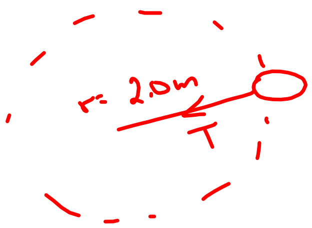
1. A 5.0 kg stone is whirled around in a horizontal circle of radius 1.0 meter at a speed of 5.0 m/s. Calculate the centripetal force on the stone.

New Equations from Old. . .

2. A ball of mass 1.0 kg is whirled around in a horizontal circle of radius 2.0 meters so that it makes 5 revolutions in 10 seconds. Calculate the centripetal force on the ball.

$m = 1.0\,kg$

$\Sigma F = T = \frac{mv^2}{r} = \frac{m4\pi^2 r}{T^2}$



$T = \frac{10s}{5} = 2s$

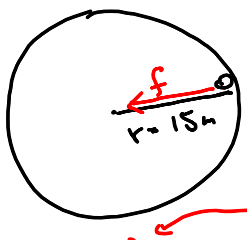
$= \frac{(1.0)(4)(\pi^2)(2.0)}{2^2}$

$= 19.7N$

3. A car rounding a turn of radius 50.0 m has a centripetal force of 2000 N exerted on it by the road when it has a speed of 10 m/s. Calculate the mass of the car.

4. A 50 kg person is riding on a *merry-go-round* at a Carnival. The person makes a revolution every 20 seconds and the radius of the merry-go-round is 15 m. If the person is standing up and does not hang onto anything, what is the least value of the coefficient of friction necessary to keep him from sliding off?

$T = 20s$



$m = 50kg$

$F_g = mg = 490N$

$0N$

Recall $F_c = \frac{mv^2}{r}$, but $v = \frac{2\pi r}{T}$

$= \frac{m\left(\frac{4\pi^2 r^2}{T^2}\right)}{r}$

$= \frac{m4\pi^2 r}{T^2}$

$\Sigma F = F_c = f$

$f = \mu N = \frac{m4\pi^2 r}{T^2}$

$\mu mg = \frac{m4\pi^2 r}{T^2}$

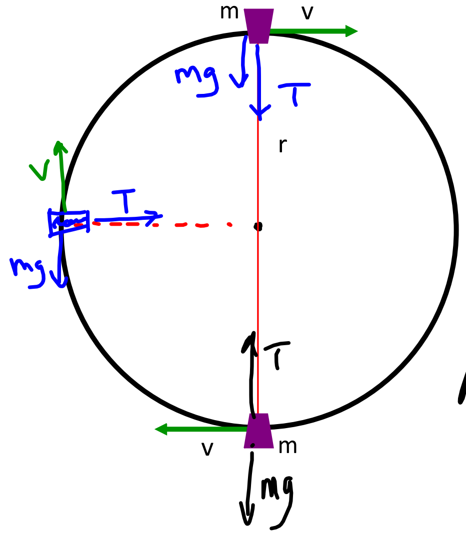
$\mu = \frac{4\pi^2(15m)}{(9.8m/s^2)(20s)^2}$

$= 0.149$

5. The moon is 3.82×10^8 m from the center of the Earth and it circles the earth once every 27.3 days (2.36×10^6) Calculate: (a) the moon's centripetal acceleration and (b) the centripetal force acting on the moon if the moon has a mass of 7.34×10^{22} kg.

Vertical Circles

Example 1: Mass on a Rope



At top

$$\Sigma F = T + mg = \frac{mv^2}{r}$$

$$T = \frac{mv^2}{r} - mg$$

If it just makes it around the top, T = ☺

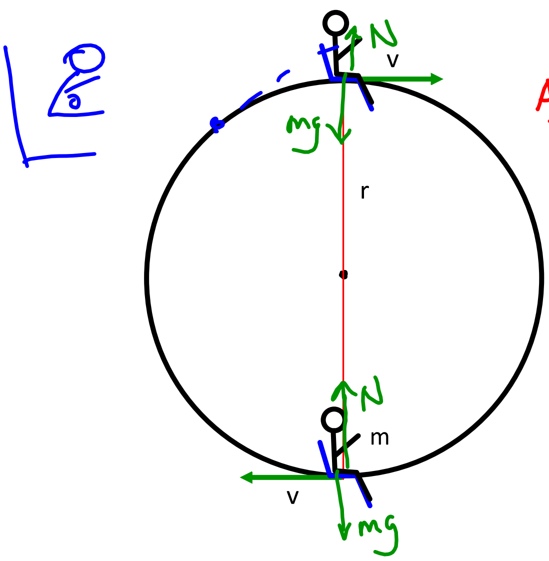
So $\cancel{m}g = \frac{\cancel{m}v^2}{r}$ $\quad v = \sqrt{gr}$

At bottom

$$\Sigma F = T - mg = \frac{mv^2}{r}$$

$$T = \frac{mv^2}{r} + mg$$

Example 1: Ferris Wheel



N = normal force = apparent weight.

At top:

$$\Sigma F = mg - N = \frac{mv^2}{r}$$

$$N = mg - \frac{mv^2}{r}$$

If N = ☹ $\quad mg = \frac{mv^2}{r} \quad v = \sqrt{gr}$

At bottom:

$$\Sigma F = N - mg = \frac{mv^2}{r}$$

$$N = mg + \frac{mv^2}{r}$$