1. [15 points]
The diagram at right shows two masses connected by a massless string over an ideal, massless pulley. Given that \( m = 9.53 \text{ kg} \), the angle is 32.6 deg, and \( M = 51.2 \text{ kg} \), find the tension in the string and the acceleration of the masses if the surface of the incline is frictionless.

Be sure to include the free body diagrams, showing all force components.

2. [10 points]
A 2.31 kg puck, initially at rest on a horizontal, frictionless surface, is struck by a 0.726 kg puck moving to the right with a speed of 3.27 m/s. After the collision, the 0.726 kg puck has a velocity of 2.03 m/s to the left. Determine the final velocity of the 2.31 kg puck.

3. [15 points]
A mass has a displacement of +51.7 m in 3.57 s. During this time it is subject to a constant acceleration of \(-4.2 \text{ m/s}^2\). Find its initial velocity.

[You can assume that all motion is along the x axis.]

4. [5 points]
A rock is thrown upward at 27 degrees with respect to the horizontal. If air resistance is negligible, its horizontal component of velocity

A. decreases as it rises  B. remains unchanged  C. increases as it rises
5. [20 points]
Given that \( \vec{F}_1 = (2\hat{i} + 3\hat{j}) \) N and \( \vec{F}_2 = (3\hat{i} - 8\hat{j}) \) N are the only forces acting on a mass of 2.91 kg:

A) Find the (vector) **acceleration** of the mass.

B) Find the (vector) **velocity** at time \( t = 1.57 \) s assuming the mass has an initial velocity of \( \vec{v}_0 = (-2\hat{i}) \) m/s at \( t = 0 \) s.

6. [20 points]
A mass of 28.3 kg hangs from a system of ropes as shown at right.

The angles are in degrees.

Find the magnitude of the tensions

\( T_1 = \underline{\ }} \)

and \( T_2 = \underline{\ } \). Show your well-organized work below.

7. [20 points]
A spring whose force constant is \( k = 7210 \) N/m is used to launch a mass of 10.5 kg from point A. The spring is initially compressed by \( x = 0.429 \) m. There is friction with \( \mu = 0.17 \) in the 2.17 m long region between B and C.

What is the speed of the mass at point D? Answer: \( \underline{\ } \)

Show your well-organized calculation below. Answer without work is worth 0.