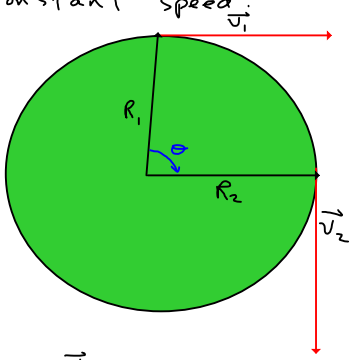
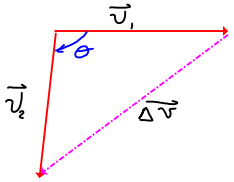
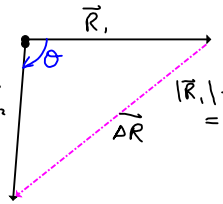
Uniform Circular Motion

- entails an object moving in a circular path with constant speed.





What is the instantaneous acceleration?



$|\vec{v}_1| = |\vec{v}_2| = v$

$|\vec{R}_1| = |\vec{R}_2| = R$

$\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t}$, so $\vec{a}_{inst} = \lim_{\Delta t \to 0} \frac{\Delta\vec{v}}{\Delta t}$

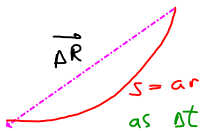
$|\Delta\vec{v}| = \Delta v$, $|\Delta\vec{R}| = \Delta R$

and $\frac{\Delta R}{R} = \frac{\Delta v}{v}$ (similar Δ s)

or $\Delta v = \frac{v}{R}\Delta R$

now $\vec{a}_{inst} = \lim_{\Delta t \to 0} \frac{v\,\Delta R}{R\,\Delta t}$

$= \frac{v}{R} \lim_{\Delta t \to 0} \frac{\Delta R}{\Delta t}$



s = arc length

as $\Delta t \to 0$, $\Delta R \to s$