Warm-up

1) $y=6(x+7)^{2}-1$ Transformation:

Range:
Increasing:
2) $y=2 \sqrt{x-6}+3$

Transformation:
Range:

## End Behavior:

Domain:
Decreasing:

End Behavior:
Domain:
Increasing:
Decreasing:

## Homework

1. T: Left $5 \quad \mathrm{D}:[-5, \infty) \quad \mathrm{R}:(0, \infty)$ EB: As $x \rightarrow \infty, y \rightarrow \infty$. Increasing: $(-5, \infty)$ Decreasing: None
2. T: Down $3 \mathrm{D}:(-\infty, \infty) \mathrm{R}:(-\infty, \infty)$ EB: As $x \rightarrow \infty, y \rightarrow \infty$; As $x \rightarrow-\infty, y \rightarrow-\infty$. Increasing: $(-\infty, \infty)$ Decreasing: None

## Homework

3. T: Left 5, Vertical stretch by 4
D: $(-5, \infty)$
R: $(0, \infty)$

EB: As $x \rightarrow \infty, y \rightarrow \infty$.
Increasing: $(-5, \infty)$ Decreasing: None
4. T: Reflect across x-axis; Vertical Stretch by 2; Right 1; Down 4
D: $(-\infty, \infty) \quad$ R: $(-\infty, \infty)$
EB: As $x \rightarrow \infty, y \rightarrow \infty$; As $x \rightarrow-\infty, y \rightarrow-\infty$.
Increasing: None Decreasing : $(-\infty, \infty)$

## Homework

5. T: Vertical shrink by $\frac{1}{5}$; Left 4

D: $[-4, \infty) \quad$ R: $(0, \infty)$
EB: As $x \rightarrow \infty, y \rightarrow \infty$.
Increasing: $(-4, \infty)$ Decreasing: None
6. T: Reflect across x-axis; Vertical Stretch by 5; Left 5; Down 7
D: $(-\infty, \infty) \quad$ R: $(-\infty, \infty)$
EB: As $x \rightarrow \infty, y \rightarrow \infty$. As $x \rightarrow-\infty, y \rightarrow-\infty$. Increasing: None Decreasing : $(-\infty, \infty)$

## Homework

7. T: Reflect across x-axis; Vertical shrink by $\frac{1}{4}$; Right 6; Up 2
D: $[6, \infty) \quad \mathrm{R}:(-\infty, 2]$
EB: As $x \rightarrow \infty, y \rightarrow-\infty$. Increasing: None Decreasing : $(6, \infty)$
8. T: Left 4; Up 6

$$
\text { D: }(-\infty, \infty) \quad \text { R: }(-\infty, \infty)
$$

EB: As $x \rightarrow \infty, y \rightarrow \infty$. As $x \rightarrow-\infty, y \rightarrow-\infty$. Increasing: $(-\infty, \infty)$ Decreasing: None

## Homework

9. T: Vertical shrink by $\frac{2}{5}$; Right 1 ; Up 3

D: $[1, \infty) \quad$ R: $(3, \infty)$
EB: As $x \rightarrow \infty, y \rightarrow \infty$.
Increasing: $(-4, \infty)$ Decreasing: None

# $U$ <br> $\int_{y=x^{2}} \int_{y=\sqrt{x}}^{\substack{x=5 \sqrt{x}}}$ Graphing Reciprocal Functions 

## Graphing Reciprocal Functions

- Consider the function $\begin{aligned} y & =\frac{1}{x} \\ 0 & =\perp\end{aligned}$
- Without graphing, can you find any limitations for $x$ ?

The denominator of a fraction can never equal 0 , so $x \neq 0$.

- How about limitations for $y$ ?

Since $x y=5, y \neq 0$

## ( 0,0 )

The graph and its parts


End Behavior:
Branches

Increasing/Decreasing:

Domain and Range:


Asymptotes

$$
x=0, y=0
$$

## Transformation of inverse variations

- Given the parent function $y=\frac{\infty 1}{x}$
- What do you think the following transformations will do to the function?

- What do you notice about the asymptotes for the transformed functions?


## The Properties

Translations of Inverse Variations
The graph of

$$
y=\frac{k}{x \beta b}+c
$$

is a translation of $y=\frac{k}{x}$
by $b$ units horizontally and $c$ units vertically. The vertical asymptote is $x=b$. The horizontal asymptote is $y=c$.

When $k$ is positive:

the graph is in quadrants I and III
When k is negative:
the graph is in quadrants II and IV (reflection)

## Describe the transformations, name the asymptotes, domain and

 range
## Try some on your own:

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

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

$$
F . y=\frac{4}{x-5}+4
$$

## Examples

1. Write the equation if the parent function

$$
\begin{gathered}
y=\frac{2}{x} \text { has asymptotes at } x=-2 \text { and } y=3 . \\
y=\frac{2}{x+2}+3
\end{gathered}
$$

- 2. For the same parent function, write the equation for the translation of that is 4 units left and 5 units up

$$
y=\frac{2}{x+4}+5
$$

## Examples



1. Write the equation if the parent function


- 2. For the same parent function, write the equation for the translation of that is 7 units right and 2 units down.

$$
y=\frac{3}{x-7}-2
$$

## Examples

1. Write the equation if the parent function $y=\frac{5}{x}$ has asymptotes at $x=8$ and $y=-4$.

- 2. For the same parent function write the equation for the translation of that is 7 units up and 2 units left.

$$
y=\frac{5}{x+2}+7
$$

- Graph the following:

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

- Find the:
a. Asymptotes
V.A $x=2 \quad$ H.A $y=5$
b. Domain and Range
$\underset{x \rightarrow-\infty}{ }$ d. Intervals of increasing and decreasing

$$
\begin{aligned}
& \text { Inc } \quad N / A \\
& \text { Dec: }(-\infty, 2) \cup(2, \infty)
\end{aligned}
$$

- Graph the following:

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

- Find the:
$\left\{\begin{array}{l}V A X=-1 \quad H A \\ \text { a. Asymptotes }\end{array}\right.$
b. Domain and Range
$D^{\prime}(-\infty,-1) \cup(-1, \infty) R^{\prime}(-\infty, 2) \cup$
C. End Behavior ( $-2, \infty$ ) $x \rightarrow-\infty, y \rightarrow-2 \quad x \rightarrow \infty, y \rightarrow-2$
d. Intervals of increasing and decreasing

$$
\sum_{\operatorname{Duc}}^{N / A}(-\infty,-1) \cup(-1, \infty)
$$

- Graph the following:

b. Domain and $p(-\infty$, Range
c. End Behavior
$\leftarrow, 4 \quad \rightarrow, 4$
d. Intervals of increasing and decreasing

$$
(-\infty, 0) \cup(0, \infty)
$$

- Graph the following:

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

- Find the:
a. Asymptotes

VA $\quad x=-3) \quad y=-4$
b. Domain and Range
D: $(-\infty,-3) \cup(-3, \infty)$
R: $(-\infty,-4) \cup(-4, \infty)$
c. End Behavior
$x \rightarrow-\infty, y \rightarrow-4 \quad x \rightarrow \infty, y \rightarrow-4$
d. Intervals of increasing and decreasing

Inc:
$(-\infty,-3) \cup(-3, \infty)$
N/A

## Example:

- Write and graph the inverse variation in which $y=1 / 2$ and $x=10$.

What are/is the:
Asymptotes?
End Behavior?
Domain and Range?
Interval notation?


