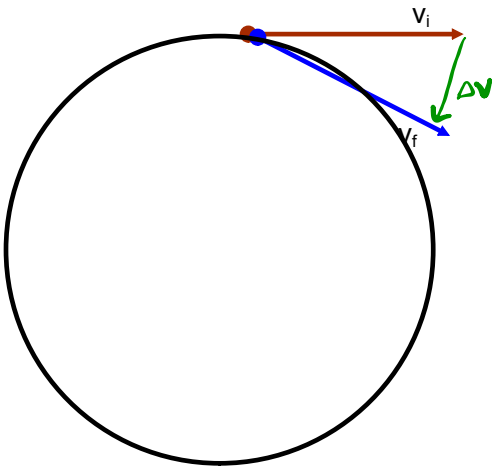
L07 - Centripetal Acceleration and Force

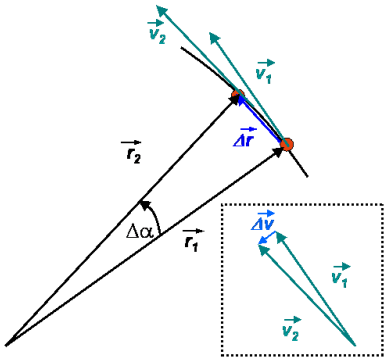
If an object is moving clockwise, what is the direction of it's acceleration at point A?



$\Delta v = v_f - v_i$

$v_i + \Delta v = v_f$

$\vec{v}_f = \vec{v}_i + \Delta\vec{v}$



$\vec{\Delta v} = \vec{v}_f - \vec{v}_i$

$\vec{v}_f = \vec{v}_i + \vec{\Delta v}$

Centripetal Acceleration: The acceleration acting toward the center of the circle.

Centripetal Force: The force acting toward the center of the circle causing an object to move in a circular path.

Centripetal Force Formula? Needs to be Derived every time!

$F = ma$

$a_c = \frac{v^2}{r}$ new!

$F_c = \frac{mv^2}{r}$ Memorize!

Use the following information to answer Q1-Q3:

A dragster's tire has a mass of 45.0 kg, a radius of 0.480 m, and is rotating at a speed of 30.0 m/s.

$m = 45\text{kg}$ $v = 30\text{m/s}$
$r = 0.48\text{m}$

Q1: What is the frequency of rotation of the wheel, in rpm?

$f = ?$ $f = \frac{1}{T}$ $v = \frac{2\pi r}{T}$

$30 = \frac{2(\pi)(0.48)}{T}$

$\times T$ $\times T$

$T = \frac{2\pi(0.48)}{30}$

$T = 0.100530964915\ldots\text{s}$

$f = \frac{1}{T} = 9.947\ldots\text{Hz}$

$\times 60$

$f = 597\text{ rpm}$

Q2: What is the magnitude of the centripetal acceleration of the tire, in m/s²?

$|a_c| = \frac{v^2}{r} = \frac{(30)^2}{0.48} = 1875\text{m/s}^2$

Q3: What is the magnitude of the centripetal force acting on the tire, in Newtons?

$F_c = ma_c$

$F = (45)(1875)$

$= 84{,}375\text{N}$

or

$F_c = \frac{mv^2}{r} = \frac{(45)(30)^2}{0.48} = 84{,}375\text{N}$

Practice

Pg 255, Practice Problems #1-3

Pg 256, Practice Problems #1-2

Pg 268, Check and Reflect #2,6-7