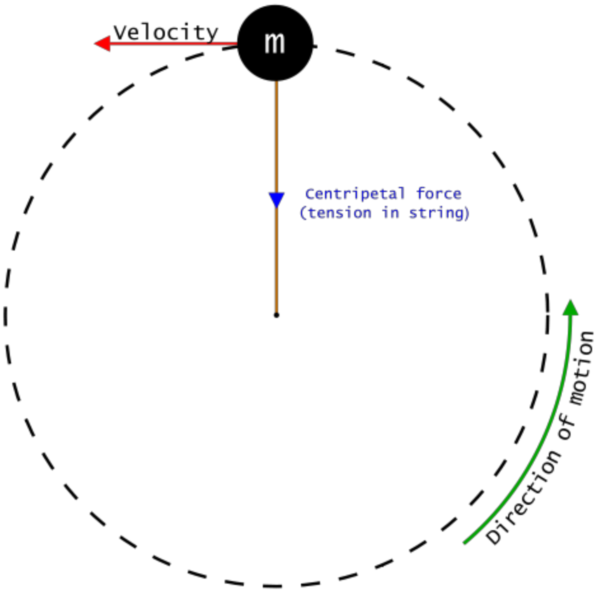
Centripetal Motion

Centripetal Motion is motion in a circle at a constant speed.

The motion is caused by a centripetal force which is directed toward the center of the circular path.

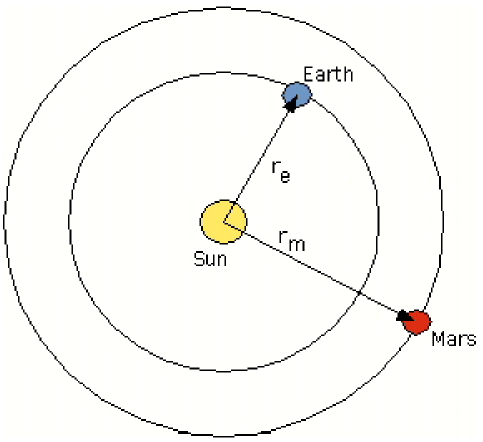
According to Newton's Second Law, the acceleration must also be directed toward the center of the circle/

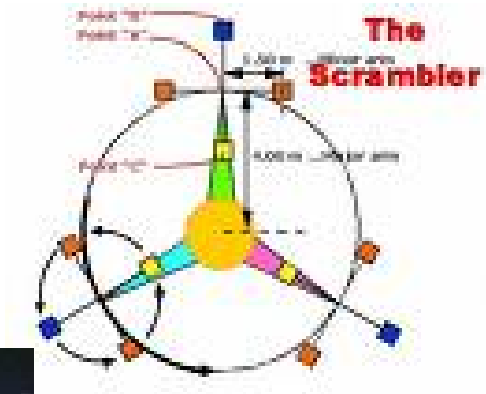


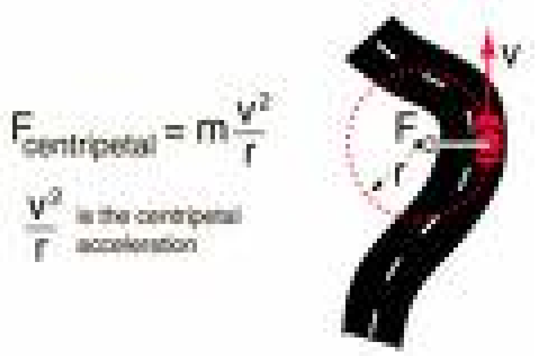
The centripetal force is NOT a new force.

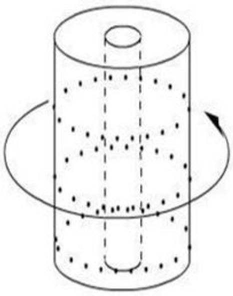
The centripetal force needed can be provided by a number of familiar forces.

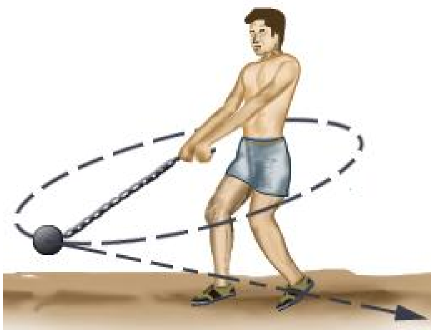
Such as...






$F_{centripetal} = m\frac{v^2}{r}$
$\frac{v^2}{r}$ is the centripetal acceleration
v
F_c
r





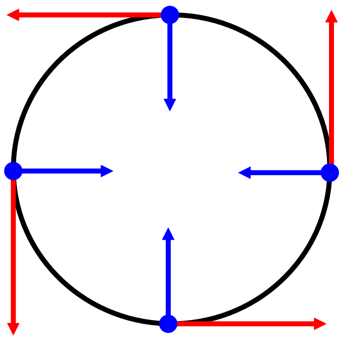
The speed is constant at all points on the circle but the velocity is changing because the direction is changing..

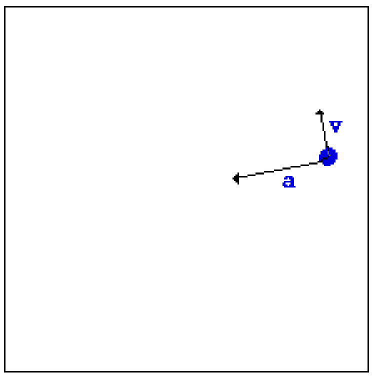
Any object undergoing UCM is accelerating.

confused yet?

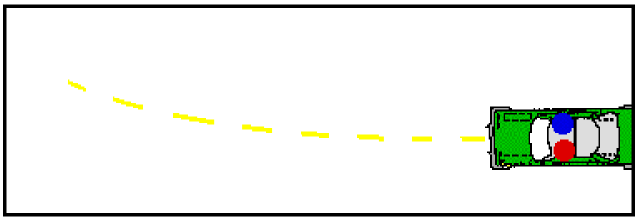
This acceleration is called the centripetal acceleration, a_c, and it always points towards the center of the circle.

notice the velocities are tangential to the circle, while the accelerations are perpendicular.

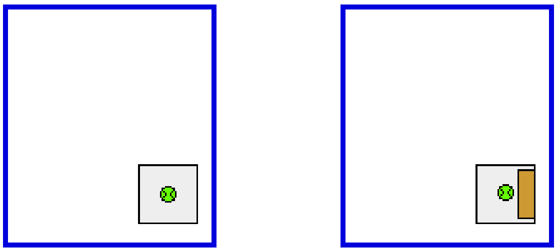




Consider the force you feel when going around a right hand turn



Without a centripetal force, an object in motion continues along a straight-line path. With a centripetal force, an object in motion will be accelerated and change its direction.



Calculating centripetal force and acceleration...

$v = d/t$

a_c = centripetal acceleration (m/s^2)

v = speed (tangential) (m/s)

r = radius (m)

T = period (s)

f = frequency (Hz) or (s^{-1})

$$a_c = \frac{v^2}{r}$$

* *not given*

* *But what does F = ?*

Ex 1: A 32.0 kg mass moves in uniform circular motion at 4.1 m/s around a 12.0 m radius horizontal track.

a) What is the centripetal acceleration, a_c

b) How much force is required to keep the object moving in a circle?
Remember the net force is the centripetal force.

Practice...

p. 206 #1 - 6