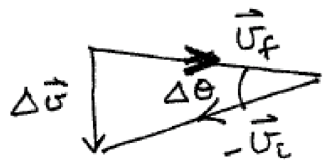
When direction of velocity changes ⇒ acceleration

Centripetal acceleration $\vec{a}_c = \lim_{\Delta t \to 0} \frac{\vec{v}_f - \vec{v}_i}{\Delta t} = \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t}$

See lecture slides



as $\Delta t \to 0$, $\Delta\theta \to 0$

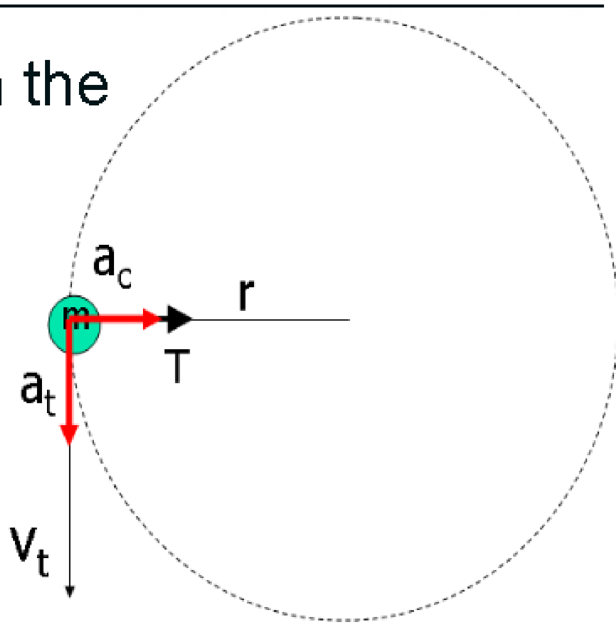
and $\frac{|\Delta \vec{v}|}{|\vec{v}_t|} = \Delta\theta$

$$\Rightarrow |\vec{a}_c| = \lim_{\Delta t \to 0} |\vec{v}_t| \frac{\Delta\theta}{\Delta t} = |\vec{v}|\omega = \frac{v_t^2}{r}$$

⇒ $\vec{a}_c$ points towards the center of the circle and $|\vec{a}_c| = \frac{v_t^2}{r}$

Centripetal force $= \frac{m v_t^2}{r}$

Mass m revolving in the horizontal plane



$$T = ma_c = \frac{mv_t^2}{r}$$