Name: _____

PHY 105 Test 1 September 30, 2005 60 minutes

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Do all work in the blue book! All answers must be in MKS units unless otherwise specified.

1. The *x*-component of a vector $\vec{A}$ in the *xy* plane is positive and 1/4th as large as the magnitude of the vector. Sketch a vector with this property, and determine the angle that the vector makes with respect to the x-axis. (**6 pts**)

2. A large cannon is fired from ground level over level ground at an angle of 30° above the horizontal. The muzzle speed is 980 m/s. Neglecting air resistance, determine the projectile airtime and range. (**12 pts**)

3. Suppose $A = B^n C^m$, where *A* has dimensions LT, *B* has dimensions L^2T^{-1}, and *C* has dimensions LT^2. Determine the values of the exponents *n* and *m*. (**6 pts**)

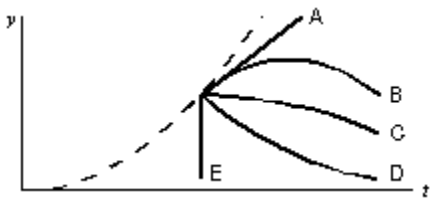
4. The coordinate of a particle moving in 1-D is given by $x(t) = 16t - 3.0t^3$ meters, where the time *t* is in seconds. (**8 pts**)

   a) Calculate the instantaneous velocity at t = 15 s.

   b) Calculate the average acceleration over the first 30 s

5. Of the following situations, which one is impossible? Explain your answer! (**4 pts**)
   a) A body having velocity east and acceleration east
   b) A body having velocity east and acceleration west
   c) A body having zero velocity and non-zero acceleration
   d) A body having constant acceleration and variable velocity
   e) A body having constant velocity and variable acceleration

6. An elevator is moving upward with constant acceleration. The dashed curve shows the position *y* of the ceiling of the elevator as a function of the time *t*. At the instant indicated by the dot, a bolt breaks loose and drops from the ceiling. Which curve best represents the position of the bolt as a function of time? Explain!! (**4 pts**)



7. What must be the speed of a biological sample in a 1.0-m radius centrifuge to have a centripetal acceleration of 25g's? (**4 pts**)

8. A baseball is hit straight up and is caught by the catcher 2.0 s later. The bat is 1.5 m above the ground when the ball is hit, while the catcher's mitt is 2.0 m above the ground when the ball is caught. With what velocity did the ball leave the bat? (**8 pts**)

9. An airplane is flying north at 500 km/h. It makes a gradual 180° turn at constant speed, changing its direction of travel from north through east to south. The process takes 40 s. What is the average acceleration of the plane during this turn? (**8 pts**)