Problem Set #9 Energy and Friction
Due Thursday December 13th (A/B) and Friday December 14th (C/D)

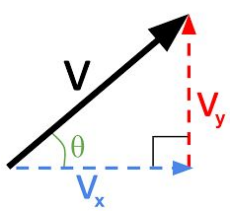
Name:_____

I worked with:

Equations:

Displacement:	$x(t) = x_0 + v_0t + ½ at^2$
Velocity:	$v(t) = v_0 + at$
Final Velocity (time):	$v_f = v_0 + at_f$
Final Velocity (displacement):	$v_f^2 = v_0^2 + 2ax_f$
Force:	$F = ma$
Acceleration due to gravity:	$9.8\ m/s^2$
Momentum:	$p = mv$
Impulse:	$F(t_2 - t_1) = m(v_2 - v_1)$
Kinetic Energy:	$KE = ½mv^2$
Gravitational Potential Energy:	$PE = mgh$

Use a right triangle and sine and cosine to Calculate V_x and V_y



1. Santa's reindeer train in the summer months to pull Santa's sleigh. They pull the sleigh on the grass because it has a greater coefficient of kinetic friction than snow. If Santa's sleigh has a mass of 40,000 kg, the coefficient of kinetic friction of the sleigh on grass is 0.35, and the coefficient of kinetic friction of the sleigh on snow is 0.02, how much more force must the reindeer apply to pull Santa's sleigh on grass than on snow?

2. Your kinetic sculpture is at the top of a hill which is 12 m high. You release the sculpture and it plunges down the hill. The bottom of the hill is at ground level (meaning 12 m below your starting point) and the mass of your sculpture is 15 kg.
    a. What is the kinetic energy of your sculpture at the bottom of the hill?
    b. What is the velocity of your sculpture at the bottom of the hill?

3. A team has a kinetic sculpture prototype that has a mass of 0.5 kg. The test ramp is at an angle of 20 degrees, the height of the ramp was 0.8 m, and the distance the prototype traveled was 2 meters.
    a. What ideal velocity would this team have calculated in their model?
    b. What was the potential energy of the sculpture prototype at the top of the ramp?
    c. If the actual velocity of the sculpture prototype was 2.1 m/s how much energy was lost to friction?

4. (Honors) In this problem you will need to use the concept of conservation of energy and conservation of momentum to help you solve it.

A 1200 kg car travelling west at a speed of 25 km/h collides elastically with a 1600 kg car travelling east at a speed of 30 km/h. What are the magnitude and direction of the velocities of both of the cars after the collision.