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Instructions: You have a total of 55 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 _____

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

[1] Consider the following vectors:

$$\vec{A} = 2\hat{x} + 9\hat{y} : \vec{B} = -3\hat{x} + 5\hat{y} : \vec{C} = 5\hat{x} - 3\hat{y}$$

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

(b) $\vec{A} \bullet \vec{B} =$ _____

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

(d) $(\vec{A} + \vec{C}) \bullet \hat{y} =$ _____

(e) The angle that vector A makes with respect to the positive x-axis. $\theta =$ _____

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[2] A particle is observed to move with an acceleration given by:

$$\vec{a} = 0\,\hat{x} + c t^3 \hat{y}$$

where the constant b has SI units of $[c] = [\frac{m}{s^5}]$.

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

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

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

$$\vec{R}(t) = (-ct)\hat{x} + (f t^3 - e t^4)\hat{y} \quad ,$$

Where the constants c,e,f,and h have SI units of $[c] = [\frac{m}{s}], [f] = [\frac{m}{s^3}], [e] = [\frac{m}{s^4}]$.

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

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

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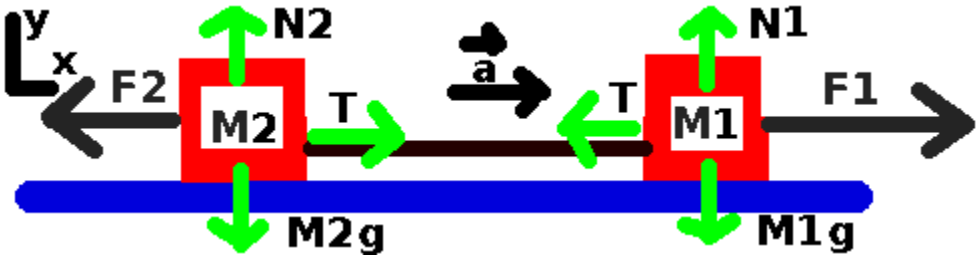
[3] Two masses resting on a frictionless table are connected by a string and forces are applied as shown. You may assume F1 > F2 here.



(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 M1, M2, F1 and F2.

(d) Find the tension in the string in terms of M1, M2, F1 and F2.

(e) If M1=2kg, M2=3kg, F1=20N, F2=10N, then provide numerical answers for a and T together with correct SI units.

a=_____ T=_____

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[4] A ball is thrown upward at an angle of 65^0 with respect to the horizontal direction with an initial velocity of 15 m/s. Answer the following questions, **providing correct SI units.**

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

(b) How long is the ball in the air?

(c) What is the range of the ball?

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