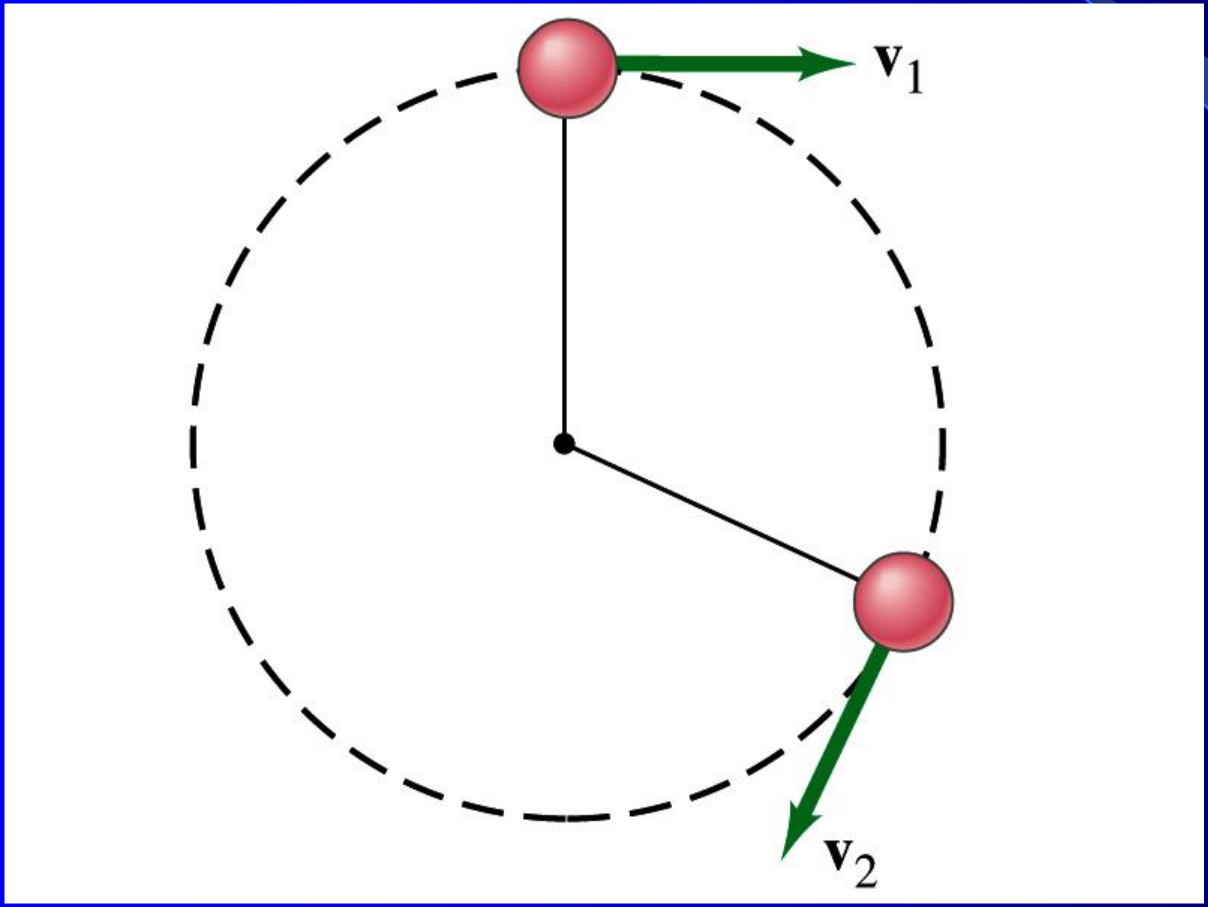
Uniform Circular Motion



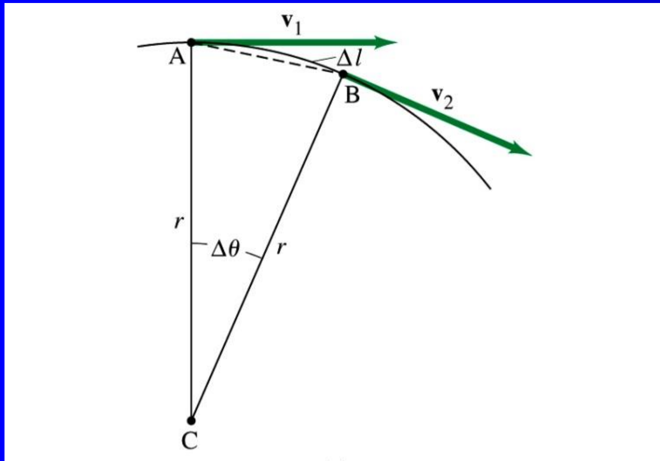
Object moves on a circle at constant speed.

Direction changes at every instant!

$v_1 = v_2$

$\mathbf{v}_1 \neq \mathbf{v}_2$

Uniform Circular Motion



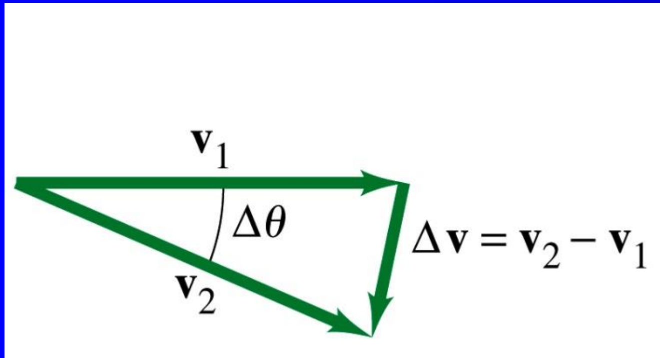
(a)

$\mathbf{a} = \lim_{\Delta t \to 0} \Delta \mathbf{v}/\Delta t$ here a_R: radial acc.

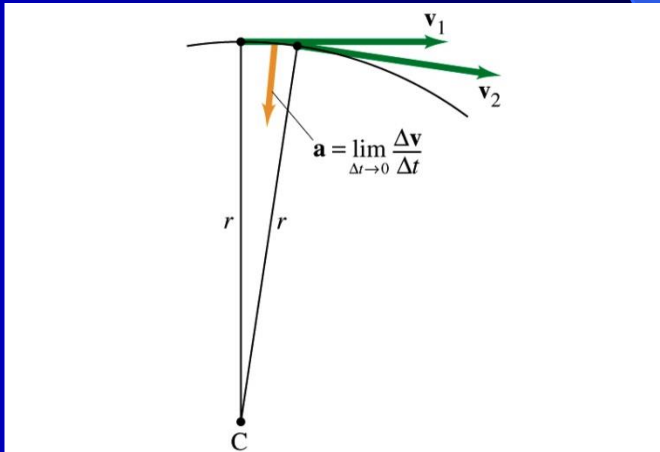
$\Delta v/v = \Delta l/r \Rightarrow \Delta v = \Delta l\ v/r$

$a_R = \lim_{\Delta t \to 0} \Delta v/\Delta t = \lim_{\Delta t \to 0} (v/r\ \Delta l/\Delta t)$

But $\lim_{\Delta t \to 0} \Delta l/\Delta t = v \Rightarrow a_R = v^2/r$

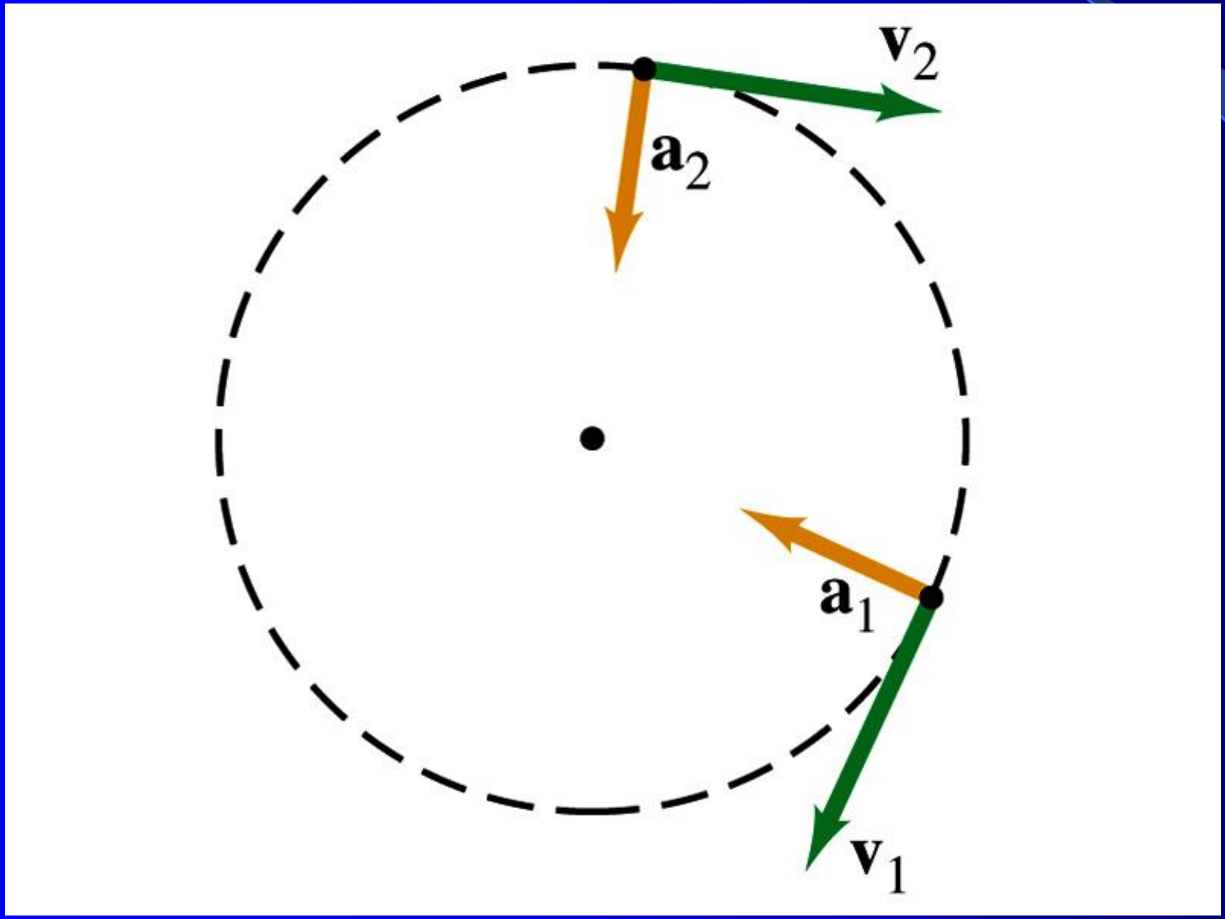


(b)



(c)

Uniform Circular Motion

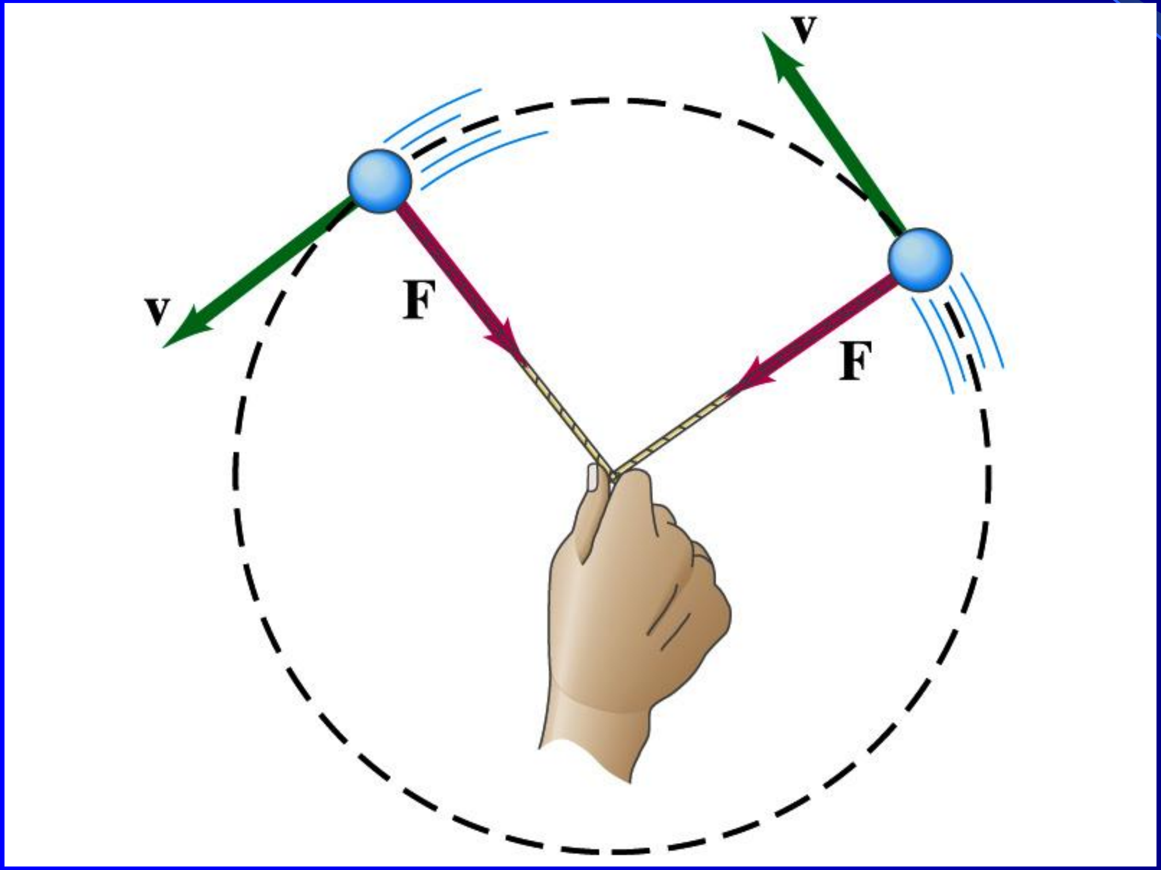


Acceleration a is always perpendicular to velocity

$T = 1/f$

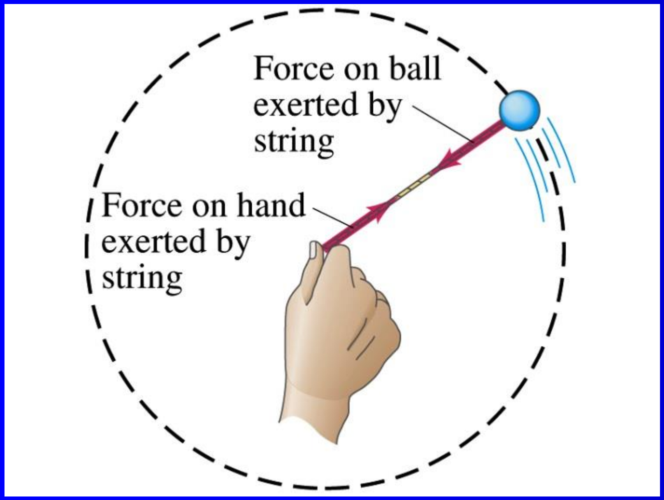
$\mathbf{v} = 2\pi r/T$

Dynamics of Circular Motion



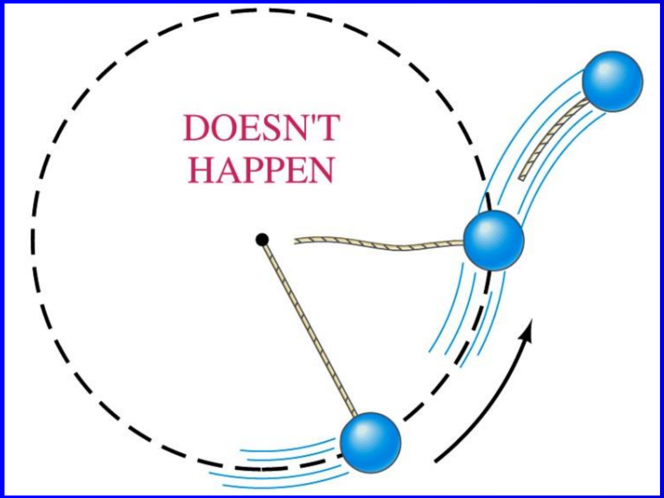
$a_R = v^2/r \Rightarrow$
$F_R = m\, a_R = m\, v^2/r$

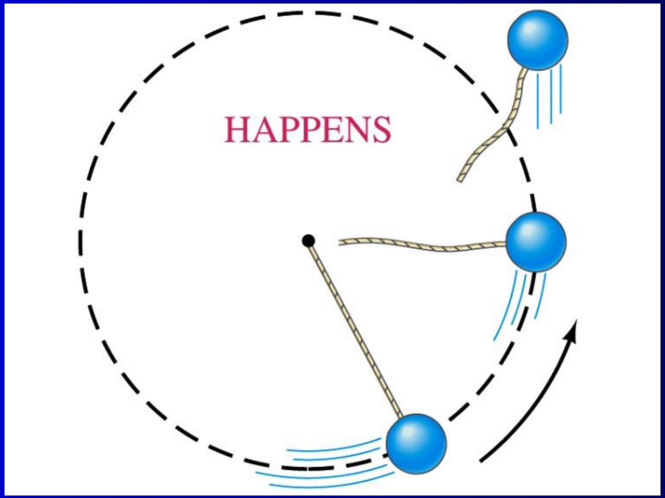
Dynamics of Circular Motion



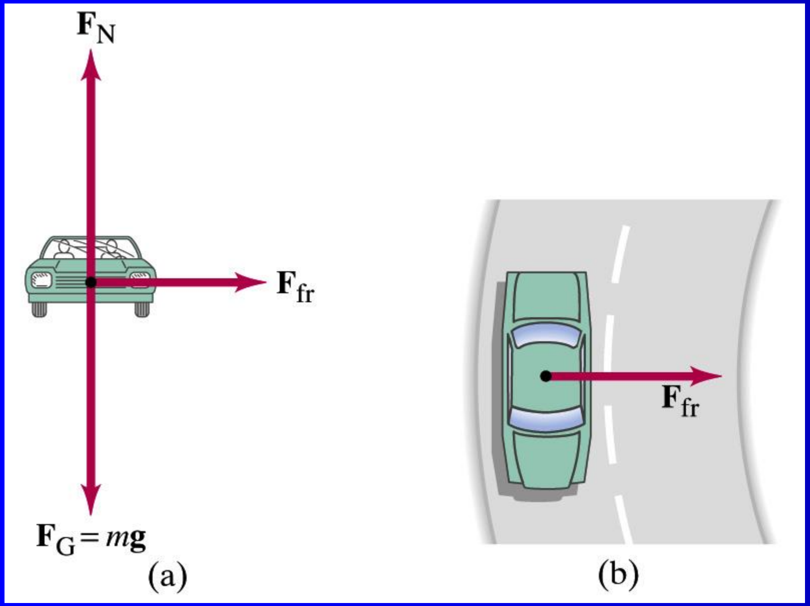
Force Diagram: Centripetal force
Newtons 3rd law: Force on your hand

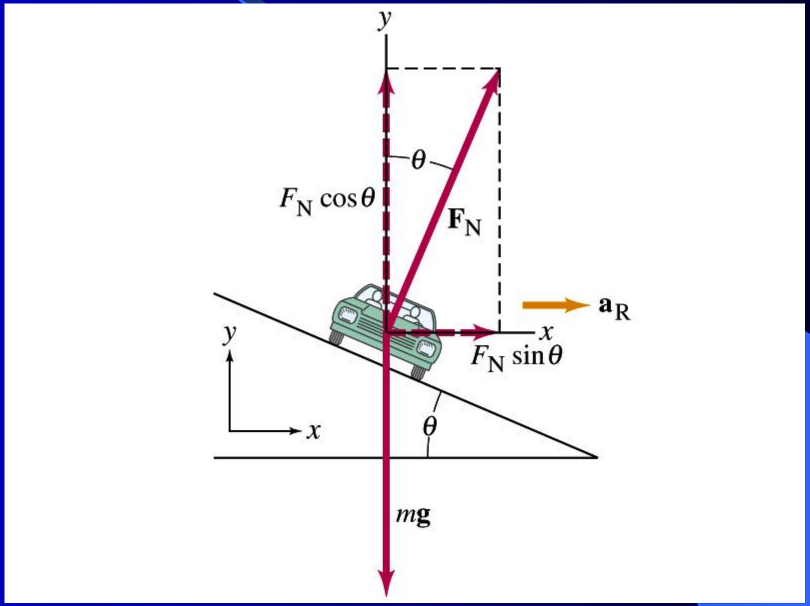
Centrifugal force does not exist!





Unbanked vs. Banked Curves





Calculate Banked Curve Problem