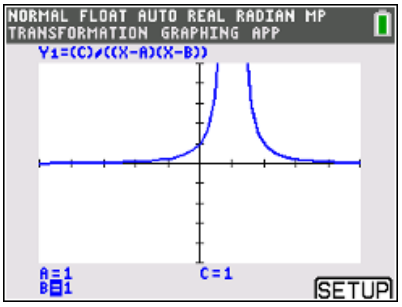
Exploring Vertical Asymptotes
Student Activity

Name _____

Class _____

Given the equation of a rational function, will you always be able to determine the domain? In this activity, you will explore vertical asymptotes and removable discontinuities using the **Transformation Graphing App** on the handheld.



Problem 1

To turn on the **Transformation Graphing** app, press **apps**, **:Transfrm**, and press any key. Press $y =$ and in Y_1, type in the equation $Y_1 = \frac{C}{(X-A)(X-B)}$.

1. Use the up/down arrows to change between the values of *A, B, and C*. Use the left/right arrows to change each individual value. Change the value of *A*. Describe how the graph changes.

2. Change the value of *B*. Describe how the graph changes.

3. What do the values of *A* and *B* represent in the function?

4. What are the equations of the vertical asymptotes?

5. State the domain of the function in terms of *A*, *B*, and *C*.

6. Change the value of *C*. How does changing *C* affect the domain?

7. Describe how you could find the vertical asymptotes for any rational function with a constant numerator.

Problem 2

8. For problem 2, type the following equation into Y_1, $Y_1 = \frac{(X-A)(x-B)}{(X-C)}$. Using the arrows, set *A* = 2 and *B* = –1, and then change the value of *C*. For which values of *C* are there no asymptotes? Explain why there are no asymptotes for these values of *C*.

9. The "hole" in the graph is called a removable discontinuity. Explain why the hole exists and how you might remove it by modifying the function definition.

10. Answer the following question:
The function $f(x) = \frac{(x+6)(x-3)}{(x+6)}$ has
(a) an asymptote at x = -6 (b) a removable discontinuity at x = -6
(c) an asymptote at x = 6 (d) a removable discontinuity at x = 6
(e) continuity

Problem 3

11. For problem 3, type the following equation into Y_1, $Y_1 = \frac{(X-A)}{(X-B)(X-C)}$. Using the arrows, set *B* = –1 and *C* = *4*, and then change the value of *A*.
a. Describe how the graph changes as the value of *A* changes.

b. What is the domain of the function in terms of *A*, *B*, and *C*?

c. For which values of *A* is there only one asymptote? Describe the graph at these values.

d. Explain algebraically why the graph looks as it does at these points.

12. Describe how the domain would change if you changed the values of *B* and *C*.

13. Answer the following question:
The function $f(x) = \frac{(x-3)}{(x+6)(x-3)}$ has

(a) one asymptote at x = 3
(b) a removable discontinuity at x = 3
(c) two asymptotes at x = -6 and x = 3
(d) one asymptote at x = -6
(e) continuity

Problem 4

For problem 4, type the following equation into Y_1, $Y_1 = \frac{(X+1)^A}{(X+1)^B}$. Using the arrows, set *B* = –1 and *C = 4*, and then change the value of *A*.

14. Answer the following questions:
Holes were discussed in question 9. While manipulating *A* and *B* on your graph, what would *A* and *B* have to be for *f1(x)* to have a hole?

(a) If *A* < *B*
(b) If *A* = *B*
(c) If *A* > *B*

What would *A* and *B* need to be to have a vertical asymptote?

(a) If *A* < *B*
(b) If *A* = *B*
(c) If *A* > *B*