PC12 Name____________________________

Rational Functions

Chapter Notes

Key

Assignment List

Date	Lesson	Assignment
	Features of Rational Functions I	Mickelson Page 188 #1 & Page 189 #4 (find y-intercepts as well)
	Features of Rational Functions II	Mickelson Page 181 #3
	Features of Rational Functions III	Mickelson Page 180 #2 Page 182 #4 Answer 4h) HA: $y = 2$ VA: $x = -1,4$ hole: $(0, \frac{9}{2})$
	Graphing Rational Functions	Mickelson Page 188 #2, 5, 6
		Practice Test
		Review
		Rational Functions Test

Rational Functions Day 1:

Features of Rational Functions I

Rational Expressions

- A rational expression is a ratio of two polynomial functions.

$\frac{g(x)}{h(x)}$ where $h(x) \neq 0$ E.g. $\frac{2x-5}{3x^3+2x^2-1}$

To simplify a single-fraction rational expression we factor the numerator and denominator fully and simplify if possible. Keep track of restrictions at each step and *state the restrictions as part of your final answer.*

Example 1: $\frac{6-2m}{m^2-9}$ ← re-order ← factor (difference of squares)

$= \frac{-2m+6}{(m+3)(m-3)}$ ← factor (gcf)

$= \frac{-2\cancel{(m-3)}}{(m+3)\cancel{(m-3)}}$, $\boxed{m \neq \pm 3}$ state restrictions (the "zeros" of the denom.) cancel identical factors top & bottom.

$= \boxed{\frac{-2}{m+3}, \ m \neq \pm 3}$

Example 2: $\frac{x^2+3x-10}{2x^2+x-10}$

factor: $5 \times -2 = -10$, $5 + -2 = 3$

factor: $5 \times -4 = -20$, $5 + -4 = 1$

$2x^2+5x-4x-20$

$x(2x+5)-2(2x+5)$

$(2x+5)(x-2)$

$= \frac{(x+5)\cancel{(x-2)}}{(2x+5)\cancel{(x-2)}}$, Restrictions: $\boxed{x \neq \frac{-5}{2}, 2}$ cancel

$= \boxed{\frac{x+5}{2x+5}, \ x \neq -\frac{5}{2}, 2}$

*note: nothing else cancels!

Restrictions

- **Restrictions** are any values of x that would make the denominator equal to zero. *Restrictions are part of the final answer.* They also help us describe the **Domain** of a **Rational Function**.
- **Domain** describes all the possible x-values of a function.

Rational Functions

- A **rational function** is an equation with "x" and "y" (or $f(x)$) that has a rational expression in it. Until we have better techniques, we can graph a rational function using a table of values.

E.g. $\overset{y}{\cancel{f(x)}} = \frac{2x-5}{3x^3+2x^2-1}$

***x*- and *y*- intercepts**

- ***x*-intercepts** are where the graph crosses the x-axis (where height = 0, or $\boxed{y = 0}$).
- ***y*-intercepts** are where the graph crosses the y-axis (where you are "zero over" or $\boxed{x = 0}$).

Graphs of Rational Functions

Example 3: a) Create a table of values to graph the following rational function.

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

x	y
-9	$-1/2$
-4	-1
0	-5
1	(undefined)
2	5
6	1
11	$1/2$

sub in $x = -9$:

$y = \frac{5}{(-9)-1} = \frac{5}{-10} = -\frac{1}{2}$ etc.

$y = \frac{5}{(-4)-1} = \frac{5}{-5} = -1$

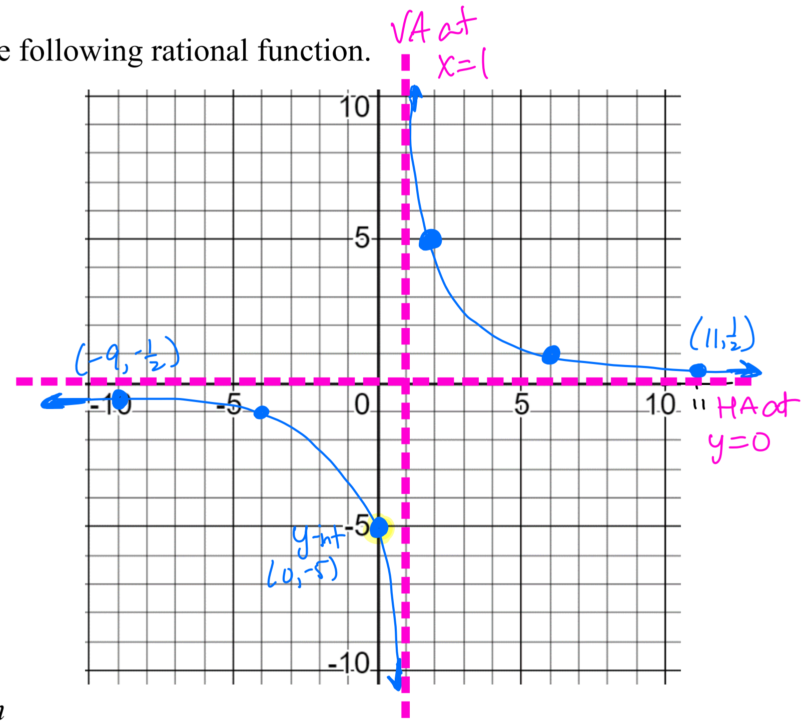
$y = \frac{5}{(0)-1} = \frac{5}{-1} = -5$

$\boxed{\text{restriction: } x \neq 1}$

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

$y = \frac{5}{(6)-1} = \frac{5}{5} = 1$

$y = \frac{5}{(11)-1} = \frac{5}{10} = \frac{1}{2}$



b) *label any x- and y-intercepts on the graph*

no x-int's. y-int. at (0, -5)

c) List any restrictions: $x \neq 1$ d) what is the Domain? D: $\{x \mid x \neq 1, x \in \mathbb{R}\}$

(x is all real numbers except for 1.)

e) What happens as the x-values get really close to 1?

test: $x = 0.9$ $y = \frac{5}{((.9)-1)} = -50$ Big neg #s! ↓ test: $x = 1.1$ $y = \frac{5}{((1.1)-1)} = 50$ Big #s! ↑

f) What happens as we put in really large, positive values for x?

test: $x = 100$ $y = \frac{5}{(100)-1} = 0.05$ small! Close to zero (but positive)

g) What happens as we put in really large, negative values for x?

test: $x = -100$ $y = \frac{5}{(-100)-1} = -0.049$ Small! Close to zero (but negative)

Asymptotes

- An **asymptote** is a line which the graph approaches but never reaches. We use a dotted line to show them on a graph. *(Draw in **asymptotes** on the graph above)*

- **Vertical Asympotes (VA)** have an equation of the form "x = _"

  *(Label the **vertical asymptote** on the graph above)*

  $x = 1$

- **Horizontal Asympotes (HA)** have an equation of the form "y = _"

  *(Label the **horizontal asymptote** on the graph above)*

  $y = 0$

page 188 #1

Determining y-intercepts Algebraically

1. Set $\boxed{x = 0}$
2. Find y

   Hint: remember that $f(x) = y$

Example 4: Find the y-intercepts of the following Rational Functions:

a) $\overset{y}{\cancel{f(x)}} = \frac{x^2+7x+10}{x^2-4}$ (set $x=0$)

$$y = \frac{[(0)^2+7(0)+10]}{[(0)^2-4]}$$

$$y = \frac{10}{-4}$$

$$y = -5/2$$

$\boxed{(0, -5/2)}$

b) $\overset{y}{\cancel{g(x)}} = 1 - \frac{8}{x^2-1}$ (set $x=0$)

$$y = 1 - \frac{8}{(0)^2-1}$$

$$y = 1 - \frac{8}{-1}$$

$$y = 1 + 8$$

$$y = 9$$

$\boxed{(0, 9)}$

Determining x-intercepts (also called "the zeros") Algebraically

1. Set $\boxed{y = 0}$ **Hint**: remember that $f(x) = y$
2. Solve for x

To solve a rational equation:

1. Factor everything. State restrictions. Reduce if possible.
2. "Clear ~~denominators~~ fractions" (multiply **all** terms by any factor in a denominator).
3. Solve the resulting equation.

↳ terms are separated by add/subtract/=

Example 5: Find the x-intercepts of the following Rational Functions:

a) $\overset{y \to 0}{\cancel{f(x)}} = \frac{x^2+7x+10}{x^2-4}$ (set $y=0$) factor!

$$0 = \frac{(x+5)\cancel{(x+2)}}{\cancel{(x+2)}(x-2)}$$

Restrictions $\boxed{x \neq \pm 2}$ Then cancel

$$(x-2) \cdot 0 = \frac{(x+5)}{(x-2)} \cdot (x-2)$$

Clear fractions

$$0 = x+5$$

$$-5 \quad\quad -5$$

solve

$$-5 = x$$

$\boxed{x\text{-int: } (-5, 0)}$

b) $\overset{0}{\cancel{g(x)}} = 1 - \frac{8}{x^2-1}$ (set $y=0$) factor

$$0 = 1 - \frac{8}{(x+1)(x-1)}$$

Restrictions: $\boxed{x \neq \pm 1}$ Nothing cancels.

$$0^{(x+1)(x-1)} = 1^{(x+1)(x-1)} - \frac{8\,\cancel{(x+1)}\cancel{(x-1)}}{\cancel{(x+1)}\cancel{(x-1)}}$$

clear fractions

$$0 = (x+1)(x-1) - 8$$

Expand & collect

$$0 = x^2 - 1 - 8$$

$$0 = x^2 - 9$$

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

Factor to solve quadratic

$$\therefore x = \pm 3$$

x-ints: $\boxed{(-3, 0) \text{ and } (3, 0)}$

Assignment: Page 188 #1, #4 (#4 asks for "zeros" which are x-intercepts. Find y-intercepts as well)

Rational Functions Day 2:

Features of Rational Functions II

Warm-up: Label any intercepts and asymptotes on the following graph. (Approximate if needed)

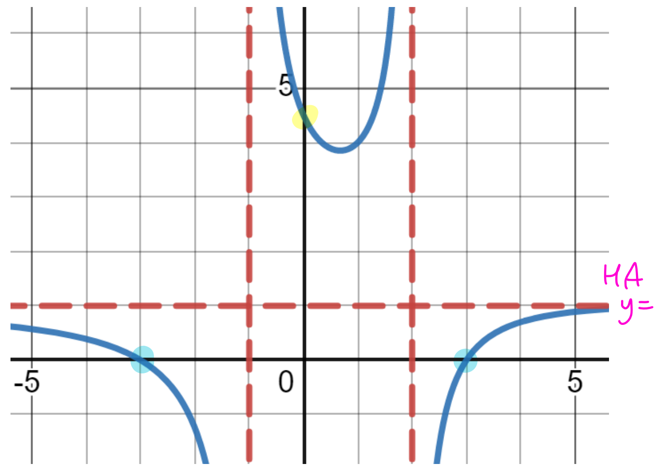
x-intercept(s): $(-3,0)(3,0)$

y-intercept: $(0,4.5)$ approx.? ⊛

HA: $y=1$

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

Domain: $\{x \mid x \neq -1, 2, x \in \mathbb{R}\}$



Example 1: The equation of the graph above is $f(x) = \frac{x^2-9}{x^2-x-2}$.

⊛ can confirm y-int: $y = \frac{0^2-9}{0^2-0-2} = \frac{-9}{-2} = 4.5$

a) Factor and simplify. State restrictions.

$f(x) = \frac{(x+3)(x-3)}{(x+1)(x-2)}$, $\boxed{x \neq -1, 2}$

b) What do you notice about the restrictions and the asymptotes? The same!

Except the restrictions and Domain are $x \neq -1, 2$

and the asymptotes are at $x = -1, 2$

Determining the Vertical Asymptotes Algebraically

- The vertical asymptotes are created by restrictions from the denominator (after simplifying)
- For rational function, $f(x) = \frac{g(x)}{h(x)}$, if **c** is a zero of $h(x)$, then the vertical line $x = c$, is a vertical asymptote of $f(x)$.

Example 2: Determine the vertical asymptotes of $f(x) = \frac{2x-5}{x^3-9x^2}$

factor
restrictions
cancel? No.
VA at restrictions (that don't cancel)

$f(x) = \frac{2x-5}{(x)^2(x-9)}$, $\boxed{x \neq 0, 9}$

$\therefore$ $\boxed{\text{VA at } x = 0, 9}$

Determining Horizontal Asymptotes Algebraically

- Horizontal asymptotes can be determined by examining the end behaviour of a rational function as x approaches positive and negative infinity (gets really big or really small).
  "big negative"

- To examine the end behaviour, divide each term in the rational expression by the highest power of x and allow $|x| \to \infty$. This allows all but the leading term(s) to become zero and disappear.
  anywhere! imagine really big x-values Think: $\frac{1}{BIG}$ = small

Caution: Constants beyond the rational function get added to the value of the horizontal asymptote.

Add shortcuts after: "bottom wins" → 0 "tied" → coefficients "top wins" → no HA

Example 3: Determine the horizontal asymptotes of

i) $f(x) = \frac{2x-5}{x^3-9x^2} + 3$

$$y = \frac{\frac{2x}{x^3} - \frac{5}{x^3}}{\frac{x^3}{x^3} - \frac{9x^2}{x^3}} + 3$$

$$y = \frac{\cancel{\frac{2}{x^2}}^{0} - \cancel{\frac{5}{x^3}}^{0}}{1 - \cancel{\frac{9}{x}}^{0}} + 3$$

as x gets really big, $\frac{1}{x} \to 0$

$$y = \frac{0-0}{1-0} + 3 = \frac{0}{1} + 3$$

add at end!

$\boxed{\text{HA @ } y = 3}$

ii) $g(x) = \frac{6x^2+2x-1}{4x^2-9x+7}$

$$y = \frac{\frac{6x^2}{x^2} + \frac{2x}{x^2} - \frac{1}{x^2}}{\frac{4x^2}{x^2} - \frac{9x}{x^2} + \frac{7}{x^2}}$$

$$y = \frac{6 + \frac{2}{x} - \frac{1}{x^2}}{4 - \frac{9}{x} + \frac{7}{x}}$$

$$y = \frac{6}{4} = \frac{3}{2}$$

$\boxed{\text{HA @ } y = \frac{3}{2}}$

iii) $h(x) = \frac{3x^2-1}{9x+4} - 3$

$$y = \frac{\frac{3x^2}{x^2} - \frac{1}{x^2}}{\frac{9x}{x^2} + \frac{4}{x^2}} - 3$$

$$y = \frac{3 - \cancel{\frac{1}{x^2}}^{0}}{\cancel{\frac{9}{x}}^{0} + \cancel{\frac{4}{x^2}}^{0}} - 3$$

$$y = \frac{3}{0} - 3$$

! undefined!

∴ no H.A

(note: "undefined" − 3 is still undefined!)

Short-cut!

For Horizontal Asymptotes:

For $f(x) = \frac{g(x)}{h(x)} = \frac{a_n x^n + \cdots + a_1 + a_0}{b_d x^d + \cdots + b_1 + b_0}$ where $a_n \neq 0$, $b_d \neq 0$

"bottom wins" → 0 1. If $n < d$, the line $y = 0$ (the x – axis) is a horizontal asymptote. (highest power is in denom.)

"tied" → coefficients 2. If $n = d$, the line $y = \frac{a}{b}$ is a horizontal asymptote. (highest power is found in num. & den.)

"top wins" → no HA 3. If $n > d$, there is no horizontal asymptote. (highest power is in numerator)

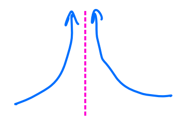
Assignment: Page 181 #3

Rational Functions Day 3:

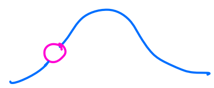
Features of Rational Functions III

Discontinuity

- Rational functions are **undefined** when there is a value of x that causes **division by zero**. This causes a discontinuity or "break" of some kind in the graph.
- **Vertical Asymptotes** are a type of discontinuity we have already seen.



- **Holes** are another type of discontinuity.

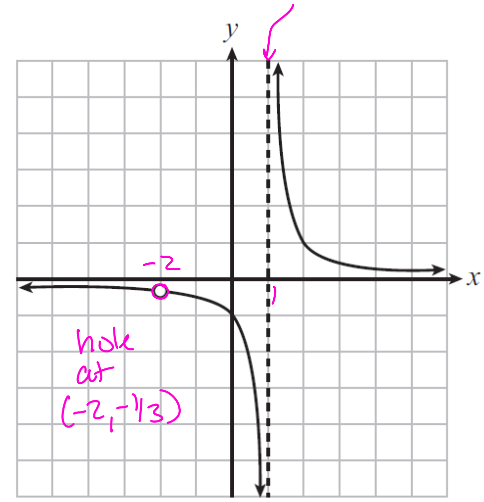


Holes in Rational Functions

- A **hole** in a rational function is created when the factored form of a rational function simplifies by cancelling common factors. But because the restricted value still exists, a **hole** in the function is created at that x-value.
- To find the coordinate of the hole, sub the restricted value (that cancelled away) into the **simplified** equation to find y.

Example 1: Consider $f(x) = \frac{x+2}{x^2+x-2}$. The graph is shown below.

VA at $x=1$



a) Simplify the function and state restrictions.

$f(x) = \frac{\cancel{(x+2)}}{\cancel{(x+2)}(x-1)}$, $\boxed{x \neq -2, 1}$

$f(x) = \frac{1}{x-1}$, $\boxed{x \neq -2, 1}$

b) Explain why there is an asymptote at $x = 1$ and a hole at $x = -2$.

- The factor $(x-1)$ is still in the simpler function, and creates a V.A.
- The factor $(x+2)$ cancelled, but $x \neq -2$ is still a restriction.

c) Sub $x = -2$ into the **simplified** version of $f(x)$ to find the coordinate of the hole:

or y

$f(-2) = \frac{1}{(-2)-1} = \frac{1}{-3} = \frac{-1}{3}$

hole at $(-2, -1/3)$

Looks about right on the graph!

Page 180 #2

Features of Rational Functions

Now we are able to find all the key features of a rational function. Next day we can graph them!

Example 2: Determine the vertical & horizontal asymptotes, *x* & *y* intercepts, and any holes in the function

$$f(x) = \frac{x^2-5x}{x^3-25x} - 2$$

$\boxed{HA}$

denom. has highest power

$y = \frac{x^2-5x}{x^3-25x} - 2$

0

$y = 0 - 2$

HA at $y = -2$

$\boxed{\text{Simplify:}}$

$y = \frac{x^2-5x}{x^3-25x} - 2$ factor

$y = \frac{x(x-5)}{x(x^2-25)} - 2$

$y = \frac{\cancel{x}(\cancel{x-5})}{\cancel{x}(x+5)(\cancel{x-5})} - 2, \quad x \neq 0, -5, 5$

hole VA hole

Simplified Equation (use for the other work)

$$\boxed{y = \frac{1}{x+5} - 2, \quad x \neq 0, -5, 5}$$

$\boxed{VA}$

VA at $x = -5$

$\boxed{\text{Holes}}$ Sub in $x=0$ and $x=5$ into simplified eq'n

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

$y = \frac{1}{5} - 2$

$y = \frac{1}{5} - \frac{10}{5}$

$y = -\frac{9}{5}$

hole at $(0, -9/5)$

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

$y = \frac{1}{10} - 2$

$y = \frac{1}{10} - \frac{20}{10}$

$y = -19/10$

hole at $(5, -19/10)$

$\boxed{y\text{-int}}$

set $x = 0$

! but $x \neq 0$

$\therefore$ no y-int

$\boxed{x\text{-int}}$

Set $y=0$ (use simplified!)

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

$0(x+5) = \frac{1\cancel{(x+5)}}{\cancel{(x+5)}} - 2(x+5)$

$0 = 1 - 2(x+5)$ Expand

$0 = 1 - 2x - 10$ Collect

$0 = -2x - 9$ solve

$+9 \qquad +9$

$\frac{9}{-2} = \frac{-2x}{-2}$

$-\frac{9}{2} = x$

x-int: $(-9/2, 0)$

Example 3: Determine the vertical & horizontal asymptotes, x & y intercepts, and any holes in the function

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

HA

powers "tied" top/bottom.
∴ use coefficients!

$\frac{-1}{2}\frac{x^3}{x^3}$

∴ HA at $y = -\frac{1}{2}$

Simplify:

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

$$y = \frac{-\cancel{x}(x+3)\cancel{(x-3)}}{\cancel{x}(2x+3)\cancel{(x-3)}}, \quad x \neq 0, -\frac{3}{2}, 3$$

hole VA hole

Simplified Eq'n

$$\boxed{y = \frac{-(x+3)}{(2x+3)}, \quad x \neq 0, -3/2, 3}$$

VA

VA at $x = -\frac{3}{2}$

y-int (set $x=0$, but $x \neq 0$!)

∴ no y-int

Holes at $x=0$ and $x=3$

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

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

$$y = -1$$

Hole at $(0,-1)$

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

$$y = \frac{-6}{(6+3)}$$

$$y = \frac{-6}{9}$$

$$y = -2/3$$

Hole at $(3, -2/3)$

x-int (set $y=0$)

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

clear fractions

$$0^{(2x+3)} = \frac{-(x+3)\cancel{(2x+3)}}{\cancel{(2x+3)}}$$

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

$$x = -3$$

can expand, or use the "zero of the bracket!"

x-int: $(-3, 0)$

Assignment: Page 180 #2, Page 182 #4

Answer 4h) HA: $y = 2$ VA: $x = -1, 4$ hole: $(0, \frac{9}{2})$

Rational Functions Day 4:

Graphing Rational Functions

Now that we know how find all the key features of a rational function, we can use them to graph!

Key Ideas:

- Restrictions
- Asymptotes
- Intercepts
- Holes

Sometimes, when we simplify a function, it turns into something we know how to graph already. Just watch out for restrictions!

Example 1: Sketch an accurate graph of $f(x) = \frac{x^2-9}{x+3}$.

$\boxed{\text{HA}}$ top has highest power ∴ no HA

$\boxed{\text{Simplify:}}$ factor

$y = \frac{\cancel{(x+3)}(x-3)}{\cancel{(x+3)}}$, $\boxed{x \neq -3}$

hole

no VA

$\boxed{\text{VA}}$ no VA

$\underbrace{y = x - 3}$, $x \neq -3$

- this is a line! $y = mx + b$

$y = x - 3$

$m = 1$ $b = -3$

- except a line with a hole in it!

$\boxed{\text{hole}}$ $x = -3$

$y = x - 3$

$y = (-3) - 3$

$y = -6$

hole at $(-3, -6)$

(Plot)

plot points on line:

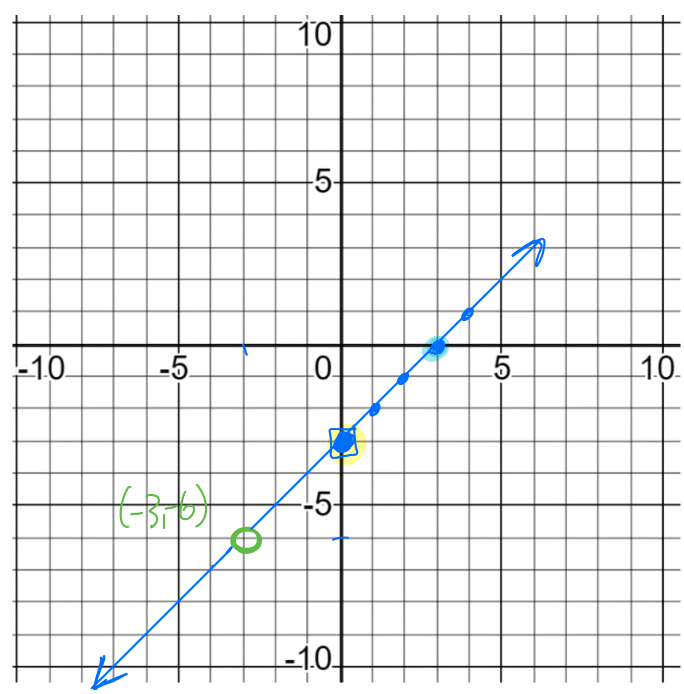
y-int at -3

up1 rt1

x-int: $(3, 0)$

y-int: $(0, -3)$

(from graph)



Pg 188 #2

Steps to Graphing a Rational Function:

1. Find and plot any **Horizontal Asymptotes** (before you simplify)
2. **Simplify** the function* (factor, restrictions, cancel – note Holes/VA)

   *Note: You may be able to sketch the graph of the function in its simplified form if you know it (e.g. a line). If not….

Use the **simplified** function to find all of the following:

3. Find and plot any **Vertical Asymptotes**
4. Find and plot ***y*-intercept** (set $x = 0$ and find y) and ***x*-intercepts** (set $y = 0$ and solve for x)
5. Find the y-coordinates of any holes (sub x-value of hole into **simplified** function) and plot **holes**
6. You may need to use a table of values to include
   a. $x = 0.1$ or 0.01 above and below each vertical asymptote (to see how it approaches)
   b. $x = \pm 1000$ ($\pm\infty$) (to see end behaviour)
   c. any other helpful points
7. Draw a smooth curve through the points, and "approach" the asymptotes

Example 2: Sketch an accurate graph of $f(x) = \frac{x-2}{x+1}$.

(No factoring)

Simplified Equation

$y = \frac{(x-2)}{(x+1)}$, $x \neq -1$

VA

HA

Powers "tied" ∴ use coefficients

HA at $y = 1$

VA

VA at $x = -1$

Holes

no restrictions that cancelled ∴

no holes

y-int

set $x = 0$

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

$y = \frac{-2}{1}$

y-int: $(0, -2)$

x-int

set $y = 0$

$(x+1)\,0 = \frac{(x-2)\cancel{(x+1)}}{\cancel{(x+1)}}$

$0 = (x-2)$

$x = 2$

x-int: $(2, 0)$

Other Points

Need to know what's happening "left of VA at $x=-1$"

try $x = 1$

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

plot $(1, -\frac{1}{2})$

try $x = -2$

$y = \frac{(-2)-2}{(-2)+1} = \frac{-4}{-1} = 4$

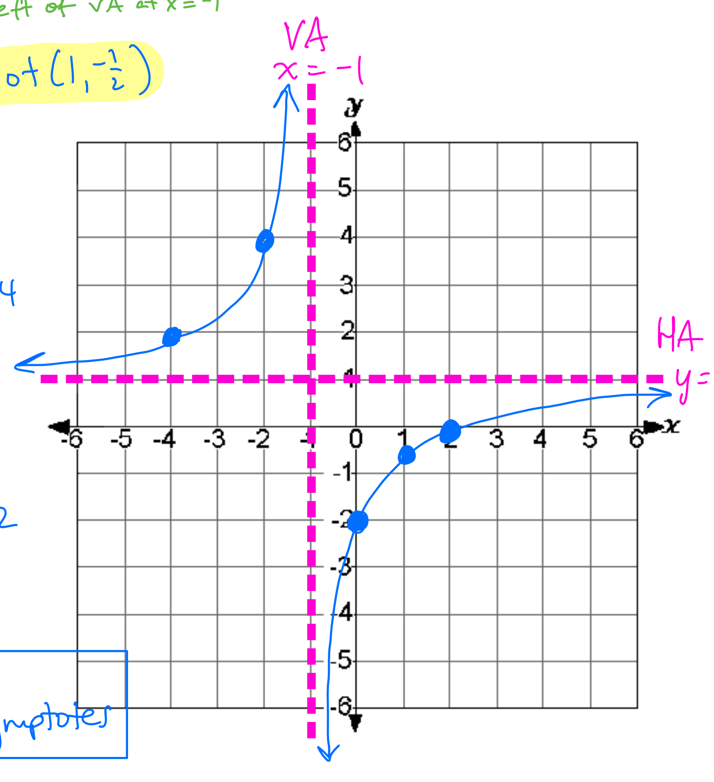
plot $(-2, 4)$

try $x = -4$

$y = \frac{(-4)-2}{(-4)+1} = \frac{-6}{-3} = 2$

plot $(-4, 2)$

Connect dots, "follow" asymptotes



Example 3: Sketch an accurate graph of $f(x) = \frac{x^2+5x+6}{x^2-9}$.

HA highest powers "tied". Use coeff. $y=\frac{1}{1}$

HA at $y=1$

Simplify: $y = \frac{(x+2)\cancel{(x+3)}}{\cancel{(x+3)}(x-3)}$, $\boxed{x \neq -3, 3}$

hole VA

VA VA at $x=3$

Simplified Eq'n: $\boxed{y = \frac{(x+2)}{(x-3)}, \quad x \neq -3, 3}$

hole sub $x=-3$ into simpler eq'n

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

$y = \frac{-1}{-6}$

$y = \frac{1}{6}$ $\therefore$ hole at $(-3, 1/6)$

y-int: set $x=0$

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

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

$y = -2/3$ y-int at $(0, -2/3)$

*draw curve as though it is going "through" the hole, but just leave the hole out!

x-int: set $y=0$

$(x-3)\, 0 = \frac{(x+2)}{(x-3)}\,(x-3)$ x-int at $(-2, 0)$

$0 = (x+2)$

$x = -2$

Other Points What's happening right of VA?

try $x=4$

$y = \frac{(4+2)}{(4-3)} = \frac{6}{1} = 6$ Plot $(4,6)$

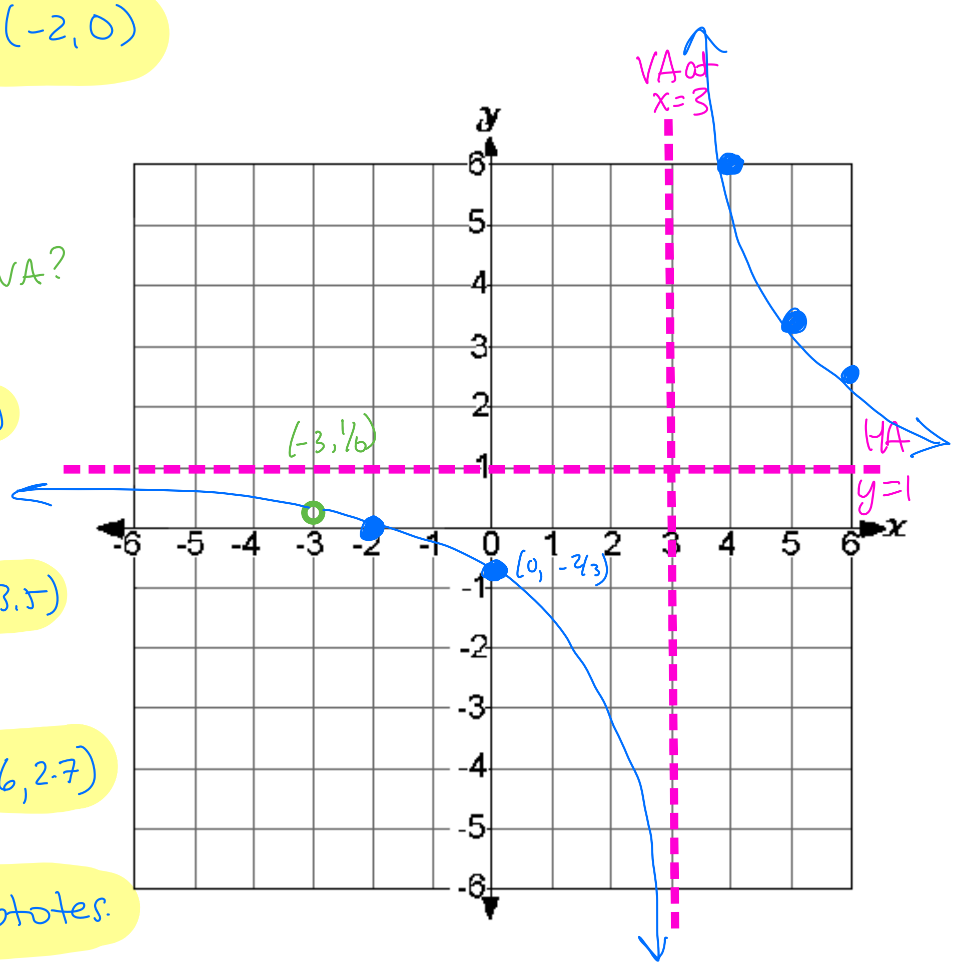
try $x=5$

$y = \frac{(5+2)}{(5-3)} = \frac{7}{2} = 3.5$ Plot $(5, 3.5)$

try $x=6$

$y = \frac{(6+2)}{(6-3)} = \frac{8}{3} = 2.\overline{6}$ Plot $(6, 2.7)$

Draw curves; follow asymptotes.



Example 4: Sketch an accurate graph of $f(x) = \frac{2x}{x^2-4}$.

$\boxed{\text{Simplify:}}$ $y = \frac{2x}{(x+2)(x-2)}$, $\boxed{x \neq -2, 2}$

VA VA

$\boxed{\text{HA}}$ highest power in denom. ∴

HA at $y=0$

*Note: graphs can cross HA's in the middle. They only apply at the "ends".

$\boxed{\text{VA}}$ VA's at $x=-2$, $x=2$

$\boxed{\text{holes}}$ no holes

$\boxed{\text{y-int:}}$ set $x=0$

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

$y = 0$

y-int: (0,0)

$\boxed{\text{x-int:}}$ Set $y=0$

$(x+2)(x-2)\,0 = \frac{2x}{\cancel{(x+2)(x-2)}}\,\cancel{(x+2)(x-2)}$

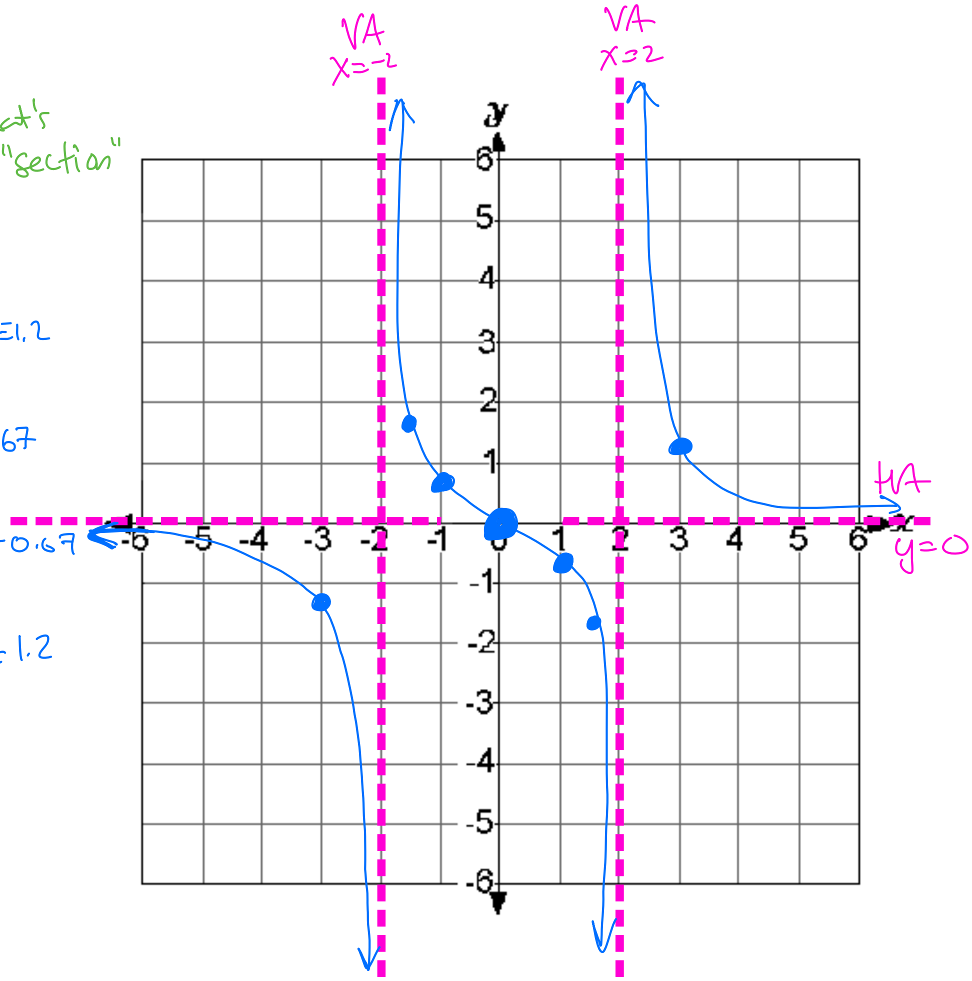
$\frac{0}{2} = \frac{2x}{2}$

$0 = x$

x-int (0,0)

$\boxed{\text{Extra Points}}$ Need to know what's happening in each "section"

x	$y = \frac{2x}{(x+2)(x-2)}$	
-3	-1.2	$\frac{2(-3)}{(-3+2)(-3-2)} = \frac{-6}{(-1)(-5)} = \frac{-6}{+5} = -1.2$
-1	0.7	$\frac{2(-1)}{(-1+2)(-1-2)} = \frac{-2}{(1)(-3)} = \frac{-2}{-3} = 0.67$
1	-0.7	$\frac{2(1)}{(1+2)(1-2)} = \frac{2}{(3)(-1)} = \frac{2}{-3} = -0.67$
3	1.2	$\frac{2(3)}{(3+2)(3-2)} = \frac{6}{(5)(1)} = \frac{6}{5} = 1.2$
-1.5	1.7	Typed in calculator
1.5	-1.7	



Assignment p. 188 #2, 5, 6