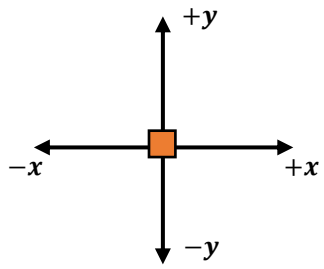
CONCEPT: INTRO TO CENTRIPETAL FORCES

● **LINEAR** force problems vs. **CIRCULAR** / **CENTRIPETAL** forces are solved the *same* way! But there are differences:

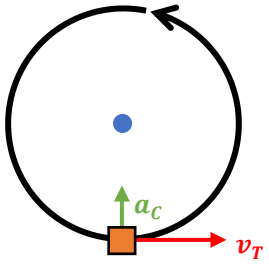
LINEAR



● Forces along X & Y axes

- Solve with $\Sigma F_x = ma_x, \Sigma F_y = ma_y$

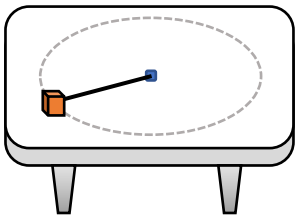
CENTRIPETAL



● Forces along _____ direction, i.e. toward/away from center

- Solve with _____

EXAMPLE: A small 3kg block is tied to the end of 2m string and slides around in a circle on a frictionless table. If the block completes a rotation every 4 seconds, calculate the tension on the string.



CENTRIPETAL FORCES
1) Draw FBD **2)** Write $\boldsymbol{\Sigma F_c = ma_c}$ (rewrite $\boldsymbol{a_C \Rightarrow v^2/R}$) **3)** Solve

Circ. Motion / Centripetal Forces
$\boldsymbol{a_C = \frac{v_T^2}{R} = \frac{4\pi^2 R}{T^2} = 4\pi^2 R f^2}$ $\boldsymbol{T = \frac{1}{f} \Leftrightarrow f = \frac{1}{T}}$ $\boldsymbol{v_T = \frac{C}{T} = \frac{2\pi R}{T} = 2\pi R f}$

PROBLEM: A small 4kg block is tied to the end of 3m string and slides around in a circle on a frictionless table. Suppose the string will break if the tension exceeds 50N. Find the maximum speed the block can have without breaking the string.

A) 37.5m/s
B) 6.1m/s
C) 8.7m/s
D) 2.8m/s

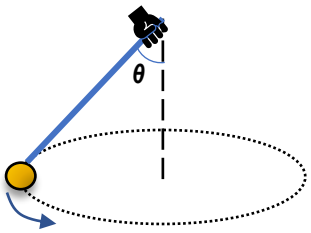
CENTRIPETAL FORCES

1) Draw FBD
2) Write $\Sigma F_c = ma_c$
(rewrite $a_C \Rightarrow v^2/R$)
3) Solve

Circ. Motion / Centripetal Forces

$$a_C = \frac{v_T^2}{R} = \frac{4\pi^2 R}{T^2} = 4\pi^2 R f^2$$
$$T = \frac{1}{f} \Leftrightarrow f = \frac{1}{T} = \frac{\text{RPM}}{60}$$
$$v_T = \frac{C}{T} = \frac{2\pi R}{T} = 2\pi R f$$

PROBLEM: A 0.50-kg ball is tied to the end of a 4m light cord that spins the ball around in a horizontal plane at constant speed with the cord making a 30° angle with the vertical. Determine the ball's speed.



CENTRIPETAL FORCES

1) Draw FBD
2) Write $\Sigma F_c = ma_c$
(rewrite $a_C \Rightarrow v^2/R$)
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