Uniform circular motion

Sources:
https://www.physicsclassroom.com/class/circles/Lesson-1/Mathematics-of-Circular-Motion
http://hyperphysics.phy-astr.gsu.edu/hbase/circ.html
3000 solved problems in physics chapter 11

Key equations:

$x \rightarrow \theta$ (angle)

$v \rightarrow \omega$ (angular velocity - rad/s)

$a \rightarrow \alpha$ (angular acceleration - rad/s^2)

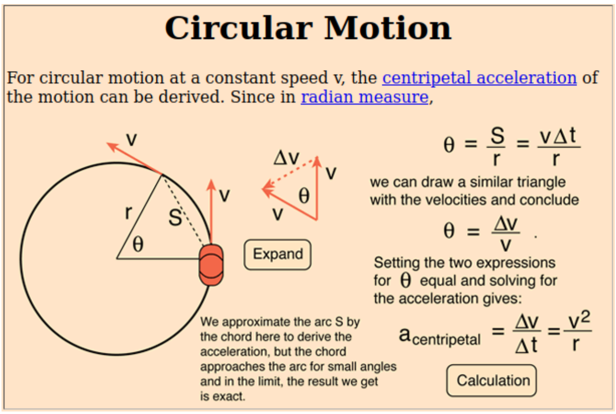
(constant α)

$\theta = \omega t$

$\omega = \omega_0 + \alpha t$

$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$\omega^2 = \omega_0^2 + 2\alpha\theta$



$\theta = \frac{S}{r}$ arc length

$\omega = \frac{v}{r}$ $\quad \alpha = \frac{a_t}{r}$ tangential acceleration

$\omega = 2\pi f$ f = frequency (cycles/s)

$a_c = \frac{v^2}{r}$ - centripetal acceleration $\quad F_c = m\frac{v^2}{r}$

from centripetal force (always points towards center of circle)

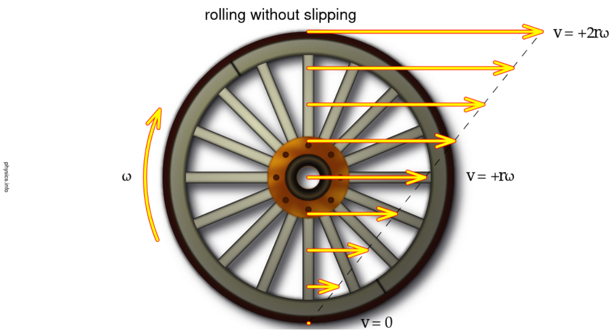
Not to be confused with centrifugal force (which is a fictitious force)

Rotational kinetic energy = $\frac{1}{2} I \omega^2$

moment of inertia

angular velocity (rad/s)

Rolling without slipping:



https://physics.info/rolling/

$KE = \frac{1}{2} m (r\omega)^2 = \frac{1}{2} m r^2 \omega^2$ (translational)

$KE_r = \frac{1}{2} I \omega^2$

to solve these problems, we can set up a system of equations, have a common relationship between KE_T and KE_r through ω

Centripetal force: force pointing inward that keeps an object in circular motion (ex: friction force between road and tires keeping the car in a turn)
Centrifugal force: apparent force felt by the object, usually described in the object's (nonintertial) reference frame). (ex: apparent force pushing you to the outside of the turn)