**Honors Precalculus Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Average Rate of Change Investigation Date: \_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_\_\_**

Use desmos.com/calculator as a graphing utility for the following investigation. Type your responses to the following questions. For all prompts, provide detailed responses. Type your answers and submit electronically via email or print and turn in. Feel free to include screenshots of the graphs you are examining in desmos, if that supports your explanation. These questions are available as a Word document on my website, so you can download and add your responses if desired.

**Note:** In your responses, don’t exclusively use language the “derivative.” Yes, we are examining the derivative, but lets explain what the points, graphs and function represent in terms of the situation proposed. For example, don’t say “$m(x)$ is the derivative.” Say, “$m(x)$ is a function that for every value of $x$, the time in seconds,…”.

**When an object falls from a resting start, the distance (in feet) it has fallen in** $x$ **seconds after being released is given by the function** $d\left(x\right)=16x^{2}$ **(assuming no air resistance).**

1. Graph the function $g\left(x\right)=d\left(x+1.5\right)-d(x)$. What does 1.5 represent? What does any point on the graph represent? For example, what does $(0.7, g\left(0.7\right))$ represent? What question would the graph of $g$ answer?

2. Graph the function $k\left(x\right)=\frac{d\left(x+1.5\right)-d(x)}{1.5}$.

What does the 1.5 represent? What does any point on the graph represent? How is $k\left(x\right)$ different from $g(x)$?

3. Graph the function $m\left(x\right)=\frac{d\left(x+h\right)-d(x)}{h}$, and add $h$ as a slider. Once $h$ is a slider, click settings (this button: and change the range of values so $0\leq h\leq 1.5$, step: 0.1.

Examine $m(x)$ for a few values of $h$. Record your observations here. Please use specific values of $h$ in your explanations and be sure to use values at each extreme and one in the middle.

4. Expand and simplify the expression $\frac{d\left(x+h\right)-d(x)}{h}$ to explain why the graph of $m(x)$ is always a straight line, regardless of the value of $h$. What effect does $h$ have on the average rate of change function? Explain the effect of $h$ in terms of the situation.

5. Graph the function $l\left(x\right)=\frac{m\left(x+h\right)-m(x)}{h}$. What does any point on the graph represent? Use the graph of $l(x)$ to explain how the objects average speed changes over time.