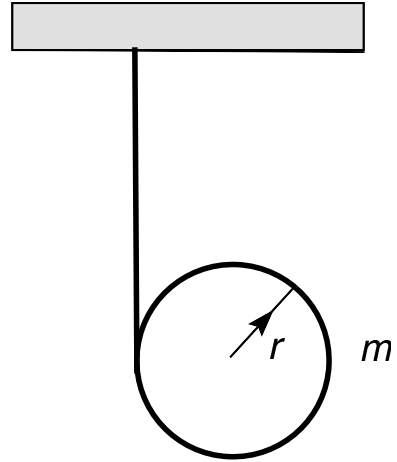


PHY820 Homework Set 1

1. [5 pts] A string is wrapped around a uniform homogeneous cylinder whose radius is r and mass is m . The free end of the string is tied to the ceiling and the cylinder is allowed to fall, see the figure, starting from rest. As the string unwraps, the cylinder rotates.

- (a) What is the linear acceleration of the center of mass of the cylinder?
(b) What is the tension in the string?
(c) What is the linear velocity of the cylinder after it has dropped down a distance h ?



2. [5 pts] Johnson, problem 1.7.
3. [10 points] (a) Find the curve $y(x)$, representing a differentiable function, that passes through the endpoints $(x, y) = (0, 0)$ and $(1, 1)$ and minimizes the integral

$$I[y] = \int_0^1 dx \left[\left(\frac{dy}{dx} \right)^2 + y^2 \right].$$

Are you sure that you found a curve that minimizes the integral? Explain why yes or why not. (b) What is the value of the functional for your curve? (c) Evaluate $I[y]$ for a straight line that passes through the same two endpoints. Is this smaller or larger than your answer in part (b)?