Announcements

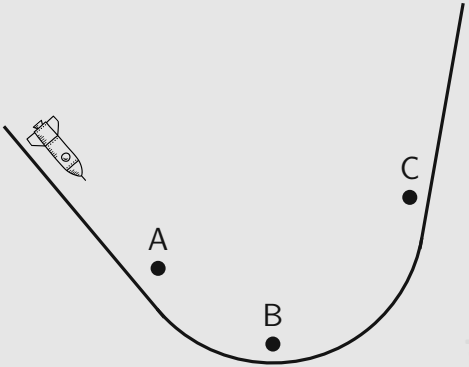
- Homework 3 is posted and due on Monday!
  - Only 3 problems for this one since Ch 3 is short!
- CompDay 2 due tonight!
  - If you haven't seen, I got CompDay 1 scored with feedback
- Read Ch 4.6 for Friday
- Responses: `rembold-class.ddns.net`

Today's Objectives

- Reaquaint ourselves with center of mass
- Remember how angular momentum equations work
- Reinforce the basics of work energy theorems

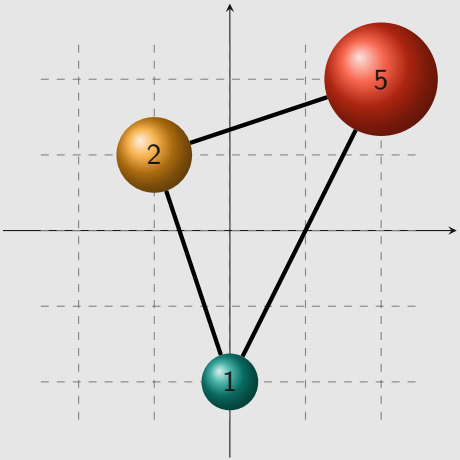
Q1

Suppose your rocket had a small amount of fuel, which you can burn all at once in a sudden burst. The rocket is traveling through the curve shown to the right, and you have the option to decide when you want to burn your fuel. At which point should you hit the thruster to make sure you make it up the far slope as high as possible? You can assume no forces except gravity are acting on your rocket otherwise.



D: It doesn't matter.

Q2



Given the 2D arrangement of masses to the left, where would the center of mass of the system be located?

A) $\vec{\mathbf{R}} = 1.6\hat{\boldsymbol{x}} - 1\hat{\boldsymbol{y}}$

B) $\vec{\mathbf{R}} = 1.125\hat{\boldsymbol{x}} + 1.25\hat{\boldsymbol{y}}$

C) $\vec{\mathbf{R}} = 1.125\hat{\boldsymbol{x}} + 1\hat{\boldsymbol{y}}$

D) $\vec{\mathbf{R}} = 1\hat{\boldsymbol{x}} + 1.25\hat{\boldsymbol{y}}$

Q3

A rectangle has a continuous density that varies as:

$$\rho(x, y, z) = 5x^2$$

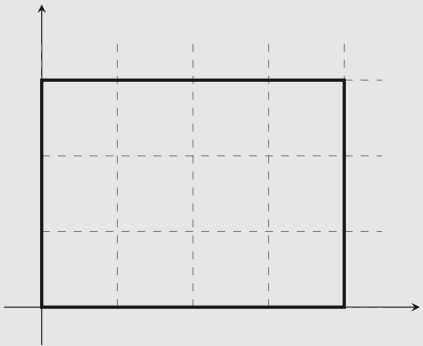
and is positioned as shown to the right. What is the x-component of the rectangle's center of mass position?

A) 2

B) 2.33

C) 2.82

D) 3



Q4

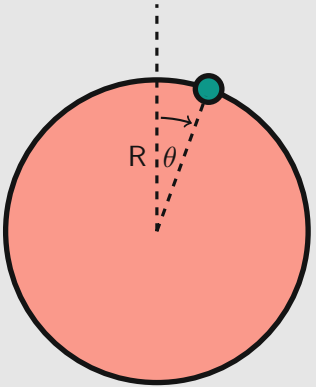
You have a solid disk ($I = \frac{1}{2}MR^2$) of mass M and radius R oriented vertically (like a wheel). You attach a bead, also of mass M to the edge of the disk at an angle of θ from the vertical. What expression below best describes the bead's equation of motion?

A) $\ddot{\theta} = -\frac{g}{3R}\sin\theta$

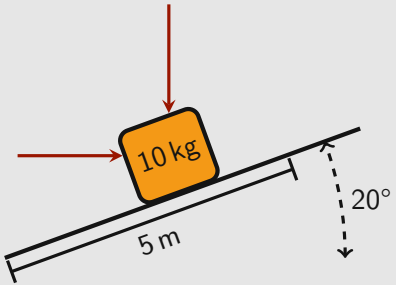
B) $\ddot{\theta} = \frac{2g}{3R}\sin\theta$

C) $\ddot{\theta} = \frac{g}{5R}\cos\theta$

D) $\ddot{\theta} = -\frac{R}{5g}\cos\theta$



Q5



A force of 50 N acts horizontally against a 10 kg mass on a 20° frictionless slope. If the mass starts from rest at the bottom of the slope what is its total kinetic energy when it has moved 5 m up the slope?

A) 67 J
B) 695 J
C) 740 J
D) None of the above