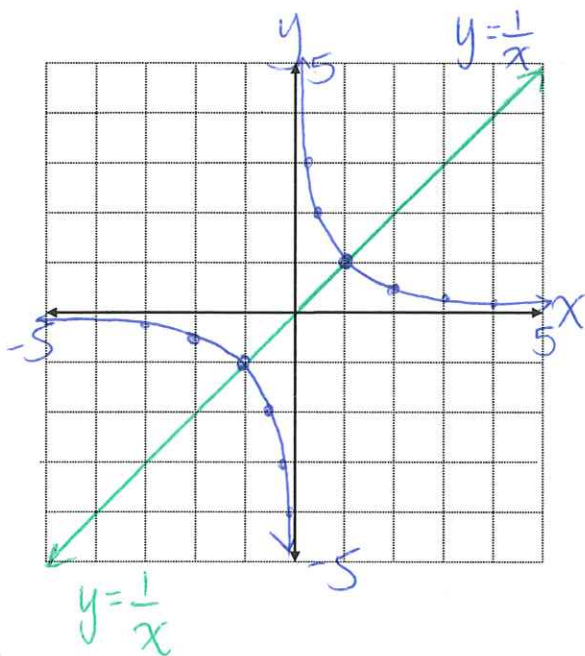


Reciprocal Functions (with graphing technology)

Use a graphing calculator or online graphing tool (desmos).

Part 1: Investigating the function $y = \frac{1}{x}$.



1. a) Graph the function $y = \frac{1}{x}$.

b) Use your cursor (desmos) or the **TRACE** key (graphing calculator) to display coordinates of points on the graph. Trace along both parts of the curve. Mentally check that some of these coordinates satisfy the equation of the function.

c) Use the cursor or **TRACE** key to move the cursor to the point where $x = 0$ appears at the bottom of the screen. What happens to the y -coordinate at this point? Explain.

It doesn't exist, we are trying
to calculate $\frac{1}{x}$, in this case
 $\frac{1}{0}$. It's undefined.

2. On the same grid, graph both $y = \frac{1}{x}$ and $y = x$.

3. For the graph of $y = \frac{1}{x}$, state what happens to the value of y as x becomes:

a) very large and positive: $y = \frac{1}{x}$ stays positive and gets close to 0.

b) very small and positive: $y = \frac{1}{x}$ stays positive and gets very large

c) very large and negative: $y = \frac{1}{x}$ stays negative and gets close to 0.

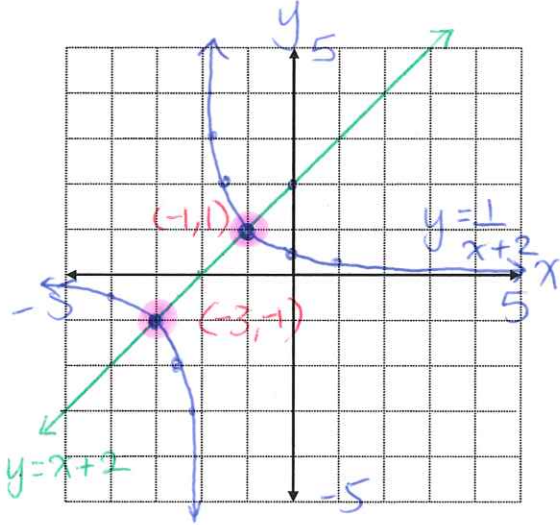
d) very small and negative: $y = \frac{1}{x}$ stays negative and gets very "large"

Note: The function $y = \frac{1}{x}$ is called the **reciprocal** of the function $y = x$.

Part 2: Graphing Reciprocal Functions

In General: The reciprocal of $y = f(x)$ is $y = \frac{1}{f(x)}$, $f(x) \neq 0$.

1. Graph each function and its reciprocal on the same grid. Find the points of intersection and label them on each graph. The calculator entries for example a) are shown. Notice that you must use brackets around each denominator. Be sure to clear the equations after each part.



a) $y = x + 2$, $y = \frac{1}{x + 2}$

If using a graphing calculator:

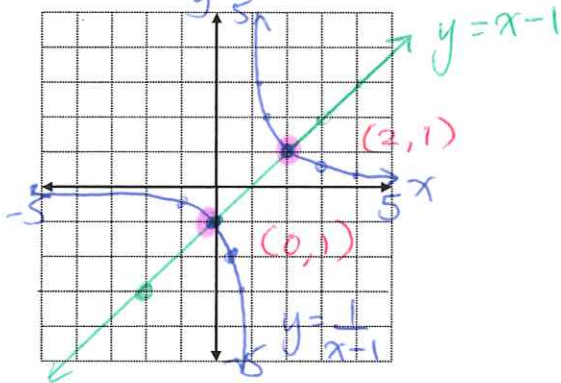
$Y_1 = x + 2$

$Y_2 = 1 / (x + 2)$

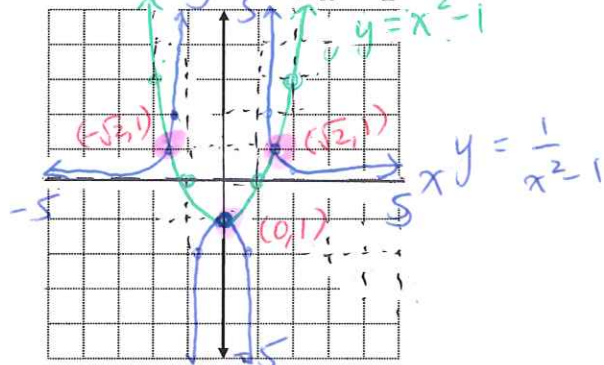
CALC \rightarrow 5: intersect

Move the cursor close to the point of intersection that you are trying to find, using the blue arrow keys. To have the calculator determine the intersection point, press ENTER, ENTER, ENTER.

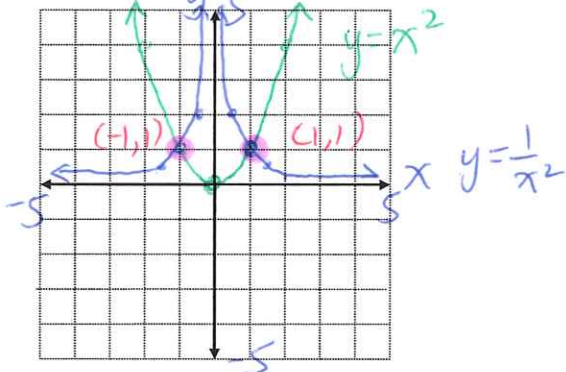
b) $y = x - 1$, $y = \frac{1}{x - 1}$



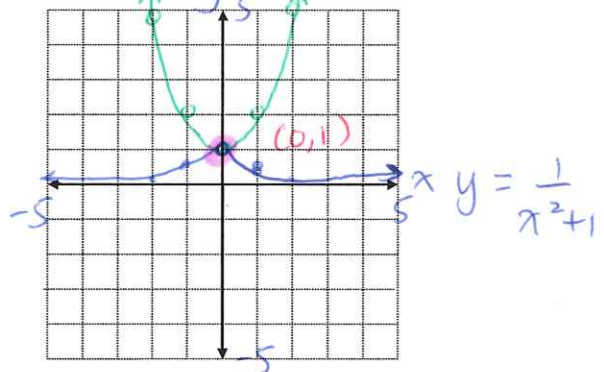
c) $y = x^2 - 1$, $y = \frac{1}{x^2 - 1}$



d) $y = x^2$, $y = \frac{1}{x^2}$



e) $y = x^2 + 1$, $y = \frac{1}{x^2 + 1}$



2. At which values of y do the functions and their reciprocals intersect?

when $y = \pm 1$ because the reciprocal of 1 is 1 and the reciprocal of -1 is -1