

**Instructions: You have a total of 50 minutes to complete this test.**

**Answer each question completely showing complete details.**

**For complete credit you must include correct SI units with numerical answers.**

Time Start \_\_\_\_\_ Time finish \_\_\_\_\_ pledged \_\_\_\_\_

$$\text{Constants: } g = 9.8 \frac{\text{m}}{\text{s}^2}$$

**(1)** A particle is observed to move with an acceleration given by:

$$\vec{a} = 0\hat{x} - ct\hat{y}$$

where the constant  $c$  has SI units of  $[c] = \left[\frac{\text{m}}{\text{s}^3}\right]$ .

**(a)** Find the velocity **vector** at a later time assuming that at  $t=0$  the initial velocity vector is zero.

**(b)** Find the position **vector** at a later time assuming that at  $t=0$ , the velocity and position vectors are both zero.

Suppose another particle is seen to have a position vector given by:

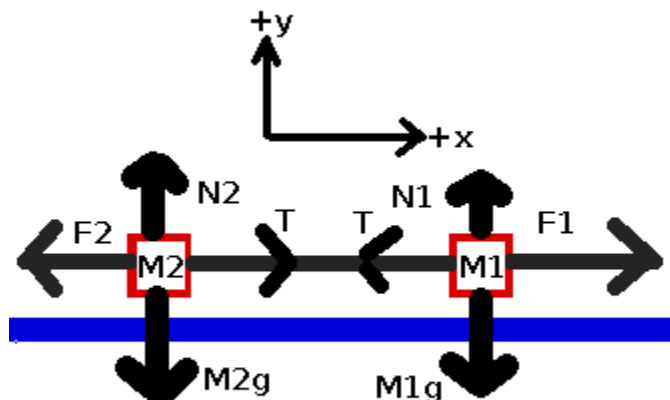
$$\vec{R}(t) = (v_{0,x}t)\hat{x} + \left(v_{0,y}t - \frac{1}{2}gt^2 - kt^3\right)\hat{y}.$$

The constants  $g$  and  $k$  have SI units of  $g = 9.8 \left[\frac{\text{m}}{\text{s}^2}\right]$   $[k] = \left[\frac{\text{m}}{\text{s}^3}\right]$ .

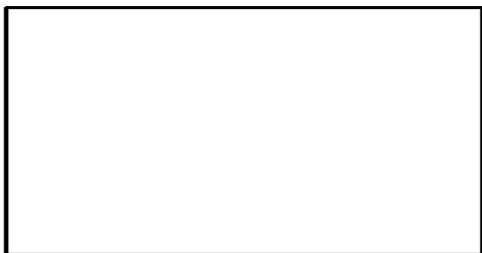
**(c)** Find the velocity **vector** at a later time.

**(d)** Find the acceleration vector at some later time.

(2) Two masses resting on a frictionless table are connected by a string and forces are applied as shown. You may assume  $F_1 > F_2$  here.



(a) In the boxes below, draw complete and correct free body diagrams for this system.



(b) Provide the 4 equations that come from Newton's Laws for this system.

(c) Find the acceleration of the system in terms of  $M_1$ ,  $M_2$ ,  $F_1$  and  $F_2$ .

(d) Find the tension in the string in terms of  $M_1$ ,  $M_2$ ,  $F_1$  and  $F_2$ .

(e) If  $M_1=1\text{kg}$ ,  $M_2=2\text{kg}$ ,  $F_1=4\text{N}$ ,  $F_2=2\text{N}$ , then provide numerical answers for a and T together with correct SI units.

a= \_\_\_\_\_

T= \_\_\_\_\_

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Physics 240: UnTest 1

Name: \_\_\_\_\_

**(3)** A ball is thrown upward at an angle of  $80^\circ$  with respect to the horizontal direction with an initial velocity of 25 m/s. Answer the following questions, **providing correct SI units**.

**(a)** How long is the ball in the air?

**(b)** What is the maximum height to which the ball rises?

**(c)** What is the impact velocity **vector** of the ball?

**(d)** What is the range of the ball?

(4) Consider the following vectors:

$$\vec{A} = 1\hat{x} - 2\hat{y} : \vec{B} = -3\hat{x} + 4\hat{y} : \vec{C} = 5\hat{x} - 6\hat{y}$$

(a)  $\vec{A} + \vec{B} + \vec{C} =$  \_\_\_\_\_

(b)  $\vec{A} \cdot \vec{B} =$  \_\_\_\_\_

(c)  $|\vec{A} + \vec{B}| =$  \_\_\_\_\_

(d)  $(\vec{A} + \vec{B}) \cdot \hat{x} =$  \_\_\_\_\_