**Lab: Modeling with Rational Functions *(Instructor Version)***

**Motivation:** When learning about rational functions, it can seem like a lot of memorization. These activities will help students conceptually understand important characteristics of rational functions.

**Objectives:** Students will be able to understand the concept of an asymptote. Students will also be able to write a rational function based off important characteristics of the graph of a rational function.

**Activity 1:**

*You should allow for about 20 minutes for students to complete this in groups of 3.*

Have students complete the “Why Can’t I Divide by Zero?” worksheet in groups of three or four. Each group should turn in one sheet that summarizes their discussions.

**Activity 2:**

*This discussion should take about 10-15 minutes. Students do not have to hand in anything at the end of the discussion.*

Have a class discussion about the physical meaning of vertical and horizontal asymptotes as well as simple translations for the reciprocal function using the Powerpoint presentation “Splitting a Bill for a Meal Out”.

**Activity 3:**

*The first time students play Polygraph will require a little work to get them familiar with the game. The instructions online are pretty self-explanatory. Each game takes about 5 minutes once the students are logged in and have played the sample version.*

*Marbleslides takes a little while for students to get used to and many of the problems are challenging. The whole activity could take up to 30-45 minutes if students got all the way through the problem set. If you wanted them to start the activity and not finish, you could spend only 15-20 minutes.*

Go to <https://teacher.desmos.com/polygraph-rationals>. Have students play Polygraph in pairs.

If you have time, go to <https://teacher.desmos.com/marbleslides-rationals>. You might want to assign this for an at-home activity outside of class.

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**Activity 4:**

*This time spent on this activity depends on how many rounds of the game you want to play. Each round should take about 15 minutes.*

* 1. Have students form teams and pair teams against each other.
	2. Have each team pick a rational function that seems tricky and identify the important features of the graph (intercepts, asymptotes, increasing/decreasing intervals). Have each team write down these important features on a half-sheet of paper.

*At this point in the game, you might want to check each team’s work for accuracy. If the information is inaccurate when the teams swap papers, it could lead to frustration.*

* 1. Instruct opposing teams to swap papers. Now each team must graph all of the important features and try to come up with a function that matches what the opposing team initially chose.
	2. The team who can correctly write the rational function of the opposing team first wins.