MATH 133 – Calculus with Fundamentals 1
Discussion Day – "Derivative Practice"
November 2, 2015

Background

We have now seen the sum, product, and quotient rules for derivatives. The goals for today are:

(1) To continue practicing using these rules, and

(2) To think about some of the information about a function that we can get from the derivative.

Questions

(1) Differentiate each of these with respect to the indicated variable. Note: you will want to think first about which rule(s) you need to apply, and then apply them. *Don't worry too much about simplifying your answers – any correct form is OK for this.*

(a) $f(x) = \dfrac{x^2 + e^x}{\sqrt{x}}$

(b) $g(t) = e^t \left(1 + \dfrac{t^2}{1+t^2}\right)$

(c) $h(z) = \dfrac{3}{z^{2/3}} - z(e^z + 4z)$

(2) Section 3.4 in our book builds on the way we motivated the study of derivatives by considering instantaneous velocities and slopes of tangent lines. If f is any function and $f'(a)$ exists, then we can think of $f'(a)$ as an *(instantaneous) rate of change* of f with respect to the variable in f, at a. The *units* of an instantaneous rate of change are always (units of f-values)/(units of the input variable in f). For instance, if we had a function $P(R)$ giving the electrical power (in units of watts) delivered to a device by a battery, as a function of the resistance of the device (in units of ohms), then the units of $P'(R)$ would be watts/ohm. So suppose we have a battery delivering power to a device with

$$P(R) = \frac{2.25R}{(R + .5)^2},$$

where $R \geq 0$.

(a) What is the instantaneous rate of change of the power with respect to resistance when $R = 3$ ohms? (Give your answer with correct units.)

(b) What is the power delivered to a device with $R = 5$ ohms? What is the instantaneous rate of change of the power with respect to resistance when $R = 5$ ohms? Give each answer with the correct units.)

(c) Is the instantaneous rate of change of the power with respect to resistance ever equal to zero? What does that mean? Generate a sketch of the graph of $P(R)$ (R on the horizontal axis, P on the vertical axis) and show any points where $P'(R) = 0$.

Assignment

One writeup of solutions to these problems from each group, due at the end of class.