1. Centripetal Force Demonstration: You do!!
Take the tube/stopper/string/mass assembly and play with it!
Swing the stopper in a circle fast enough to pull the mass upwards.
Question: what's the relation between string radius and angular speed?

Centripetal Force (\(F_c\))
For any acceleration to happen, centripetal or linear, a force must be present.
For circular motion, this is "center seeking", or centripetal force. Many forces can be centripetal:
a swinging ball on a string = tension;
car going around a curve = friction;
satellite in orbit = gravity;
riders on the "Gravitron" = normal force; others.

A Note on Centrifugal Force
Centrifugal force (means "center fleeing"), and is often called "fictitious", in that it's not a true force: it is not part of an interaction but is a result of rotation — with no reaction-force counterpart.
Conceptually, it can be considered a reaction force against centripetal force: an apparent force that draws a rotating body away from the center of rotation.
It is caused by the inertia of the body as the body's path is continually redirected.

F_c Math
Centripetal force uses Newton's 2nd Law:
\[ F_c = ma_c \]
\[ m = \text{mass (kg)} \]
\[ a_c = \text{centripetal acceleration (m/s^2)} \]
Review: different ways to calculate \(a_c\):
\[ a_c = \frac{v_t^2}{r} \]
\[ v_t = \text{tangential speed (m/s)} \]
\[ r = \text{radius (m)} \]
\[ a_c = r \cdot \omega^2 \]
\[ \omega = \text{angular speed (rad/s)} \]

2. Centripetal Force Example
What centripetal acceleration does a 1.52 kg mass experience on a rope with 158 N tension?
Hint: \(F_c\) equals tension (this force causes acceleration).
Since \( T = F_c \):
\[ T = F_c = ma_c \]
\[ a_c = \frac{F}{m} = \frac{158 \text{ N}}{1.52 \text{ kg}} = 104 \text{ m/s}^2 \]
3. Velocity Example
If the rope's radius is 2.50 m, how fast is the mass traveling ($v_t$)?

\[ a_c = \frac{v_t^2}{r} \]

\[ v_t = \sqrt{a_c \cdot r} = \sqrt{104 \text{ m/s}^2 \cdot 2.50 \text{ m}} = 16.1 \text{ m/s} \]

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Homework 5.4

Preview 5.5

Problems 5.4 in your Booklet
Due: Next Class