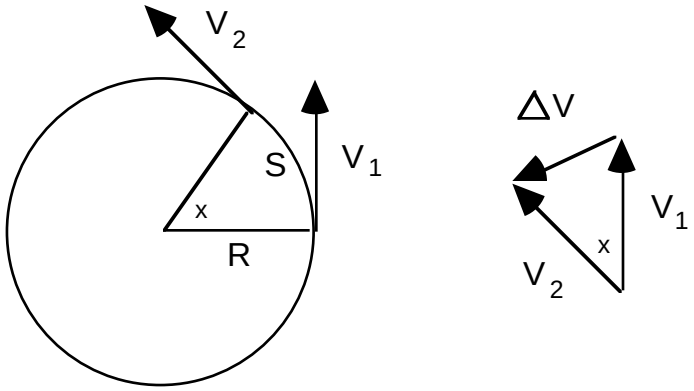
# Circular Motion : Notes-5

When any object moves in a circle at a constant speed, there must be a force acting on it. That force is directed towards the center of the circle. So the object is accelerating towards the center of the circle. We can find the magnitude of the **centripetal acceleration** using the reasoning given below.




In the diagram above, the speed of the object is constant but its velocity changes. The initial velocity is $V_1$ and the final velocity is $V_2$. The object moves through an angle x in a time $\Delta t$. Assume that angle x and arc-length S are small.

Let the speed be V. If x is small, using similar triangles, we have $\Delta V/V = S/R$. But $S = V\Delta t$. Therefore $\Delta V/\Delta t = V^2/R$, or;

$$a_c = \frac{V^2}{R}$$

This is the magnitude of the acceleration. The direction is towards the center of the circle. The **centripetal force** on the object is given by; $F_c = ma_c$. So we have;

$$F_c = \frac{mV^2}{R}$$

The direction of the force is towards the center of the circle.

## Velocity of a point on a rotating body

If an object of radius R, rotates with a period of T, then a point on the outer edge will move with a tangential velocity of $2\pi R/T$. So;

$$a_c = \frac{V^2}{R} = \frac{4\Pi^2 R}{T^2}$$