top > bottom)

Ex. 2 Graph $y = \frac{x^2-9}{x^2-4}$ deg: 2, deg: 2

top = bottom $y = \frac{1}{1} = 1$

$x^2 - 9 = 0$

$\sqrt{x^2} = \sqrt{9}$ $x = \pm 3$

$x^2 - 4 = 0$

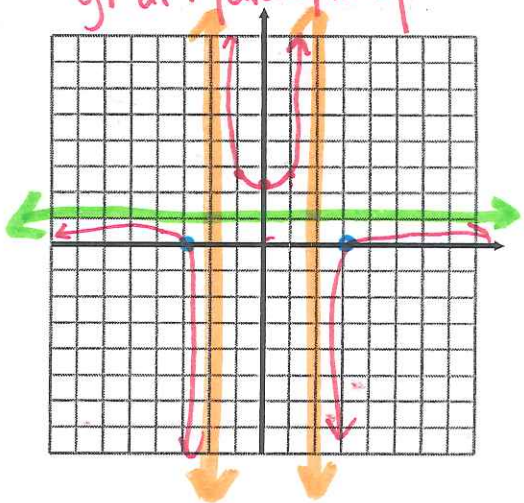
$\sqrt{x^2} = \sqrt{4}$ $x = \pm 2$

VA: $x = 2$, $x = -2$ HA: $y = 1$

x-intercepts: (3, 0) (−3, 0)

D: $\mathbb{R}$ except $x = \pm 2$ R: $\mathbb{R}$ except $y = 1$

x	-1	0	1
y	2.7	2.25	2.7



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Ex. 3 Graph $y = \frac{x^2-2x-3}{x+2}$ deg: 2, deg: 1

top > bottom

$x^2-2x-3=0$

$(x-3)(x+1)=0$

$x-3=0$ $\quad x+1=0$

$x=3$ $\quad x=-1$

$x+2=0$

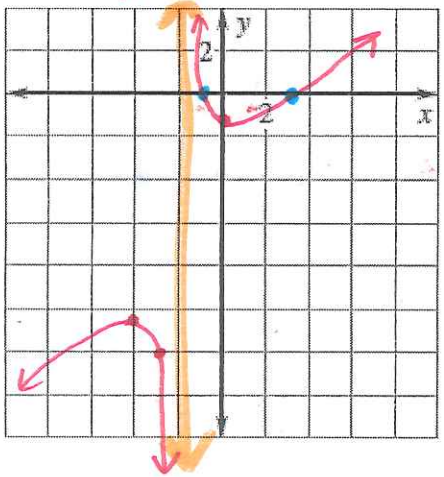
$x=-2$

VA: $x=-2$ HA: none

x-intercepts: $(3,0)(-1,0)$

D: $\mathbb{R}$ except $x=-2$ R: $\mathbb{R}$

x	y
-4	-10.5
-3	-12
0	-1.5

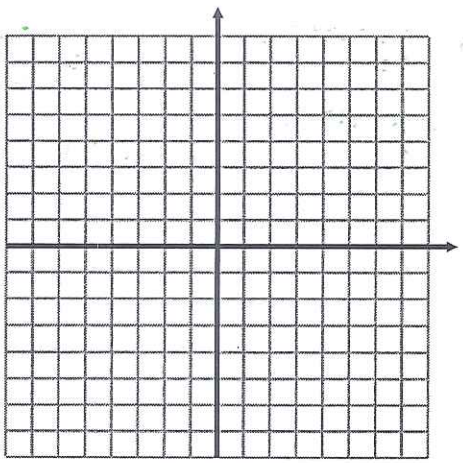


Try it! 1. Graph $y = \frac{3x^2}{x^2-16}$

VA: _____ HA: _____

x-intercepts: _____

D: _____ R: _____



Try it! 2. Graph $y = \frac{x^2+2x-8}{x-1}$

VA: _____ HA: _____

x-intercepts: _____

D: _____ R: _____