
$f(x)=\frac{1}{x} \quad \begin{aligned} & \text { Can the denominator EVER make the } \\ & \text { value of the fraction equal to zero? }\end{aligned}$
What part of the fraction makes it equal to zero? $\frac{0}{3}$

$$
f(x)=\frac{1}{x} \quad \begin{aligned}
& \text { Is there any input that will } \\
& \text { make the numerator }=0 ?
\end{aligned}
$$

The output of this function will never equal zero.

$$
y \neq 0
$$

Horizontal asymptote at: $\mathrm{y}=0$.

| $f(x)=\frac{1}{x} \quad \begin{aligned} & \text { Why is there a vertical asymptote? } \\ & \begin{array}{l} \text { What is the output when we "approach" } \\ \mathrm{x}=0 \text { from the } "+\text { " side? } \end{array} \end{aligned}$ |  |  |
| :---: | :---: | :---: |
| X | $\mathrm{f}(\mathrm{x})$ | $x \rightarrow 0^{+}, y \rightarrow \infty$ |
| 1 | 1 | $x \rightarrow 0^{-}, y \rightarrow-\infty$ |
| 0.1 | 10 |  |
| 0.01 | 100 |  |
| 0.001 | 1000 |  |
| $10^{-4}$ | $10^{4}=10,000$ |  |
| $10^{-12}$ | $10^{12}$ |  |
| The outputs "blow up" |  |  |

The Reciprocal Function
Domain?
Domain : $x \neq 0$
Range?

$$
x=0
$$

Range: $y \neq 0$

How is the graph of the parent function $\quad f(x)=\frac{1}{x}$
is transformed by each of the following equations?

$$
\begin{gathered}
g(x)=\frac{1}{x}+7 \quad \text { Up } 7 \\
h(x)=\frac{5}{(x-2)}=5 * \frac{1}{(x-2)} \quad \text { VSF }=5, \text { Right } 2 \\
f(x)=\frac{-3}{(x+3)}+5 \quad \begin{array}{c}
\text { Reflected across the x-axis, } \\
\text { VSF }=3 \\
\text { Left 3 } \\
\text { Up 5 }
\end{array}
\end{gathered}
$$



$(h, k)$ The point of intersection of the vertical and horizontal asymptotes.

Domain: $x \neq h \quad$ Range $: y \neq k$

## Horizontal/Oblique Asymptote: the quotient when you divide

$$
\begin{array}{ll}
g(x)=\frac{2 x}{x-3} \quad x-3 \sqrt{2 x} & x-3 \sqrt{2 x} \\
g(x)=2+\frac{6}{x-3} & \frac{-(2 x-6)}{6} \\
x \rightarrow \infty, g(x) \rightarrow ? \\
g(x)=2+\frac{6}{x-3} \rightarrow 0 \\
x \rightarrow \infty, g(x) \rightarrow 2
\end{array}
$$

Horizontal/Oblique Asymptote: y = 2
Name:
a) vertical asymptote, (b) horizontal asymptote
c) Domain
(d) Range

Asymptotes are lines. I want the equation of the line.

$$
\left.\begin{array}{cll}
g(x)=\frac{1}{x}+7 & \begin{array}{l}
\text { VA: } x=0 \\
\text { HA: } \mathrm{y}=7
\end{array} & \begin{array}{l}
\text { Domain }: x \neq 0 \\
\text { Range }: y \neq 7
\end{array} \\
h(x)=\frac{1}{(x-2)} & \begin{array}{l}
\text { VA: } x=2
\end{array} & \text { Domain }: x \neq 2 \\
\text { HA: } \mathrm{y}=0 & \text { Range }: y \neq 0
\end{array}\right] \begin{array}{lll} 
\\
f(x)=\frac{-4}{(x+3)}+5 & \begin{array}{l}
\text { VA: } x=-3
\end{array} & \text { Domain }: x \neq-3 \\
\text { HA: } y=5 & \text { Range }: y \neq 5
\end{array}
$$

Horizontal asymptote: there are different methods to find this. Not all rational functions have a horizontal asymptote
$g(x)=\frac{2 x}{x-3} \quad \begin{aligned} & \text { Another way: factor out the largest power } \\ & \begin{array}{l}\text { of ' } x \text { ' in the denominator. Then determine } \\ \text { the right end behavior. }\end{array}\end{aligned}$

$3 / x$ is the reciprocal function.



