

## Semester 1 – Final Project

The purpose of this project is in place of a semester final. It will be graded on the following priority standards as outlined by the Federal Way School District:

- PS 2 – Find, describe, and compare limits and asymptotic/unbound behavior for functions analytically, graphically, numerically, and verbally including one-sided limits.
- PS 3 – Define continuity in terms of limits and graphs (including Intermediate Value Theorem and Extreme Value Theorem).
- PS 4 – Compute and determine the derivative of functions using the power rule, product rule, quotient rule, exponent rule analytically, numerically, and verbally and as rates of change and difference quotient.
- PS 5 – At a point, find the slope of a curve, the instantaneous rate of change, and average rate of change of the function analytically, graphically, numerically, and verbally. Write the equation of the tangent line.

1. (OPTIONAL PS 4)

In class, we discussed that the generic formula for a quadratic function is  $y = ax^2 + bx + c$  and by taking the derivative and finding where the slope is zero, we can determine the vertex for a formula falls where  $x = -\frac{b}{2a}$ . Repeat this process for the generic cubic formula  $y = ax^3 + bx^2 + cx + d$ .

2. (PS 5) After you have come up with a formula:

- a. Graph a specific cubic function that has two vertices
- b. Compute the derivative of your function (show this work)
- c. Graph the derivative function  
(Be sure to label your graph as completely as possible.)

3. (PS 3) Use the internet or a textbook to look up the formal definition of continuity. Write this down and provide a visual example of how you know something is NOT CONTINUOUS.

4. (PS 3) What is the “Extreme Value Theorem” and “Intermediate Value Theorem”? Provide a definition and example for each. Explain it well enough an Algebra 1 student could understand.

5. (PS 2) In class we talked about 3 ways to compute limits of functions (notice this is different from derivatives). We graphed functions to determine limits, we used a table to determine limits and we substituted values to compute limits. For the following equation, first graph, then show all three ways to determine the limit of the function. In other words, follow the steps below:

- a. Graph  $f(x) = \frac{x^2 - 6x + 10}{(x-3)^2}$
- b. Mark the graph to show how you would inspect  $\lim_{x \rightarrow 3} f(x)$  using the graph to determine the limit visually.
- c. Explain why  $\lim_{x \rightarrow 3} f(x)$  is not solvable using direct substitution.
- d. Use a table including at least 6 x-values to show that the  $\lim_{x \rightarrow 3} f(x)$  approaches infinity.
- e. Mrs. Rho wanted to know  $\lim_{x \rightarrow \infty} f(x)$  what is the answer to this? How could you use a graph to compute the answer? Explain in as much detail as possible.

**Neatly present your work on a poster, Power Point, Google Slide or printer paper (no lined paper). You may work in a group, but must submit your own work. Name your partner at the top of this page. Groups may not be bigger than 2 members large. **EVERYONE** must submit their own project. *This project is due January 25<sup>th</sup> at 2:10pm.* You may submit a paper copy or email electronically to [rgermani@fwps.org](mailto:rgermani@fwps.org)**