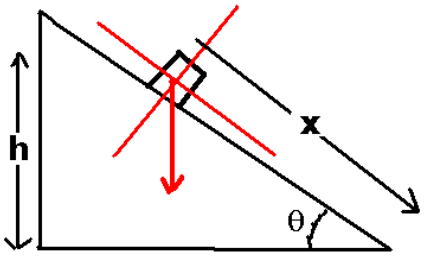
Fall 2012	Physics 240: UnTest #2:	Name _____

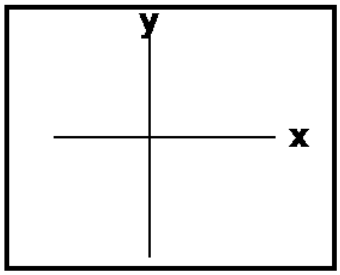
Instructions: You have a total of 55 minutes to complete this test.
Answer each of the following questions completely.

Time Start_____ Time finish_____ Pledged_____

You must supply all details that led to your answer.You must provide correct SI units where required.
Do not discuss any aspect of this test with anyone until I return the test.

[1] A mass m is on an inclined plane (inclined at an angle θ) as shown. The mass is given a tiny push to start it moving down the plane. The coefficient of friction between the mass and the plane is μ. Note: x and h are related by $h = x\sin(\theta)$.





(a) Draw in the space provided (above) a correct free body diagram of the situation.

(b) If the mass falls through the height h, how fast is the mass moving at the bottom of the plane? Your answer will involve h, g, θ and μ. You must use energy considerations here and thus, you must write the correct work-energy equation for this situation as part of your solution.

(c) Suppose h=1m, $\theta=35^0$, and μ=.3, provide a numerical answer for v together with correct SI units. v=_____

(2) A mass m1 is moving with a velocity v as shown. The mass strikes and sticks to a mass m2 which is initially at rest. The system then collides with a spring of spring constant k and the spring is observed to compress though a distance x when the system comes to a stop. Answer the following questions.

(a) What is the velocity of the system immediately after the collision in terms of m1, m2 and v?

(b) After the collision, using energy considerations, what will be the compression of the spring? You must use energy considerations here and thus, you must write the correct work-energy equation for this situation as part of your solution.

(c) If m1=2kg, m2=4 kg, v=3 m/s and k=10 N/m, provide numerical answers to (a) and (b) together with correct SI units.

(2:a): V_{after}=_____ (2:b): x=_____

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(3) A wheel of radius R which is initially at rest experiences an angular acceleration give by $\alpha=c+bt^2$ where c has SI units of $\frac{\text{"rad"}}{s^2}$ and b has SI units of $\frac{\text{"rad"}}{s^4}$. At a time t, provide the following (you may assume the wheel is initially at $\theta_0=0$).

(a) What is the angular velocity, ω, in terms of c, b and t?

(b) What is the tangential velocity, v, in terms of c, b, t and R?

(c) What is the tangential acceleration, a, in terms of c, b, t and R?

(d) What is the centripetal acceleration, a_c in terms of c, b, t, and R?

(e) What is the magnitude of the acceleration in terms of c, b, t, and R?

(f) What is the angle which the wheel turned through in terms of c, b, t, and R?

(4) A mass m_1 (initially at rest) is subject to an impulse $\vec{J}=\int\vec{F}dt$ where $\vec{F}=(c+bt)\hat{x}$ where c has SI units of N and b has SI units of $\frac{N}{s}$. Answer the following questions.

(a) After a time t, how fast is the mass moving in terms of c, b, t and m_1?

(b) Now, assume that the mass is moving with the velocity obtained in (4a) (which you may refer to as v here) after this time t (and the impulse is removed). The mass is observed to undergo a completely elastic collision with a second mass m_2 which is initially at rest. If mass m_2 is the same as mass m_1, what is the velocity of mass m_1 and m_2 after the collision?