Day 6: Reciprocal and Rational Functions

Reciprocal Functions

Non-permissible values: Values that do not exist on the graph of a function. Also known as asymptotes or points of discontinuity.

Find the non-permissible values in each of the following:

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

$x+5=0$

$x=-5$

$$y = \frac{1}{3-x}$$

$3-x=0$

$-x=-3$

$x=3$

$$y = \frac{1}{x^2-9}$$

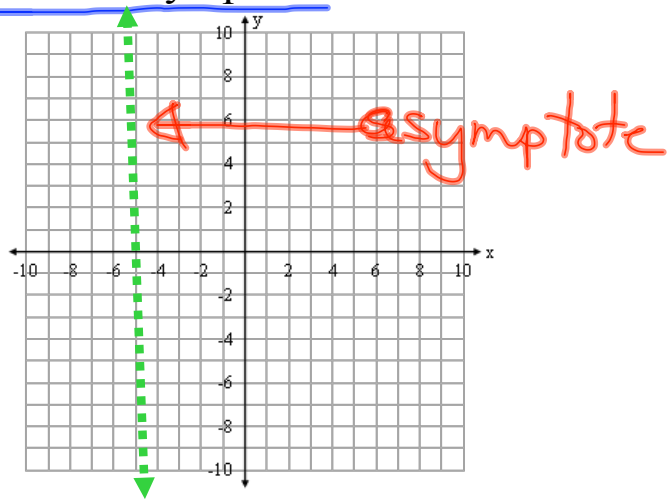
$(x-3)(x+3)$

$x-3=0$ $\quad$ $x+3=0$

$x=3$ $\quad$ $x=-3$

Each of these is a reciprocal function. In these cases, the non-permissible values represent something called an asymptote.

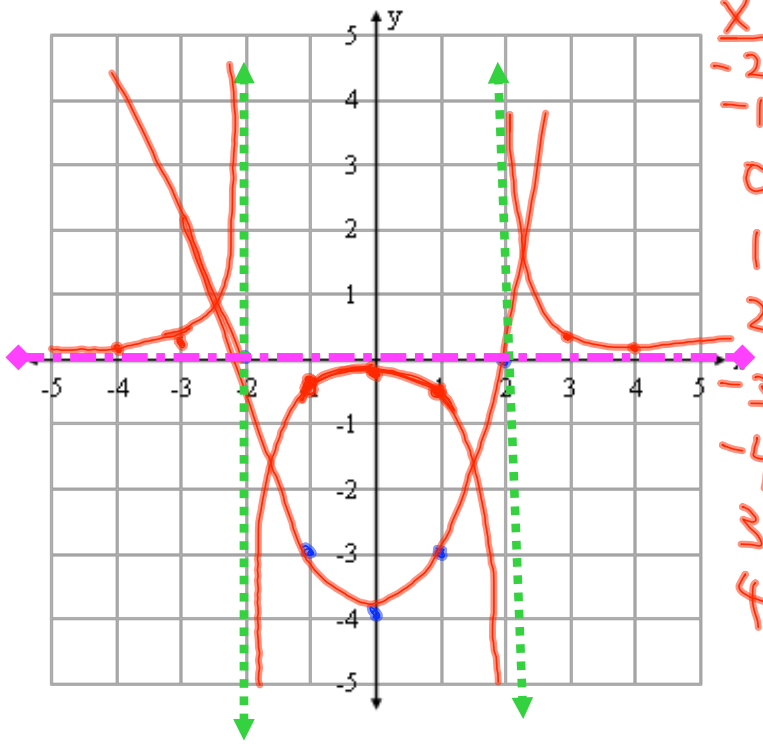
$x=-5$



Asymptote: The invisible, impassable barrier that a curve cannot cross.
Note: Any simple reciprocal function (numerator is 1) will have a horizontal asymptote of y = 0.

How to sketch a graph of a reciprocal function given its original function:
1) Pick coordinates on the original graph.
2) Take the reciprocal of their y-coordinates to form new ordered pairs.
3) Plot the new ordered pairs and asymptotes (where the x-intercepts of the original graph were).

Try sketching $y = \dfrac{1}{x^2 - 4}$ ← original



x	y	y
-2	∅	
-1	-3	-0.3
0	-4	-0.25
1	-3	-0.3
2	∅	
-3	5	0.2
-4	12	0.083
3	5	0.2
4	12	0.083

List the important features of the graph:
Max/min points, domain, range, asymptotes, and any zeros.

Max/min: rel max $(0, -0.25)$

D: $x \in \mathbb{R}$ $x \neq \pm 2$

R: $y \in \mathbb{R}$ except $-0.25 \leq y \leq 0$

asym: $x = \pm 2$

Zeros = none

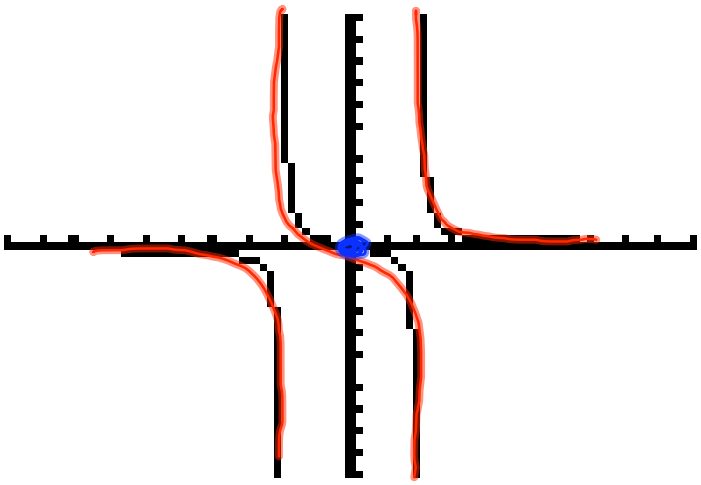
Rational Functions

Defintion: A function whose equation can be written in the form $f(x)=\frac{m(x)}{n(x)}$, where *m(x)* and *n (x)* are polynomial functions and $n(x)\neq 0$. A reciprocal function is just a simple rational function

Continuous vs. discontinuous functions:
If a graph can be drawn without lifting your pencil, it is continuous.

Graph each of the following with a graphing tool and list domain, range, zeros, asymptotes, and max/min.

$$y = \frac{x}{x^2 - 4}$$



D: $x \in R, x \neq \pm 2$

R: $y \in R$

Asym: $x = \pm 2$

zero: $(0,0)$

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

Assignment:
Pg. 194 #1, 2odds, 3a, 5c, 9
Pg. 200 #1, 2, 4, 10