1. A marble launcher is held horizontally 1.5 m above level ground. The gun is fired. The marble leaves the end of the barrel traveling 10 m/s.

A) How far does the marble go before landing?

B) If the launch speed were doubled, how far would the marble go?

X	Y
$\Delta x = ?$	$\Delta y = -1.5m$
$a = 0$	$a = -9.8 m/s^2$
$V_i = 10 m/s$	$V_i = 0$

$t = ?$ $\Delta y = V_i t + \frac{1}{2} a t^2$

$-1.5 = 0t + \frac{1}{2}(-9.8)t^2$

$t = 0.553 s$

$\Delta x = ?$

$\Delta x = V_i t + \frac{1}{2} a t^2$

$\Delta x = 10(0.553) + 0$

$\Delta x = 5.53 m$

B $\Delta x = 20(0.553)$

$= 11.07 m$

2. At the bottom of a water slide, riders (and the water) shoot horizontally from the end of the slide. They arc through the air for 0.50s before landing in a deep pool of water, 2.50m away from the end of the slide.

A) How fast were they going when the left the slide?

B) How high was the bottom of the slide above the water?

X	Y
$V_i = ?$	$V_i = 0$
$a = 0$	$a = -9.8 m/s^2$
$\Delta X = 2.5 m$	$y_i = ?$
$t = 0.50 s$	

$$\Delta X = v_i t + \frac{1}{2} a t^2$$

$$2.5 = v_i (0.5) + 0$$

$$V_i = 5 m/s$$

$$\Delta y = v_i t + \frac{1}{2} a t^2$$

$$= 0(0.5) + \frac{1}{2}(-9.8)(0.5)^2$$

$$\Delta y = -1.225 m$$

$$y_i = 1.225 m$$

3. A 1500 kg car travels around a 50.0m radius curve on a level road at 15.0m/s.

A) What type of force provides the net centripetal force?

B) What is the size of that force?

C) If the car's speed was cut in half, then the size of that force would be:

A) $\Sigma F_c = F_{f_s}$

B) $\Sigma F_c = ?$ $m = 1500$ $s = 15 m/s$

$r = 50 m$

$$\Sigma F_c = \frac{mS^2}{r} = \frac{1500(15)^2}{50}$$

$$\Sigma F_c = 6750 N$$

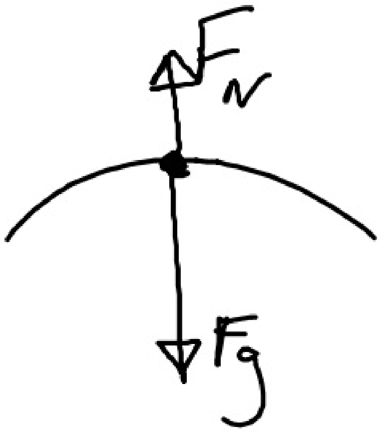
C) $$\Sigma F_c = \frac{1500(7.5)^2}{50}$$

$$\Sigma F_c = 1688 N$$

4. A 100 kg person rides a 5.0m radius Ferris wheel that makes 10 revolutions per minute. Determine the normal force on the rider at the top and the bottom of the ride.

$F_N = ?$ $m = 100\,kg$ $r = 5m$

$T = 6s$



$\Sigma F_c = ma_c$

$F_g - F_N = \frac{mS^2}{r}$

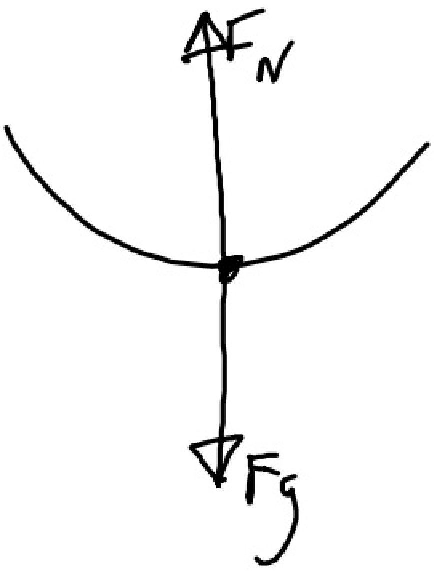
$S = \frac{2\pi r}{T}$

$= \frac{2\pi(5)}{6}$

$= 5.24\,m/s$

$980 - F_N = \frac{100(5.24)^2}{5}$

$F_N = 432N$



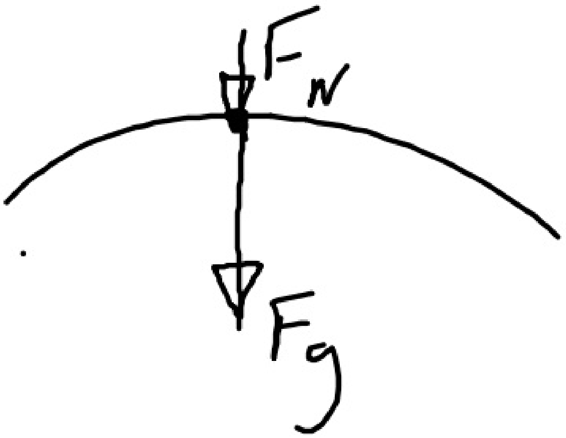
$F_N - F_g = \frac{mS^2}{r}$

$F_N - 980 = \frac{100(5.24)^2}{5}$

$F_N = 1528N$

5. Determine the minimum speed (any slower, and they fall out) for a roller coaster going through the top of a loop with a radius of 7.0m. (Hint: What force drops to zero when the going through the top of a loop at minimum speed?)

$S_{min} = ?$ $r = 7.0m$



But, at min speed $F_N = 0$

$$F_g - F_N = \frac{mS^2}{r}$$

$$\cancel{m}g = \frac{\cancel{m}S^2}{r} \qquad 9.8 = \frac{S^2}{7}$$

$S = 8.28 \, m/s$