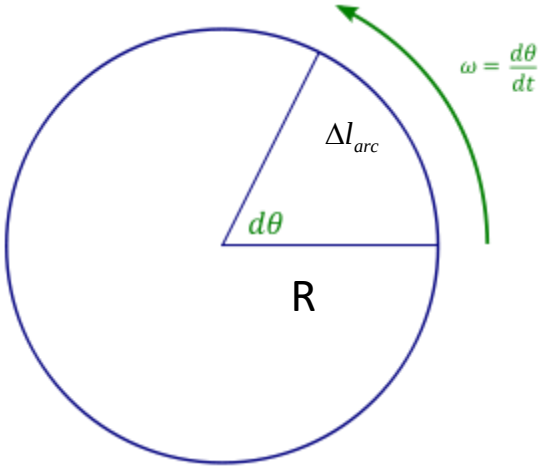
Rotational Motion

Angle (in radians): length of ark over radius

$$\Delta\alpha = \frac{\Delta l_{arc}}{R}$$



Angular velocity:

$$\varpi = \frac{\Delta\alpha}{\Delta t}$$

It is related to regular (linear) speed of rotational motion as:

$$v = \frac{\Delta l_{arc}}{\Delta t} = \varpi R$$

Centripetal acceleration

When moving along a circular path of radius R, with constant speed v, an object has acceleration directed towards the center, called Centripetal Acceleration:

$$a = \frac{v^2}{R}$$

Homework

Problem 1

A propeller of regional airplane ATR-72 spins at 1200 RPM (revolutions per minute).

a) Find the speed of propeller's tip with respect to the aircraft. Propeller radius is R=2m.

Don't forget to convert units of ω to 1/s

a) Find the total speed of the propeller's tip with respect to air, if the speed of the airplane is *v=500 km/hr.* **Pay attention to directions of rotational and translational motion!**

Problem 2

Find the speed and period of orbital motion of *the International Space Station* around the Earth. Note that its orbit is located **400 km** above the ground. This is much smaller than the Earth radius **R=6370 km.** This means that you can assume the gravitational force acting on the space station to be the same as on Earth surface, ***Mg***.