2. Modeling the cable

In the previous problem, you figured out the system of differential equations that describe the motion of the rider. However, these equations depend on the functions T, θ_R and θ_L, which depend on the shape of the cable. So, we need to figure out how the shape of cable changes as the rider travels along it. This is quite a complicated problem.

The shape of the cable as a function of time will be governed by a partial differential equation, which will depend on the motion of the rider. And, we already have the equations describing the motion of the rider, which depend on the shape of the cable. Therefore, we would need to simultaneously solve the partial differential equation governing the motion of the cable and the ODEs governing the motion of the rider. As we haven't studied PDEs yet, it seems like we might be stuck! But, remember, developing a mathematical model is all about identifying and making reasonable simplifications, so let's try and do that here.

We solve this problem by breaking it down as follows:

1. Model the hanging cable with no rider as a catenary.

2. Model the cable with a fixed pulley with the cable moving freely as two catenaries on either side.

3. See what happens when the rider moves slowly.

Modeling a hanging cable

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0:00 / 6:06

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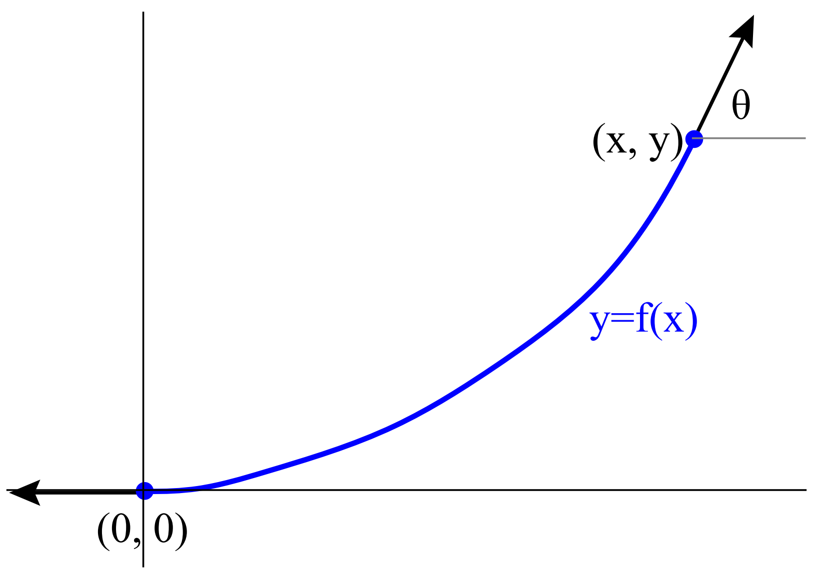
Identifying tangent theta

1 point possible (graded, results hidden)

Given the image of the segment of the hanging cable, identify $\tan(\theta)$ in terms of x and y.



- ○ x
- ○ y
- ○ $\frac{y}{x}$
- ◉ $\frac{dy}{dx}$

Submit You have used 1 of 3 attempts

Answer submitted.

Differential equation for a hanging cable

MIT180312016-V028000

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2. Modeling the cable

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