**Lab: Modeling with Rational Functions**

**Why Can’t I Divide By Zero?**

You may have been told that if you take a constant, *a*, and divide it by zero then you get an “undefined number”, but have you ever really understood why it doesn’t make sense to divide a number by zero?

Work in small groups to follow directions and turn in one worksheet per group. Decide on answers and write complete sentences to questions as a group.

1. Complete the table below by using your scientific calculator, where $f\left(x\right)=\frac{1}{x}$.

|  |  |
| --- | --- |
| $$x$$ | $$f(x)$$ |
| $$1$$ | $$1$$ |
| $$0.5$$ |  |
| $$0.3$$ |  |
| $$0.1$$ |  |
| $$0.05$$ |  |
| $$0.01$$ |  |
| $$0.005$$ |  |
| $$0.001$$ |  |

1. What do you notice about the pattern you see in the numbers for $f(x)$? What is $f\left(x\right)$ *trending* towards?
2. Next, complete the table below by using your scientific calculator, where $f\left(x\right)=1/x$.

|  |  |
| --- | --- |
| $$x$$ | $$f(x)$$ |
| $$-1$$ | $$-1$$ |
| $$-0.5$$ |  |
| $$-0.3$$ |  |
| $$-0.1$$ |  |
| $$-0.05$$ |  |
| $$-0.01$$ |  |
| $$-0.005$$ |  |
| $$-0.001$$ |  |

1. What do you notice about the pattern you see in the numbers for $f(x)$? What is $f\left(x\right)$ *trending* towards?
2. Do you see a contradiction between what you said in (2) and (4)? What happens as you divide 1 by a number that *approaches* zero from the positive side? What happens when you divide 1 by a number that *approaches* zero from the negative side? In calculus, this is known as taking the limit of a function.
3. Use Excel or Desmos to plot the points that you computed in (1) and (3).
4. Google the word “asymptote”. Discuss in your groups how this relates to what you have done so far. Can you identify a *vertical* *asymptote* for $f(x)$?
5. As a group, write a conclusion for why dividing a number by zero results in an “undefined” number using the results from above. Is there a better way to describe the result of dividing by zero? Is “undefined” the most appropriate word?