3. A mass swings on a cord (of negligible mass) in a vertical circle that has a radius of 64.0 cm. Each situation below is a separate scenario for the mass swinging in this circle. (Pay attention to your units in this problem.)
   A. When the mass is moving at 4.00 m/s, determine its centripetal acceleration.
   B. If the tension in the cord when the mass is at the lowest point is three times the weight of the mass, determine the speed of the mass at this point.
   C. Determine the minimum speed that the mass could have at the top of the circle so that it remains in the circular path.

A.)

$$a_R = \frac{v^2}{r} = \frac{(4.00\,\mathrm{m/a})^2}{0.64\,\mathrm{m}} \approx \boxed{25\,\mathrm{m/s}^2}$$

B.)
From Newton's second Law

$$\sum F_{bottom} = -mg + F_{T,bottom} = \frac{mv^2}{r}$$

We solve this for the tension and set it equal to three times the weight.

$$F_{T,bottom} = 3mg$$

$$\frac{mv^2}{r} + mg = 3mg$$

Solving algebraically for *v*, noting that the masses cancel out of the equations, we get

$$v = \sqrt{2gr} = \sqrt{(2)(9.81\,\mathrm{m/s}^2)(0.64\,\mathrm{m})} \approx \boxed{3.5\,\mathrm{m/s}}$$

C.)
At the top of the circle, the sum of forces gives:

$$\sum F_{top} = -mg - F_{T,top} = -\frac{mv^2}{r}$$

(Notice the difference in signs from the previous equation.) If the mass just barely stays in a circular path, the tension in the rope will drop to zero when it's at its highest point. Therefore,

$$\sum F_{top} = -mg - 0 = -\frac{mv^2}{r}$$

$$\longrightarrow v = \sqrt{gr} = \sqrt{(9.81\,\mathrm{m/s}^2)(0.64\,\mathrm{m})} \approx \boxed{2.5\,\mathrm{m/s}}$$