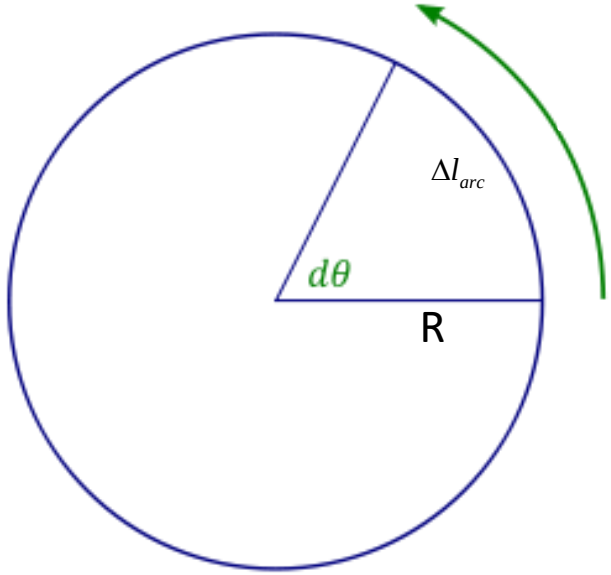
Rotational Motion

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:

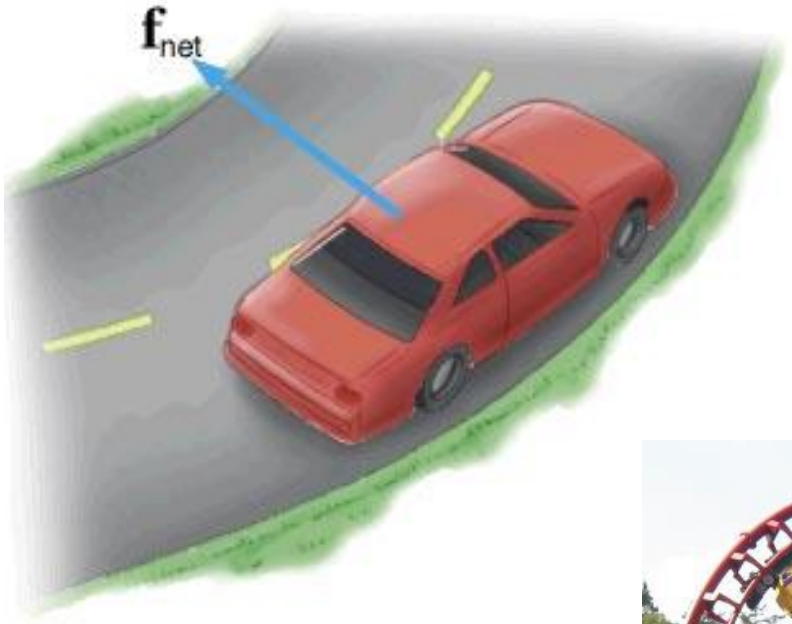
$$v = \frac{\Delta l_{arc}}{\Delta t} = \varpi R$$

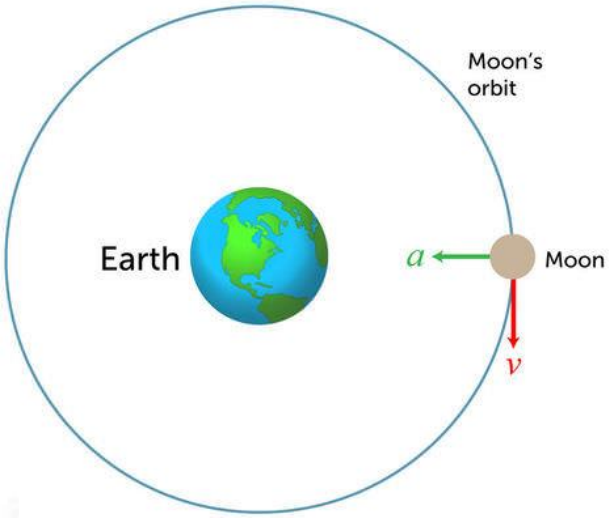
Centripetal acceleration

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

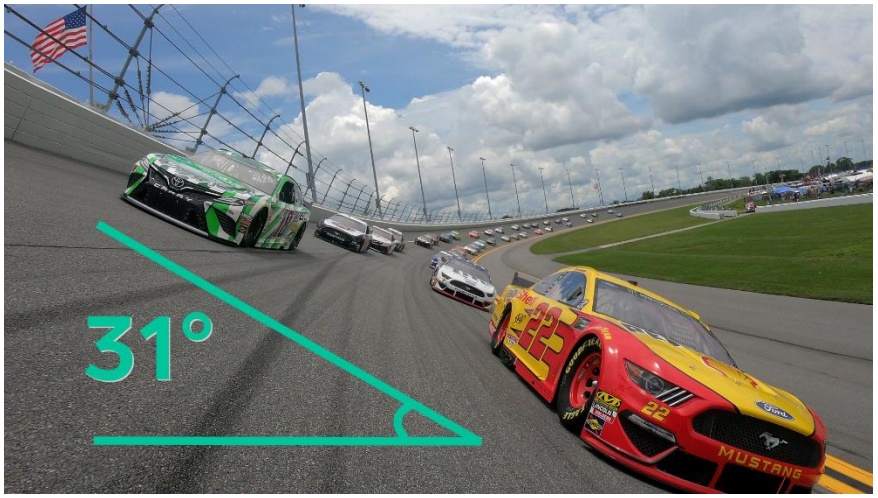
$$a = \frac{v^2}{R}$$

Examples





More Examples



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.
b) 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

Friction coefficient between the cars wheels and the road is μ. Find the maximum speed with which it can move on a curved road without slipping, if the radius of curvature of the road is R. If the friction coefficient changes from 0.7 to 0.35 due to rain, how much that speed changes?