PARTNER REQUIRED
Calculus I Project 1 Ithaca College

Parts 1 and 2 should be submitted before or in class on Monday, September 10.
Part 3 and the final report are due in class on Monday, September 17.

You have been hired by Two Flags Over Ithaca to help with the design of their new roller coaster.

Part 1 Each individual has been given a path design for a straight stretch (no turns) of a proposed roller coaster. There is a support every 10 feet. A safety rule is that a descent can be no steeper than 80° at any point. In addition each design starts with a 45° incline. (Angles refer to the angle that the path makes with a horizontal line.) Any bend must have a radius of curvature = 10 ft.

Each individual will report on her/his design. Your report should include the following data.

a) Where is the path increasing and decreasing? (Give your answer in terms of distance along the ground from the start)
b) Where is the path increasing at an increasing rate, increasing at a decreasing rate, decreasing at an increasing rate and decreasing at a decreasing rate? (Give your answer in terms of distance along the ground from the start)
c) For each fall where is the steepest descent and how steep is the angle at that point?
d) Does your path satisfy the safety criterion? Explain why or why not.
e) Draw the graph of the slope of the path vs distance along the ground from the start.
f) Draw the graph for the rate of change of the slope vs distance along the ground from the start.

(i) The Thrill of the coaster is defined as the sum of the angle of steepest descent in each fall in radians + Number of tops. Calculate the Thrill of your path.
(ii) The amount of material needed for a support is the square of the height of the support. So for example a support that is 20 feet high would require 20² or 400 feet of material. Find the amount of material needed for the supports in your path.

Part 2 Your group should submit a report deciding which of the individual paths is the:
a) Most thrilling
b) Which path uses the least material for supports

Describe how to:

1) Compute how far the coaster would travel along each of the paths your group received in part 1.
2) What is the maximum speed attained (ignoring friction)?

Part 3
a) If your coaster must start and finish on the ground and be at least 20 feet high at some point design the coaster that requires the least amount of support material.

b) Design a path which you think would be the "best" roller coaster if you have 50,000 feet of support material available. Be sure to explain why you think it is the best and any problems with your design. Your report should include how much material needs for supports, how thrilling the design is and how far the coaster will travel.

Bonus: How fast will the coaster travel?

* consult instructor