Mathematics 1110H – Calculus I: Limits, derivatives, and Integrals
TRENT UNIVERSITY, Fall 2019

Assignment #3
Tracking the Tractor?
Due on Wednesday, 16 October.

There are several instances in mythology of persons being punished for their failings in life by being given a task impossible to complete in their afterlife. For example, in Greek myth Sisyphus is condemned to roll a boulder up a hill, only to have it get away from him and roll back downhill every time he gets it near the top; for another, in Chinese folklore, Wu Gang gets tasked with trying to chop down a tree that regenerates immediately after each strike with his axe.

Our protagonist, Tractor ("Puller"), has been condemned to pull a heavy load. In the beginning, Tractor is at the origin in the Cartesian plane holding one end of a taut rope and the load attached to the other end of the rope is at the point $(3, 0)$. Tractor must walk up the y-axis pulling the load until the load reaches the y-axis. The rope always stays taut, doesn't stretch, shirink, or break, and is always tangent to the curve traced out by the load. For simplicity, we assume that Tractor and the load each occupy no more than a single point each at any given instant. Our main task will be to figure out the equation $y = f(x)$ of the curve traced out by the load.

1. Use the geometry of the stuation to find an expression in terms of x for $\dfrac{dy}{dx} = f'(x)$. Give a sketch of the situation to help explain how you got that expression. *[3]*

2. Use `Maple` (or an equivalent) to use the given information and your answer to question **1** to find $y = f(x)$. (Please provide a printout of your worksheet.) *[4]*

   Hint: You'll probably want to look up the `diff` operator and the `dsolve` command if using `Maple`.

3. Use `Maple` (or an equivalent) to plot $y = f(x)$. *[1]*

4. Does Tractor ever get to stop, or must the load be pulled forever? *[2]*