**Functions Module**

**An Activity Designed to Motivate Function Notation**

Adapted from Mathematics Teacher, August 2016, Reader Reflections, Albert Goetz and

Pat Thompson’s “Why use *f*(*x*) when all we really mean is *y*?”

The state of Virginia, in November 2012, introduced high-occupancy toll (HOT) lanes on parts of the Washington Beltway, the stretch of Interstate 495 that circumvents the nations’ capital, in an attempt to ease congestion on this road. Drivers who wish to pay a price (which varies directly with the amount of traffic) can opt to use special lanes with a higher speed limit and, at least for now, much less traffic. Is it time efficient to use these HOT lanes?

Suppose the length of the HOT lanes is 5 miles and that for the entire 5 miles drivers can average 65 MPH. For the regular lanes, let’s assume that for the same 5 miles traffic averages 35 MPH. To get to the HOT lanes, motorists must exit the regular lanes and take an overpass that puts them on the high-speed lanes, to which a traffic light controls access. Suppose the average wait time at this light is 2 minutes.

1. How much time is saved, in minutes, if a motorist takes the HOT lanes rather than the regular lanes? Be prepared to explain your results.

2. If the length of the HOT lanes were 1, 2.5, 3.7, or 4.2 miles in length, how much time, in minutes, is saved in each case? Be prepared to explain your results.

3. If the length of the HOT lanes were 6.7, 7.1, or 8.5 miles in length, how much time, in minutes, is saved in each case? Be prepared to explain your results.

4. What formula are you using to calculate the time saved in each case above? Does knowing the formula help you to calculate values faster in each case above?

5. Listen to your instructor explain how to use the Desmos calculator to help with the calculations.

6. How much does the time saved change were we to increase the length of the HOT lanes from 5.1 miles to 5.3 miles? Use the Desmos calculator to respond to this question. What will you enter into Desmos and why?

7. How might we think about what Desmos is doing when we type in *T*(number)?

8. How might we use our definition of *T* to graph the relationship between time saved and length of the HOT lanes? Create this graph. Then write a response to the initial problem statement: Is it time efficient to use these HOT lanes?

9. Suppose the assumed speeds where 60 MPH using the HOT lanes and 40 MPH using the regular lanes. Must we start over from scratch in order to do the kind of analysis done in with the original speeds?