Math 171 Group Worksheet 2
on Chapter 3 beginning ideas
Due Monday, October 8, 2018

One submission per group. Grade will be based on mathematical processes, precision, proper notation and participation. Make sure to write legible and explain your steps. If needed, staple multiple pages together before handing in work. You may also submit electronically through D2L.

Problem 1. Design a (better) roller coaster $r(x)$ with the following conditions:

- the roller coaster starts on the ground $r(0) = 0$.
- the roller coaster cannot exceed the height of 80 meters: $r(x) \leq 80$ for all $x \in [0, 100]$
- the roller coaster does not go underground: $r(x) \geq 0$ for all $x \in [0, 100]$.
- the ride is connected. No breaks, gaps or holes!
- the ride is smooth. No sudden changes in slopes.
- the roller coaster should have at least two local maximums.
- use a linear function to describe the first part of the roller coaster, a polynomial to describe the second part of the roller coaster (the hilly part) and an exponential curve to describe the remaining part (home stretch) of the roller coaster. ie: r is a piecewise defined function with three parts, a linear part, polynomial part of degree at least two and an exponential part, in that order. You can make the break points any where you want between 0 and 100.

Be sure to include the following in your problem:

(1) your equation for the graph of the roller coaster listed as a piecewise function

(2) a graph of the roller coaster is produced using either technology (such as desmos.com) or well-detailed hand drawn

(3) verification of all conditions

(4) a report that is well-organized and easy to follow and computations are presented neatly by hand or typed

Grading on Problem 1 will be on the following criteria:

Item	Criteria	Points
1.	The piecewise function $r(x)$ is clearly listed and contains a linear function, a polynomial and an exponential function, in that order.	4
2.	A graph of the roller coaster is produced either using technology or is neat and well-detailed by hand. This graph should show that the coaster has at least two local maximums and verifies the first three conditions.	4
3.	Calculus is used to demonstrate that graph of the roller coaster is continuous everywhere on its domain.	4
4.	Calculus is used to demonstrate that graph of the roller coaster is differentiable everywhere on its domain.	4
5.	The problem is well-organized and easy to follow. Computations are presented neatly by hand or typed.	4
	Participation Multiplier (full=1, some =0.5, very little=0)	

Problem 2. The frequency f of vibrations of a vibrating violin string is given by

$$f = \frac{1}{2L}\sqrt{\frac{T}{\rho}}$$

where L is the length of the string, T is its tension, and ρ is its linear density.

(a) Find $\dfrac{df}{dT}$ and describe in practical terms what this derivative means.

(b) Find $\dfrac{df}{d\rho}$ and describe in practical terms what this derivative means.

(c) Find $\dfrac{df}{dL}$ and describe in practical terms what this derivative means.

Grading on Problem 2 will be on the following criteria:

Item	Criteria	Points
1.	Accurately computes the derivatives.	4
2.	Correct use of Leibniz's notation	4
3.	Expresses what the derivatives mean in the practical setting of this application.	4
4.	The problem is well-organized. The computations are presented neatly and are easy to follow.	4
	Participation Multiplier (full=1, some =0.5, very little=0)	