

Investigating Rational Functions

Name Master E

Date _____

Block _____

1. a. List everything you already know about the function: $f(x) = \frac{1}{x}$.

Reciprocal Function
 D: $\mathbb{R}, x \neq 0$ $(-\infty, 0) \cup (0, \infty)$
 R: $\mathbb{R}, y \neq 0$ $(-\infty, 0) \cup (0, \infty)$

- b. Compare and discuss your list with your teammates.

2. Use your prior knowledge of this function and the other functions we have studied to describe the transformation of each function below as compared to the parent function $f(x) = \frac{1}{x}$. Discuss and share individual ideas with your group.

a. $f(x) = \frac{1}{x-5}$

b. $f(x) = \frac{1}{x} + 5$

c. $f(x) = \frac{1}{x-5} + 5$

Shifts right 5

Asymptotes: $x=5$
 $y=0$

Shifts up 5

Asymptote: $x=0$
 $y=5$

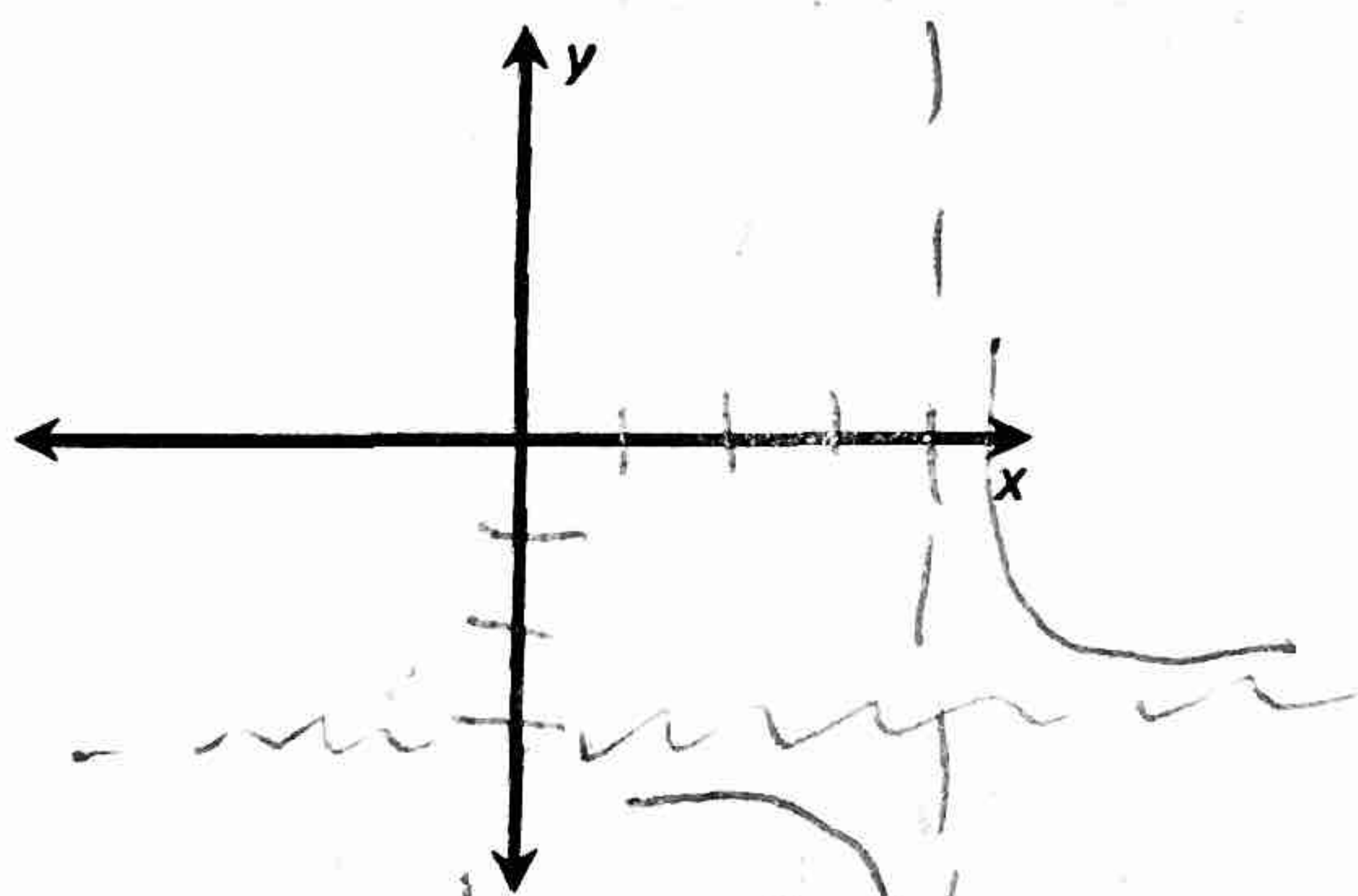
Shifts high 5
 up 5

Asymptotes: $x=5$
 $y=5$

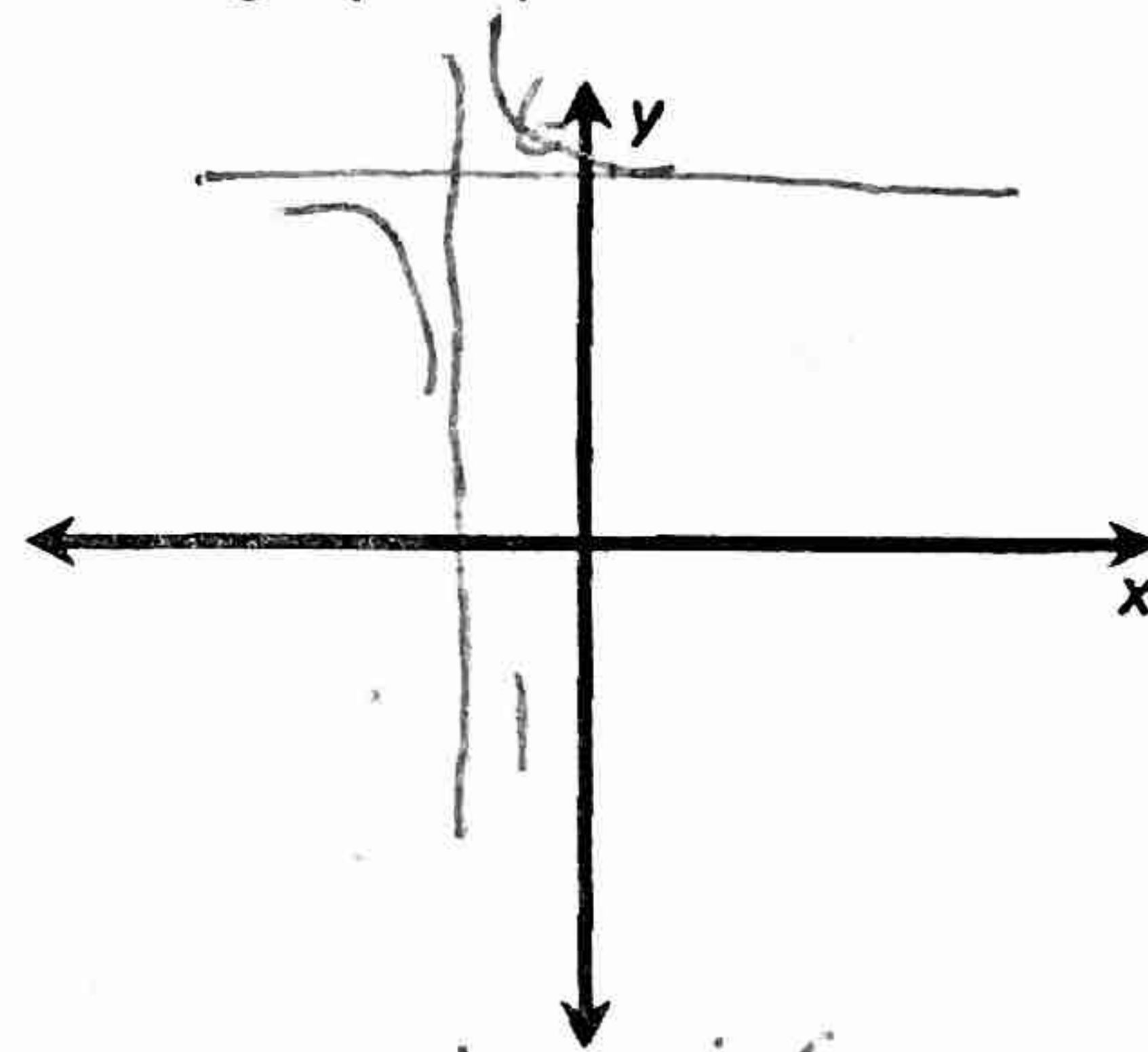
3. Explore with your teammates each of the functions above (#2) using the Desmos online calculator. Write down any additional observations you discovered from viewing the graph. Add these to your lists above. Were your predictions accurate?

4. Write an equation and sketch each transformation of the parent function $f(x) = \frac{1}{x}$. Use Desmos only to check your equations and graphs.

- a. Translate the graph right 4 units and down 3 units. b. Translate the graph up 6 units and left 1 unit.

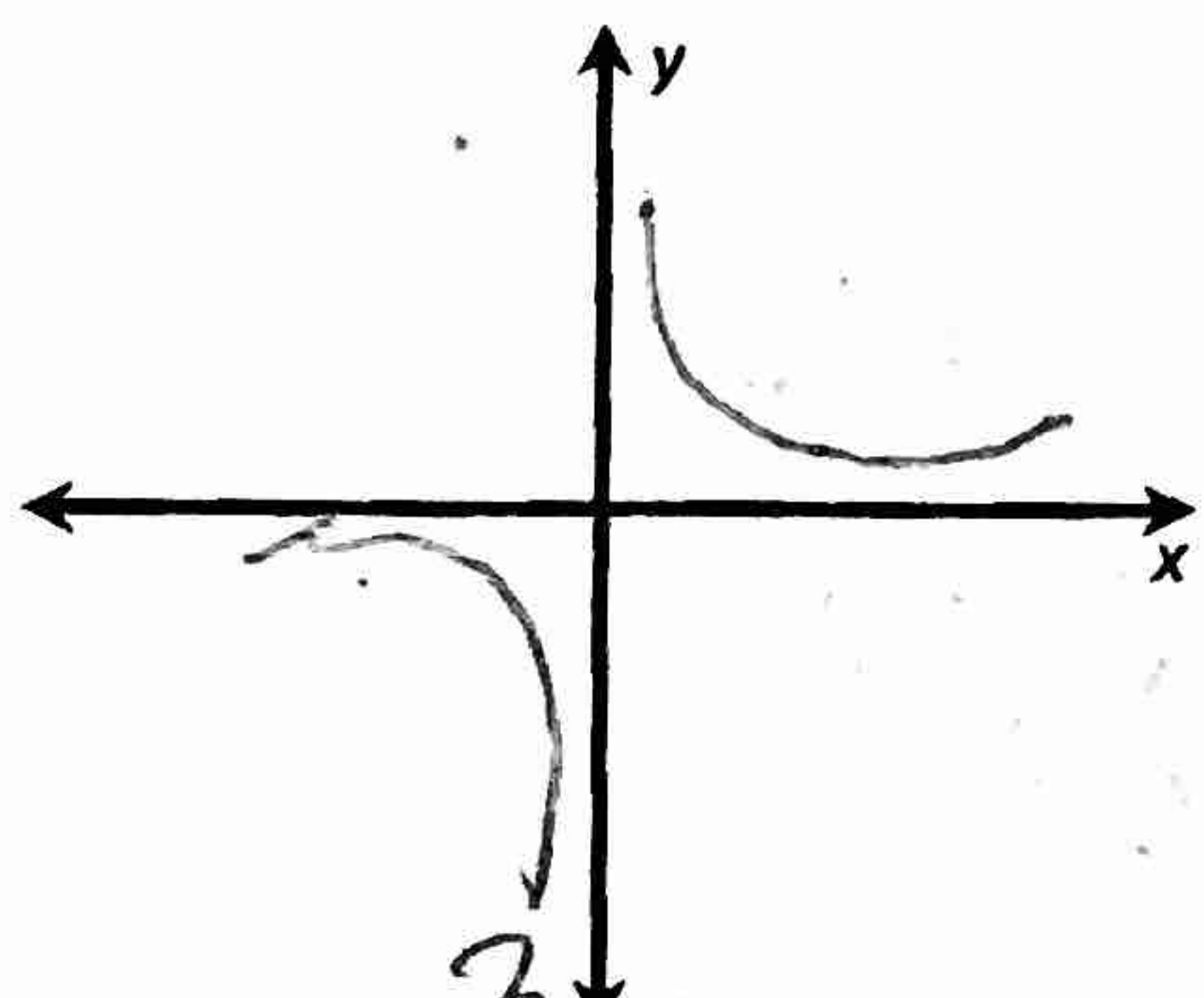


Equation: $f(x) = \frac{1}{x-4} - 3$



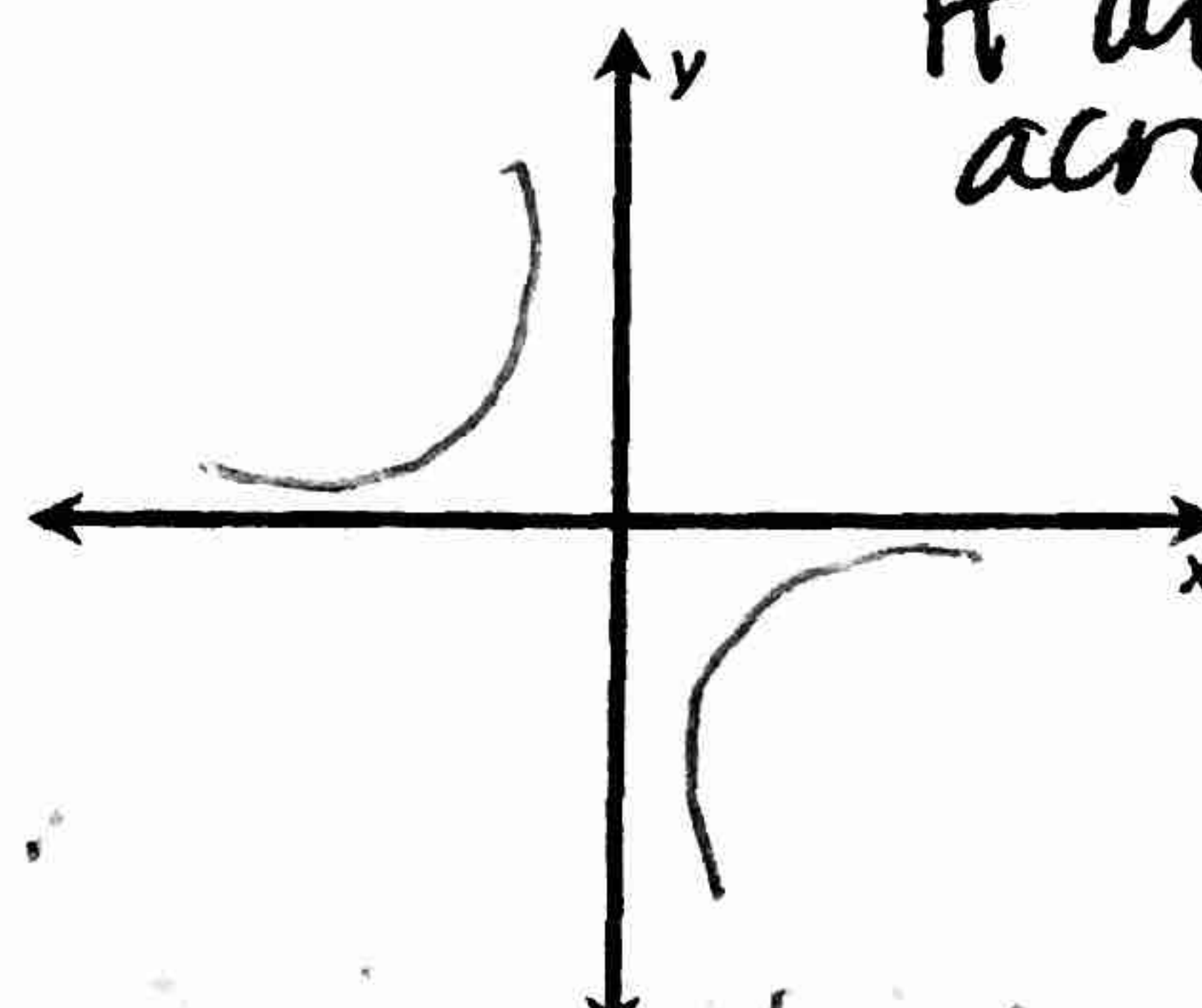
Equation: $f(x) = \frac{1}{x+1} + 6$

- c. Vertically stretch the graph by a scale factor of 3.



Equation: $f(x) = \frac{3}{x}$

- d. Reflect the graph across the y -axis.



Equation: $f(x) = -\frac{1}{x}$

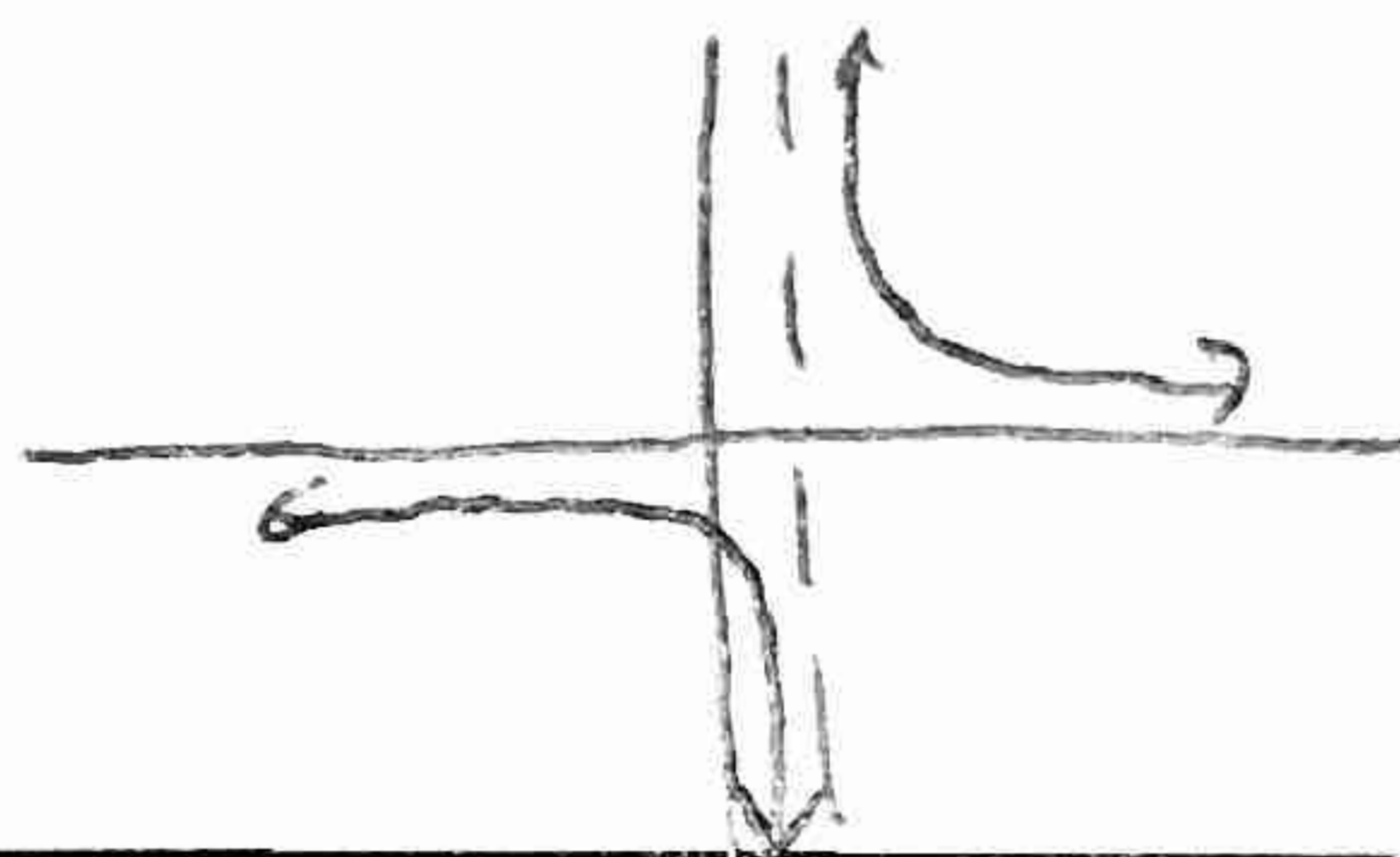
It also reflects across the y -axis!

5. Write equations for the vertical and horizontal asymptotes of each rational function.

<p>a. $f(x) = \frac{2}{x}$</p> <p>horizontal: <u>$y=0$</u></p> <p>vertical: <u>$x=0$</u></p>	<p>b. $f(x) = \frac{1}{x+3}$</p> <p>horizontal: <u>$y=0$</u></p> <p>vertical: <u>$x=-3$</u></p>	<p>c. $f(x) = \frac{1}{x} - 4$</p> <p>horizontal: <u>$y=-4$</u></p> <p>vertical: <u>$x=0$</u></p>
<p>d. $f(x) = -\frac{3}{x}$</p> <p>horizontal: <u>$y=0$</u></p> <p>vertical: <u>$x=0$</u></p>	<p>e. $f(x) = \frac{1}{x} + 5$</p> <p>horizontal: <u>$y=5$</u></p> <p>vertical: <u>$x=0$</u></p>	<p>f. $f(x) = \frac{1}{x-2} - 6$</p> <p>horizontal: <u>$y=-6$</u></p> <p>vertical: <u>$x=2$</u></p>
<p>g. $f(x) = -\frac{1}{x} + 2$</p> <p>horizontal: <u>$y=2$</u></p> <p>vertical: <u>$x=0$</u></p>	<p>h. $f(x) = \frac{4}{x+2} - 1$</p> <p>horizontal: <u>$y=-1$</u></p> <p>vertical: <u>$x=-2$</u></p>	<p>i. $f(x) = 5 + \frac{2}{x-4}$</p> <p>horizontal: <u>$y=5$</u></p> <p>vertical: <u>$x=4$</u></p>

6. Investigate each of the following functions using the Desmos online calculator. Discuss each graph with your teammates. List as many interesting features and observations about the behavior of the function as you can. Discuss and share individual ideas with your group.

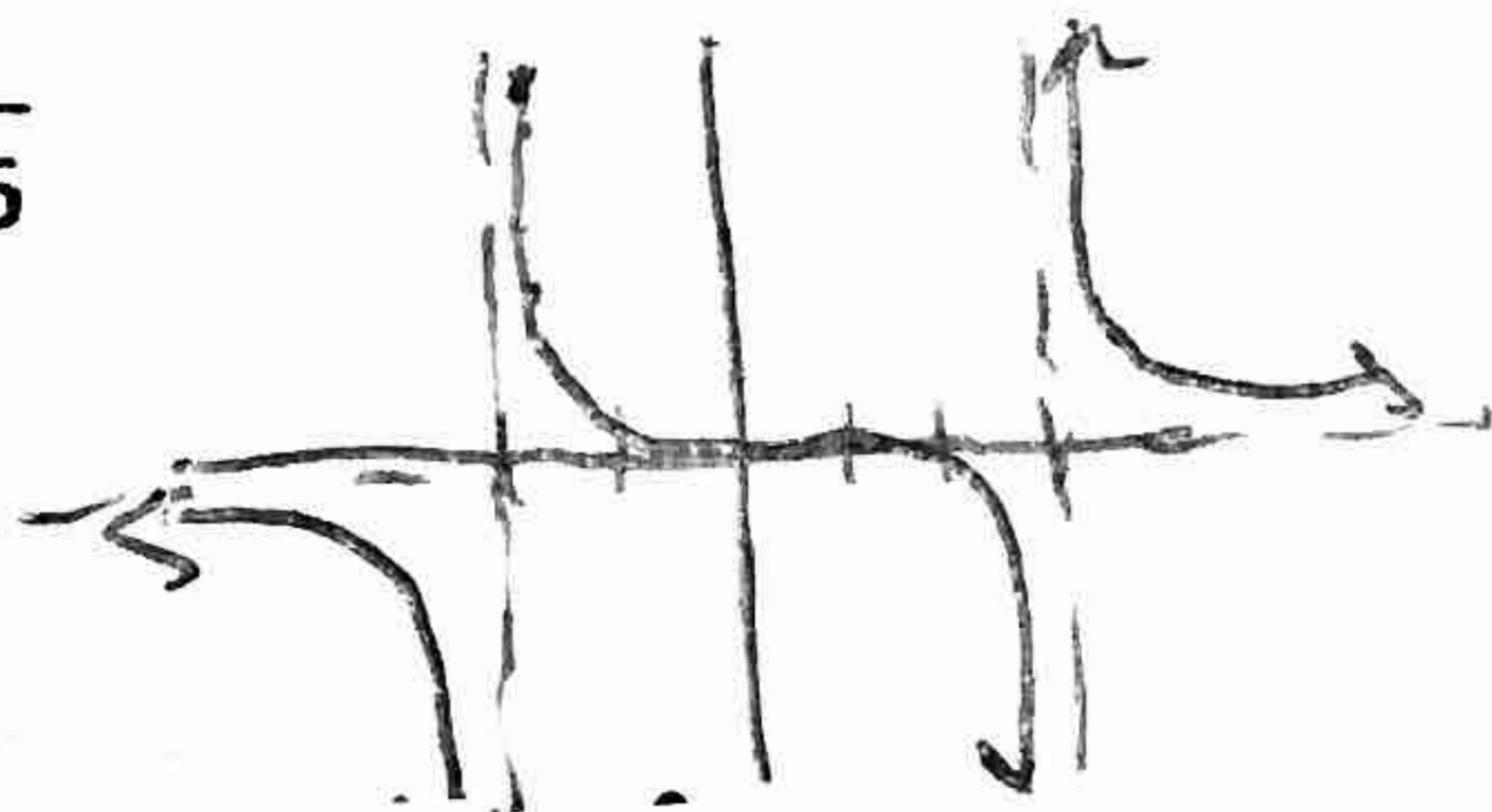
a. $f(x) = \frac{x}{x-1}$



Asymptotes $x=1$
 $y=1$

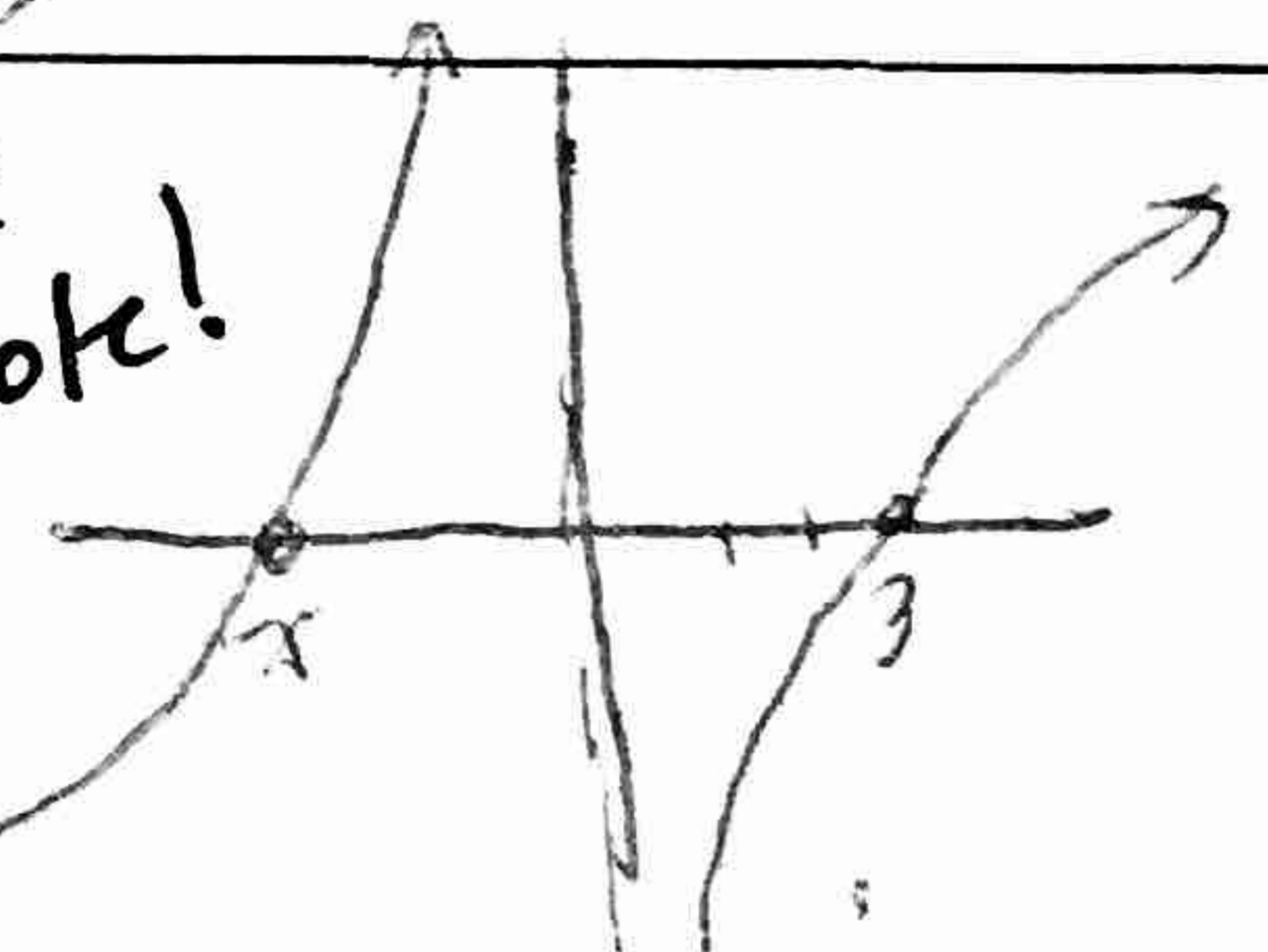
b. $f(x) = \frac{x}{x^2 - x - 6}$
 $(x-3)(x+2)$

Asymptotes:
 $x=3, x=-2$
 $y=0$

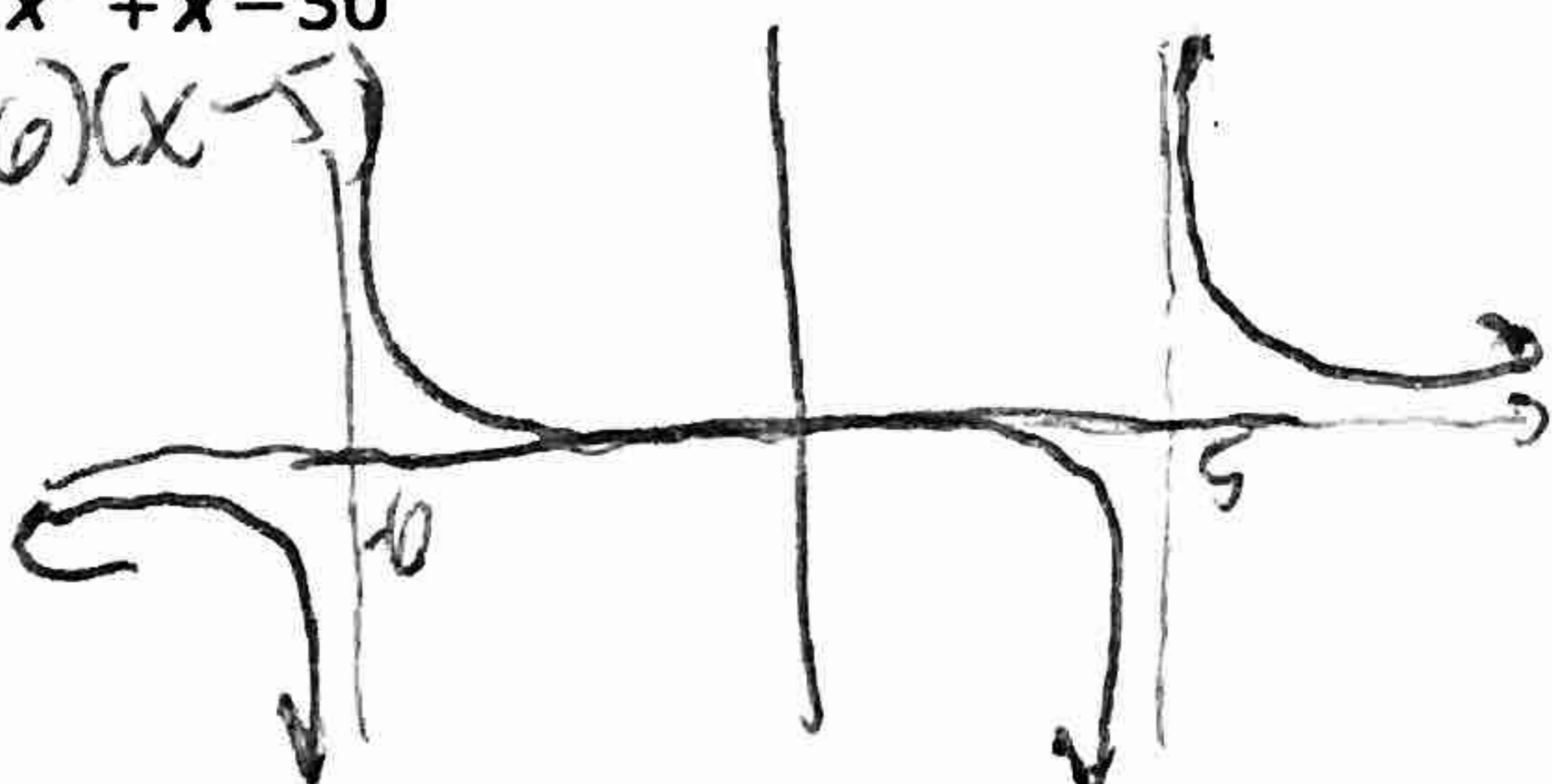


c. $f(x) = \frac{x^2 + 2x - 15}{x}$

slant asymptote!
Not horiz.
vert. asympt $x=0$



d. $f(x) = \frac{x+2}{x^2 + x - 30}$
 $(x+6)(x-5)$

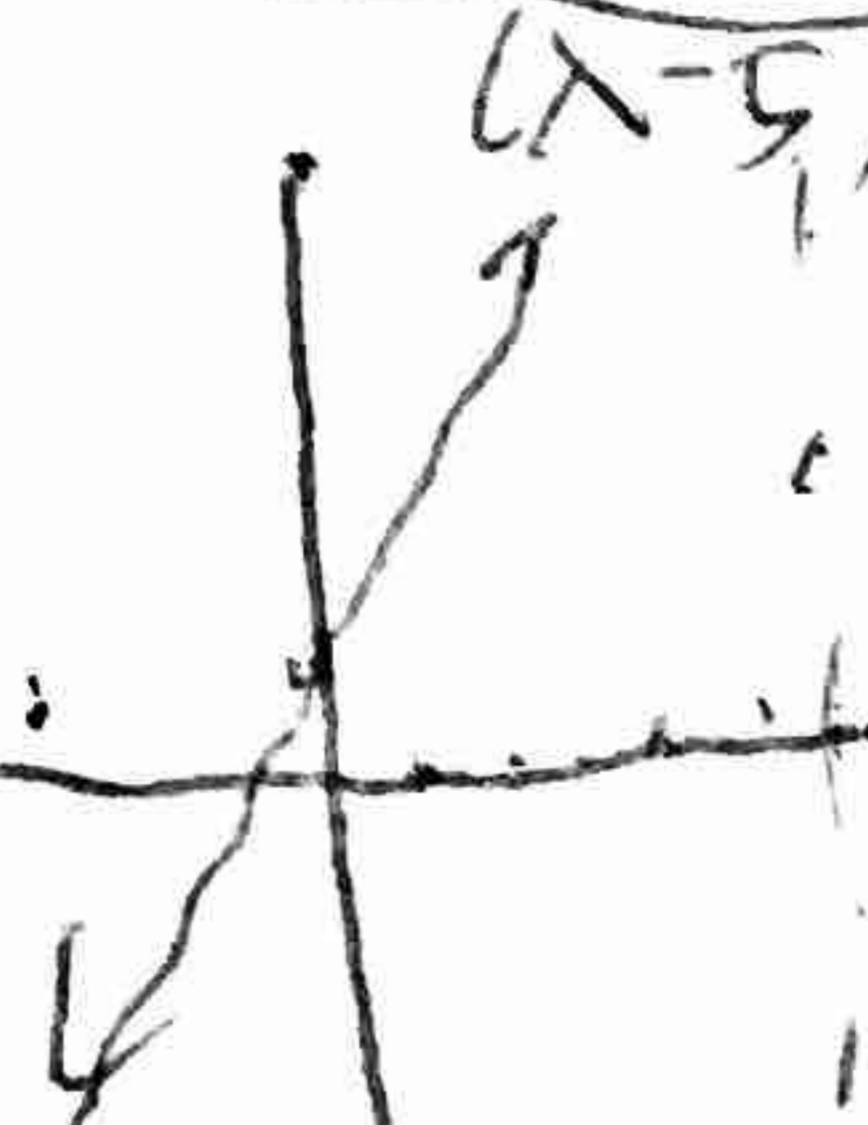


vert. asympt. $x=-6$
 $x=5$
horiz asympt: $y=0$

e. $f(x) = \frac{x^2 - 4x - 5}{x-5}$

Why is it a line?
It is a line b/c the factor $x-5$ reduces!

$(x-5)(x+1)$
 $(x-5)$
 $y=x+1$



only 1 asympt. at $x=5$, but since it reduces, it leaves a hole at the point $(5, 6)$