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Get the 4.1 checkpoint from the brown table and answer the questions.

Nov 3-4:18 PM

1 Do you plan on doing chapter 3 test corrections?

Yes

No

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## Algebra 2 4-2 and 4-3 GRAPH SIMPLE and GENERAL RATIONAL FUNCTIONS

**Objective:** Students will be able to graph rational functions of the form

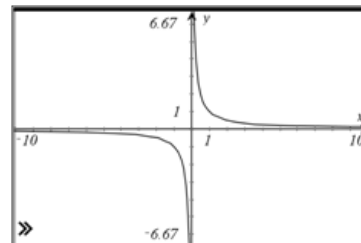
$$y = \frac{a}{x-h} + k \quad \text{and} \quad y = \frac{ax+b}{cx+d}$$

A2.9.1 Write the symbolic form and sketch the graph of simple rational functions.

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### Rational Functions

- A **RATIONAL FUNCTION** has the form  $f(x) = \frac{p(x)}{q(x)}$ , where  $p(x)$  and  $q(x)$  are polynomials and  $q(x) \neq 0$ .
- 
- The inverse variation function  $f(x) = \frac{a}{x}$  is a rational function.
- 
- The Parent Function for Simple Rational Functions
- The function  $f(x) = \frac{1}{x}$  is a split graph.
- The two symmetrical parts are called
- *branches*.
- Domain: All Real numbers except 0
- Range: All Real numbers except 0
- Vertical Asymptote  $x = 0$
- Horizontal Asymptote  $y = 0$
- Any function of the same form has the same asymptotes, domain, and range of the parent function.



**QUADRANTS!!**

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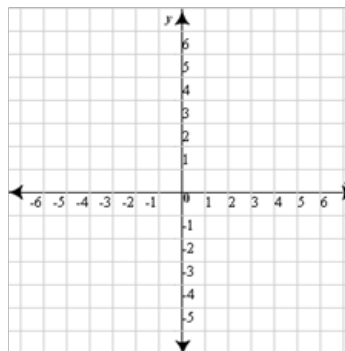
**EXAMPLE 1** Graph a rational function of the form  $y = \frac{a}{x}$

Graph the function  $y = \frac{6}{x}$  Compare the graph with the graph of  $y = \frac{1}{x}$

**STEP 1** Draw the asymptotes  $x = 0$  and  $y = 0$ .

**STEP 2** Plot points to the left and to the right of the vertical asymptote, such as  $(-3, -2)$ ,  $(-2, -3)$ ,  $(2, 3)$ , and  $(3, 2)$ .

**STEP 3** Draw the branches of the graph so that they pass through the plotted points and approach the asymptotes.



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## Graphing Translations of Simple Rational Functions

- To graph a rational function of the form  $y = \frac{a}{x-h} + k$  :

- 

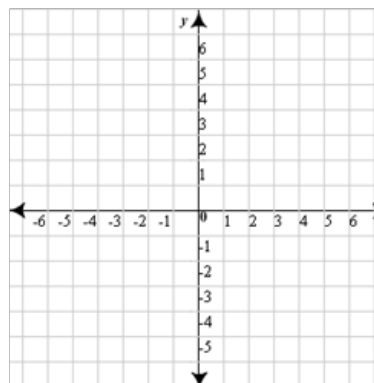
- **DRAW** the asymptote  $x = h$  and  $y = k$ .  
Notice that  $h$  changed signs! \*\* set the

- **PLOT** the points to the left and the right of the vertical asymptote.

- **DRAW** the two branches of the graph so they pass through the plotted points and approach the asymptotes.

- Give the domain & range!!

- Transformations!!



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**EXAMPLE 2** Graph a rational function of the form

$$y = \frac{a}{x-h} + k$$

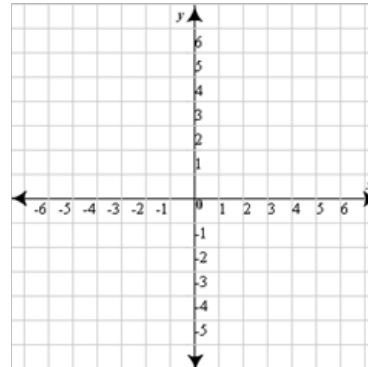
Graph  $y = \frac{-4}{x+2} - 1$  State the domain and range.

**STEP 1** Draw the asymptotes.

**STEP 2** Plot points to the left of the vertical asymptote and points to the right.

**STEP 3** Draw the two branches of the hyperbola so that they pass through the plotted points and approach the asymptotes.

**STEP 4** State the Domain and Range. The asymptotes are x and y values that can not be used!  
Transformations



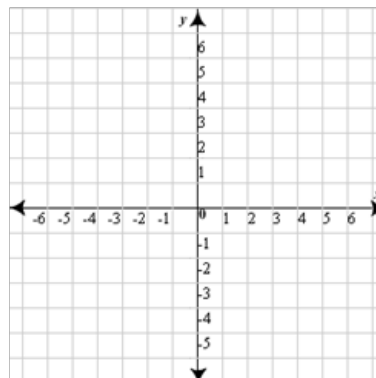
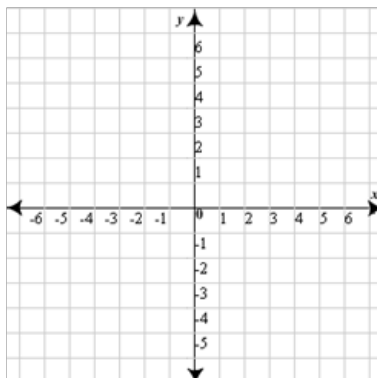
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**GUIDED PRACTICE for Examples 1 and 2**

Graph the function. State the domain and range. Transformations

1.  $f(x) = \frac{-4}{x}$

2.  $y = \frac{8}{x} - 5$



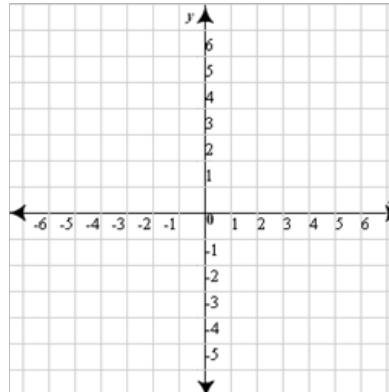
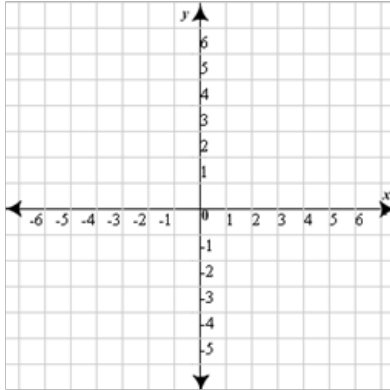
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**GUIDED PRACTICE for Examples 1 and 2**

Graph the function. State the domain and range. Transformations

3.  $y = \frac{1}{x-3} + 2$

4.  $y = \frac{1}{x+1} - 3$



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**Other Rational Functions**

$$y = \frac{a}{x-h} + k$$

- All rational functions of the form  $y = \frac{ax+b}{cx+d}$  also have graphs that are split.
- 
- The vertical asymptote is the line  $x = -\frac{d}{c}$  because the
- denominator is undefined when  $cx+d$  is zero.
- To find the vertical asymptote set the denominator equal to zero and solve for x. **Vertical Asymptote = Same**

- The horizontal asymptote is the line  $y = \frac{a}{c}$  **Top Coefficient**  
Notice these are the coefficients! **Bottom Coefficient**

**No Transformations**

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**EXAMPLE 3** Graph a rational function of  $\frac{ax + b}{cx + d}$

Graph  $y = \frac{2x + 1}{x - 3}$ . State the domain and range.

**STEP 1** Find and draw the asymptotes solving for x

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

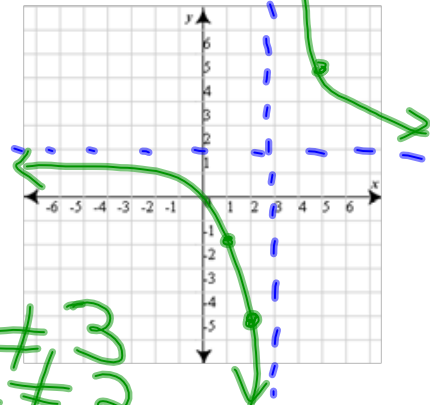
**STEP 2** Plot points.

**STEP 3** Draw the two branches of the hyperbola so that they pass through the plotted points and approach the asymptotes.

**STEP 4** Find the domain and range. The denominator is undefined when it is equal to zero.

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

4	9
5	5.5
2	-5.5
1	-5



D:  $x \in \mathbb{R}; x \neq 3$   
 R:  $y \in \mathbb{R}; y \neq 2$

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**GUIDED PRACTICE** for Examples 3 and 4

Graph the function. State the domain and range.

4.  $y = \frac{x - 1}{x + 3}$

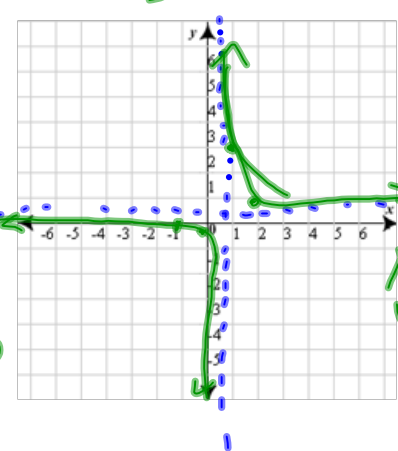
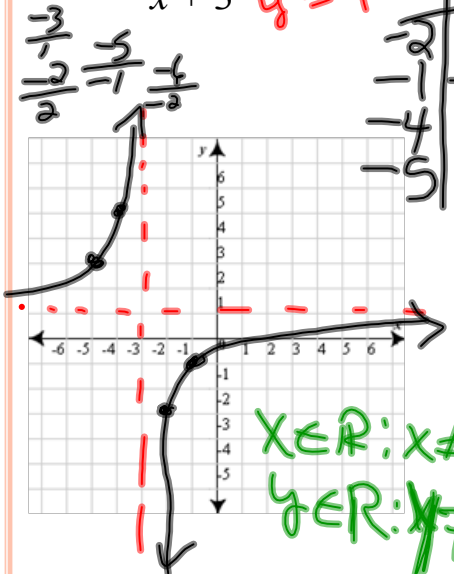
$x = -3$   
 $y = 1$

-2	-3
-1	-1
-4	5
-5	3

5.  $y = \frac{2x + 1}{4x - 3}$

$x = \frac{3}{4}$   
 $y = \frac{1}{2}$

0	-1/3
-1	1/3
1	3
2	1



$x \in \mathbb{R}; x \neq -3$   
 $y \in \mathbb{R}; y \neq 1$

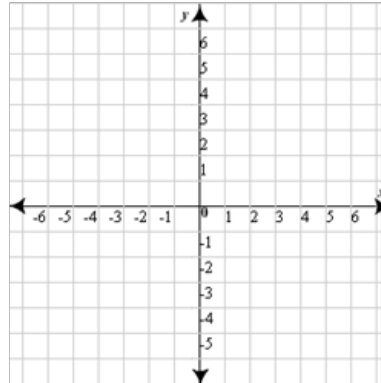
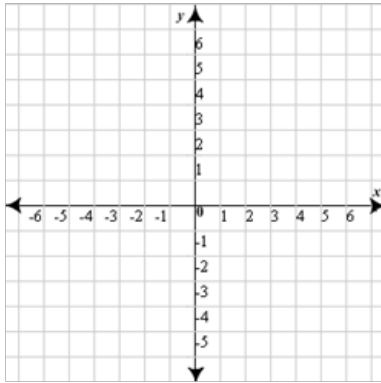
$x \in \mathbb{R}; x \neq \frac{3}{4}$   
 $y \in \mathbb{R}; y \neq \frac{1}{2}$

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**GUIDED PRACTICE for Examples 3 and 4****Graph the function. State the domain and range.**

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

7.  $f(x) = \frac{-5x}{2x+6}$



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