Problem 1:

An object moves in a circle of radius $22m$ with its speed given by $v = 3.6 + 1.5t^2$, with v in meters per second and t in seconds. At $t = 3s$,

a) Find the magnitude of the tangential acceleration.

b) Find the magnitude of the radial acceleration.

c) Find the magnitude of the total acceleration

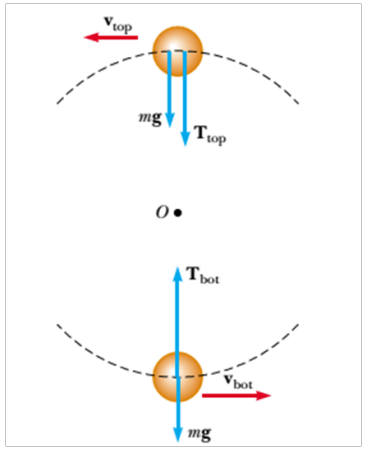
Problem 2:

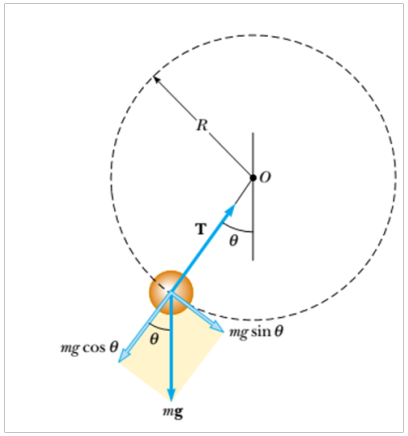
A small sphere of mass $m = 400g$ is attached to the end of a cord of length $1.2m$ and set into motion in a vertical circle about a fixed point O, as illustrated in the figure below. Determine the magnitude of the tension in the cord

a) when the object passes the top point with a speed of 6m/s **(*Answer: 8.1N*)**

b) when the object passes bottom point with a speed of 8m/s **(*Answer: 25.3N*)**

c) when the object passes the points whose angles are $\theta = 90^0$ *and* 30^0 with speeds of 7m/s and 7.8m/s, respectively. **(*Answers: 16.3N and 23.7N*)**

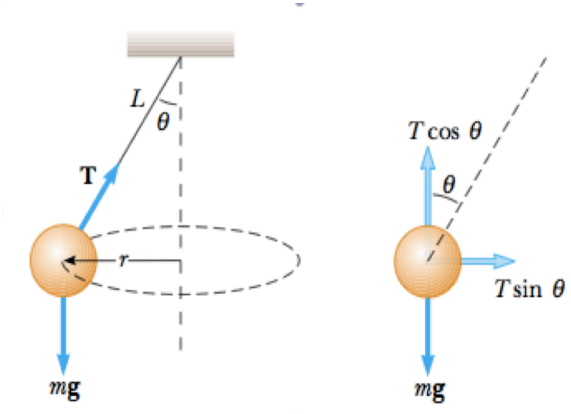




Problem 3:

A small mass of mass *m* is suspended from a string of length *L*. The ball revolves with constant speed *v* in a horizontal circle of Radius *r*. Find an expression for *v*.

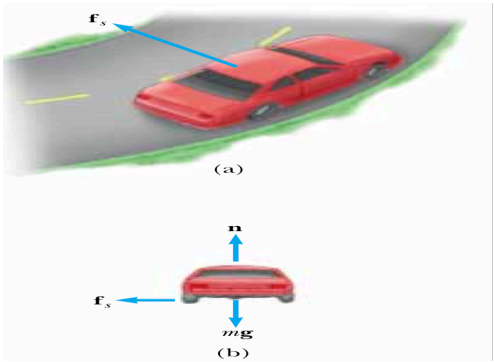
$$\left(v = \sqrt{lg \sin\theta \tan\theta}\right)$$



Problem 4:

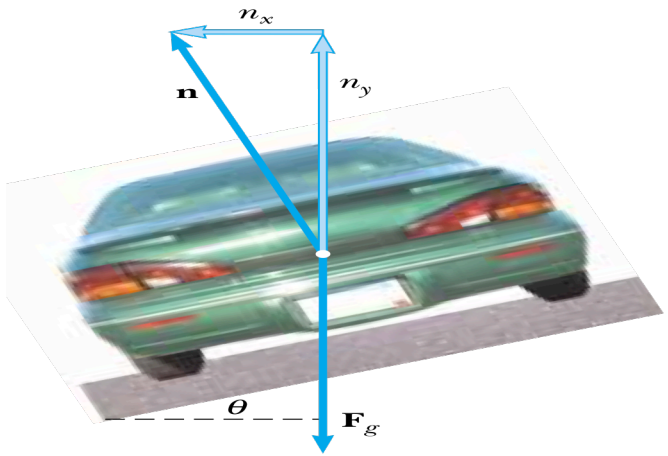
A *1500kg* car moving on a flat horizontal road negotiates a curve. If the radius of the curve is *35m* and the coefficient of static friction between the tires and dry pavement is *0.523*, find the maximum speed the car can have still make the turn successfully.

$\left(v_{max} = 13.4\, m/s\right)$



Problem 5:

A civil engineer wishes to design a curved roadway such a way that a car will not have to rely on friction to round the curve without skidding. In other words, a car moving at the designated speed can negotiate the curve even when the road is covered with ice. Such a ramp is usually banked, which means that the roadway is tilted toward the inside of the curve. Suppose the designated speed for the ramp is to be 13.4 m/s and the radius of curvature is 35 m. At what angle should the curve be banked? **(ANS: 27.6^0)**



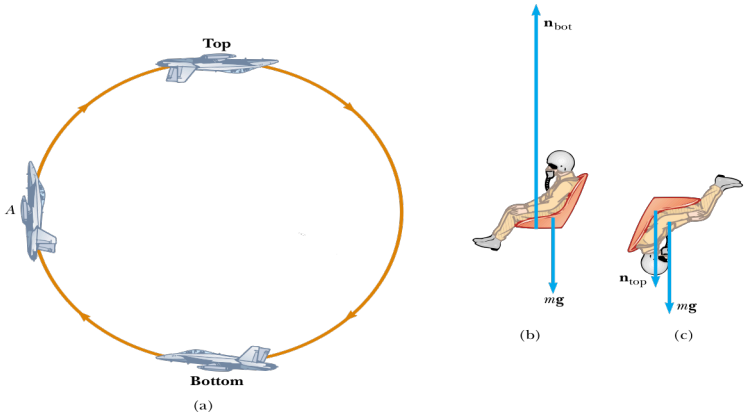
Problem 6:

A pilot of mass m in a jet aircraft executes a loop-the-loop. In this manoeuvre, the aircraft moves in a vertical circle 2.7 km at a constant speed of 225 m/s. Determine the force exerted by the seat on the pilot.

a) at the bottom of the loop and

b) at the top of the loop

express your answers in terms of the weight of the pilot, mg.



Problem7:

A light string can support a puck of $m_2 = 25kg$. An object of mass $m_1 = 3kg$ is attached to the string rotates on a frictionless, horizontal table in a circle of radius R=0.8m and the other end of the string is held fixed as in figure. The suspended object remains in equilibrium while the m1 on the table top revolves. What is

(a) What is the tension in the string? **(*Answer: 245N*)**

(b) What is the radial force acting on the puck? **(*Answer: 245N)***

(c) What is the speed of the puck? **(*Answer: 8.1m/s)***