Free Response #1 (15 points)

A disgruntled physics student throws his calculator horizontally (to the right) off of a cliff that is 60-meters tall with an initial velocity to the right of 8 m/s. At the moment it leaves his hand, t = 0 seconds.

a) Determine the horizontal component of the velocity vector at t = 2 seconds.

b) Determine the vertical component of the velocity vector at t = 2 seconds.

c) What is the velocity at t = 2 seconds?

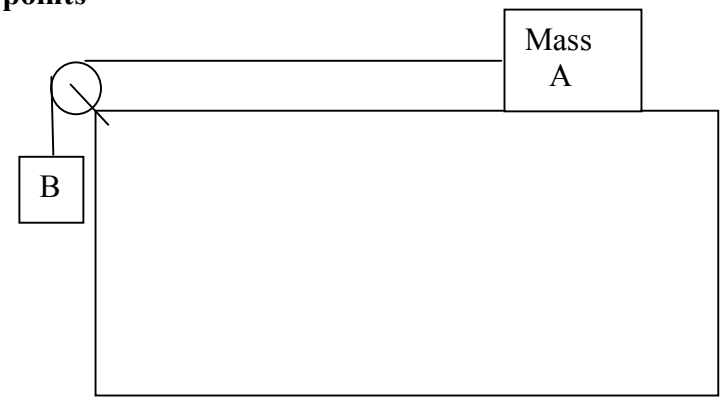
d) How many seconds will it take for the calculator to reach the ground?

e) How far from the base of the cliff will the calculator land?

f) What will be the magnitude of the velocity vector just before it hits the ground?

g) how would he answers to parts e and f change if instead it was launched at 10 degrees below the horizontal? (circle one)
part e) increase | remain the same | decrease
part f) increase | remain the same | decrease

Free Response #2 **15 points**



Two masses are arranged as shown above with a pulley system. Mass A is 5 kg and Mass B is 3 kg. When the system is free to move from rest, they undergo a constant acceleration. Mass A starts to move and covers a distance of 140 cm in a time of 1 seconds. There is friction between Mass A and the table.

a) Draw a free-body diagram for Mass A and Mass B while the system is accelerating. LABEL ALL FORCES and spell them out (instead of simply a letter).

Mass B (hanging) *Mass A (sliding)*

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b) Define your coordinate system here (be specific and use it in your vector answers):

c) Using kinematic equations, determine the acceleration of the system.

d) Determine the net force on B.

e) Determine the tension in the string as it slides.

f) Determine the coefficient of kinetic friction between Mass A and the table.

Free Response #3 12 Points

A puck is free to slide down a frictionless incline plane that has an unknown angle. It is released from a distance of 2 meters up the ramp (not "h"). When it encounters the flat region, it is slowed down and eventually comes to rest 5 meters to the left. The coefficient of friction between the floor and the puck is 0.2, and both the angle of inclination and mass are not given

a) Sketch a free-body diagram of the puck as it slides across the horizontal floor to the left.

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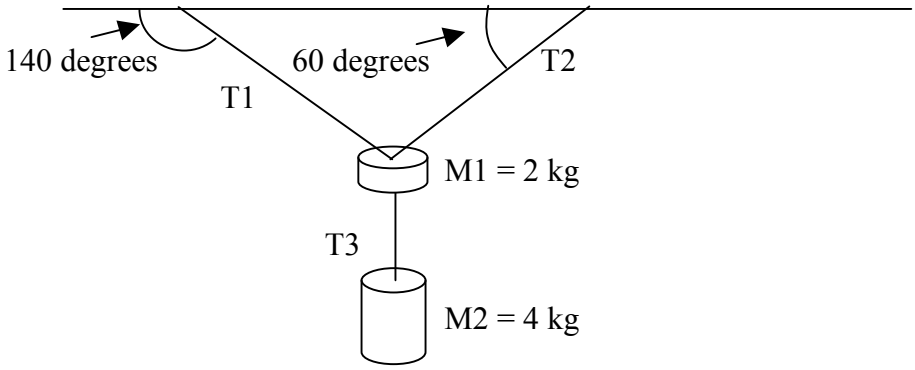
b) Determine the acceleration of the puck as it travels across the horizontal floor to the left.

c) Determine the initial velocity as the puck encountered friction.

d) Determine the angle of inclination of the ramp.

Free Response #4 8 points



Two masses (M1=2kg, M2=4kg) are held in place by the strings as shown above. The masses are at rest. T1 and T2 make angles to the ceiling as shown in the drawing. T3 is completely in the vertical axis.

a) Draw a free-body diagram for both M1 and M2. Label all forces.

M1 M2

b) Determine the tensions (hint: Tension is a vector and has 2 parts) for the three strings.

T1 = _____

T2 = _____

T3 = _____