1) (20 pts) Derive the moment of inertia (I) for a solid cylinder of radius R, length L, and mass M.
2) (20 pts) A roller coaster car has a mass of 1000 kg. It tops the first hill in this figure with an initial velocity of 20.0 m/s at a height of h=30 m.

- a) What is its velocity at point A?

- b) What is its velocity at point B?

- c) What is its velocity at point C?

- d) How high will the car go on the last hill (it doesn’t reach the top of the last hill)?
3) (20 pts) A 2.0 kg mess kit sliding on a frictionless surface explodes in two 1.0 kg parts, one moving at 2.0 m/s, at 30° north of east, and the other moving at 5.0 m/s, at 15° south of west. What is the original velocity (in vector notation) of the mess kit?

What is the original speed of the mess kit?
4) (20 pts) A wheel has a constant angular acceleration of 3.0 rad/s². During a certain 2.0 s interval, it turns through an angle of 614 revolutions. Assuming that the wheel started from rest, how long has it been in motion at the start of this 2.0 s interval?
5) (20 pts) This figure shows a uniform disk that can rotate around its center like a merry-go-round. The disk has a radius of 10.00 cm and a mass of 50.0 grams and is initially at rest. Starting at time $t=0$, two forces are to be applied tangentially to the rim as indicated, so that at time $t=4.50$ s, the disk has an angular velocity of 200 rad/s clockwise. Force $\vec{F}_1$ has a magnitude of 0.400 N. What is the magnitude of $\vec{F}_2$?