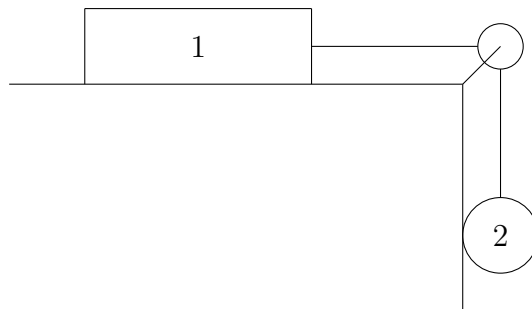


# SPH3U1 - Unit 3/4 Review Questions

December 10, 2022

## Questions

- Q1 A wedge has a  $35^\circ$  incline to the ground. The surface has a  $\mu = 0.1$ . A block that has a mass of 10 kg is placed on the wedge.
- (a) Would this block move under the influence of gravity?
  - (b) If the block moves, what extra force parallel to the surface of the wedge is required for it to be stationary? If the block does not move, what extra force parallel to the surface of the wedge is required for it to start moving?
- Q2 George drove his F1 car that weighs 0.85 tons around the bend, changing his velocity from 90 km/h [N  $10^\circ$  E] to 120 km/h [W  $25^\circ$  N] in 3 s. Assuming his acceleration is constant, what is the net force that George experiences? (20 pts)
- Q3 A block ( $m = 1.5$  kg, labeled as mass 1) is being dragged by a weight ( $m = 0.6$  kg, labeled as mass 2) illustrated below. The surface that mass 1 lies on has a coefficient of friction of 0.1.



- (a) Will mass 1 move?
  - (b) If mass 1 moves, what is the acceleration on mass 1? If mass 1 does not move, how much more mass would mass 2 need in order to move mass 1?
- Q4 A brachistochrone is the curve connecting two points that ensures the fastest descent time between the two points. A figure for brachistochrone is shown on figure 1. The

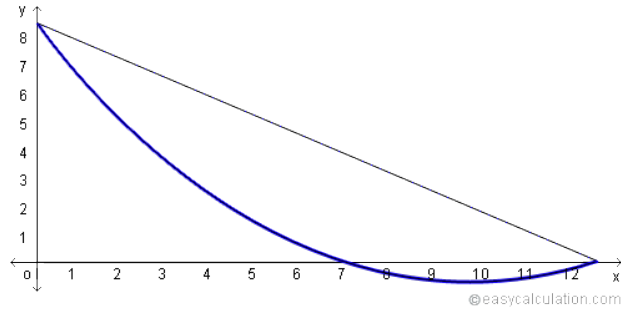
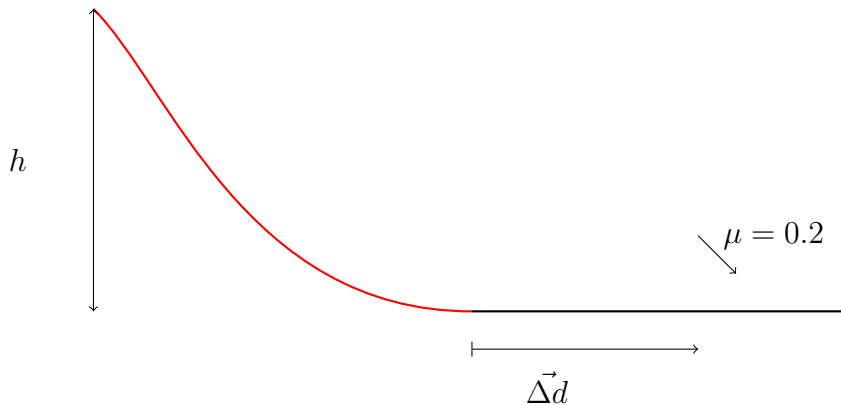


Figure 1: A brachistochrone curve between two points

height difference between two points are 8m, and the exit ramp has a 10 degree elevation with respect to the ground. A ball that has a mass of 2kg rolls down the ramp. Assume there are no friction losses.

- (a) What is the airbourne time of the ball once it leaves the ramp?
- (b) How high is the apex of the trajectory?
- (c) How far can the ball travel horizontally?

Q5 In our class we have discussed the setting of a friction-less ramp followed by a horizontal plate with certain friction coefficient.



Suppose the horizontal plate has a coefficient of friction of 0.2, and there is a ball with a mass of 2kg rolling down the ramp, how high should the ramp height,  $h$ , be such that the ball rolls precisely 10m?