Name: _____ **Panther ID:** _____

Worksheet - Dec. 03 MAT 3501 Fall 2019

1. (Adapted from UTeach materials) The Thrill Ride Company wants to build a roller coaster subject to a set of constraints. You are told that the company has several engineers who could design a blueprint and build the track if could only give them a formula for a function whose graph will be the desired curve of the track. Hence your task is to define a function over the interval $[0, 15]$ whose graph satisfies the following constraints (each unit represents 10 meters).

1. The entrance onto the track is at the point $(0, 10)$ and the exit is at $(15, 0)$. There are just two local extrema, a minimum at $(4, 2)$ and a maximum at $(8, 8)$. (You do not have to consider designing the stairs leading to the entrance.)

2. The slope of the curve at the entrance and exit points must be zero in order to facilitate getting on and off the roller coaster car.

3. The curve must be smooth, meaning that the function must be differentiable over its entire domain.

The engineers also suggest the following two options to attack the problem:

Option A: Make the roller coaster from one piece. This means you should find, if possible, a polynomial function $y = f(x)$ of suitable degree that satisfies all of the conditions.

Option B: Make the roller-coaster from several pieces, but each piece should be parabolic. Thus in option B, you need to find, if possible, a piece-wise defined function to satisfy all of the constraints and in each piece to only have quadratic expressions.

Can you be the designer of the roller coaster?