 Reciprocal functions

What do the graphs look like?

Use Desmos or other graphing software to graph the following and look at the shape of the graphs.

1. $y=\frac{1}{x}$
2. $y=\frac{3}{x}$
3. $y=\frac{0.4}{x}$
4. $y=\frac{-1}{x}$
5. $y=\frac{-2}{x}$
6. $y=\frac{-10}{x}$



Definition

All of the above graphs are reciprocal functions.

A reciprocal function is a function in the form $y=\frac{k}{x}$ (where$ k\ne 0$)

These graphs are called hyperbolas.

By looking at the graphs drawn above, complete the statements about the shape of a reciprocal function.

If the function is in the form $y=\frac{k}{x}$:

* By looking at the graphs, and knowing the quadrants of the number plane are labelled as:



* + For graphs 1, 2 and 3, where$ k>0$, the graph occupied the I and III quadrants.
	+ For graphs 4, 5 and 6, where$ k<0$,the graph occupied the II and IV quadrants.
* Cross out the incorrect description:
	+ The larger the magnitude of $k$ (the size of the number without the sign), the further away from the origin (0, 0) the graph is.
* As the magnitude of $x$ gets larger, the value of $y$ approaches zero. Lines that graphs get close to but never touch are called asymptotes. The asymptotes of $y=\frac{k}{x}$ are the x and y axes.

Using the information

Using the definition of the function, choose which of the following are reciprocal functions:

$y=\frac{x}{2} ($No)

$y=\frac{6}{x} ($Yes)

$y=x^{2} ($No)

$y=1.5^{-x}$ (No)

By looking at the shape of the graphs of the above functions, choose which of the following are reciprocal functions.



No



Yes

Yes



Yes

No



No

Match the equation with its graph:

$$y=\frac{1}{x}$$

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

$$y=\frac{0.2}{x}$$





Complete the following table of values and use the points to graph the hyperbola curve:

1. $y=\frac{2}{x}$

| x | -10 | -3 | -2 | -1 | $$-\frac{1}{2}$$ | $$-\frac{1}{4}$$ | 0 | $$\frac{1}{4}$$ | $$\frac{1}{2}$$ | 1 | 2 | 3 | 10 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| y | $$-\frac{1}{5}$$ | $$-\frac{2}{3}$$ | -1 | -2 | -4 | -8 | N/A | 8 | 4 | 2 | 1 | $$\frac{2}{3}$$ | $$\frac{1}{5}$$ |

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

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

Plot as $(-3, -\frac{2}{3})$

When $x=0$

$y$ is undefined as you cannot divide by zero

$y=\frac{2}{x}$ when $x=\frac{1}{2}$

$$y=\frac{2}{\left(\frac{1}{2}\right)}=2÷\frac{1}{2}=2×\frac{2}{1}=4$$



1. $y=\frac{0.5}{x}$

| x | -2 | -1 | $$-\frac{1}{2}$$ | $$-\frac{1}{4}$$ | 0 | $$\frac{1}{4}$$ | $$\frac{1}{2}$$ | 1 | 2 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| y | -0.25 | -0.5 | -1 | -2 | N/A | 2 | 1 | 0.5 | 0.25 |



1. $y=x^{2}$

| x | -2 | -1 | $$-\frac{1}{2}$$ | $$-\frac{1}{4}$$ | 0 | $$\frac{1}{4}$$ | $$\frac{1}{2}$$ | 1 | 2 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| y | 0.55 | 1.1 | 2.2 | 4.4 | N/A | -4.4 | -2.2 | -1.1 | -0.55 |

