Name: _____ DISC: _____ Score: _____ / 20

Instructions:

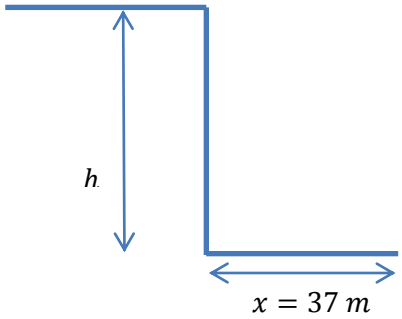
- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers.

Q1	Q2	Q3	Q4
10	10	5	5

1. A ball is thrown off a cliff of height h at an angle $\theta = 45°$ with respect to the horizontal ground. The ball has an initial velocity of $16\ m/s$ and reaches the ground after traveling $x = 37\ m$. Let the x-direction be horizontal and the y-direction be vertical.

   a. Draw a picture of the path you expect the ball to take to the ground. *Include the coordinate system*.

Picture (1 pt):



   b. Now let's work on the motion of the ball.

1 pt each
Acceleration:
Direction:
v_x
v_y:

   i. What is the acceleration of the ball?
   ii. What is the direction of the acceleration?
   iii. What is the x-component of the ball's initial velocity (v_{0x})?
   iv. What is the y-component of the ball's initial velocity (v_{0y})?

   c. Now we want to find the height h. Select the equations you could use to calculate h (select all correct equations).

Choice (1 pt):

   i. $x(t) = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$
   ii. $y(t) = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$
   iii. $v_x^2 = v_{0x}^2 + 2\,a_x\,\Delta x$
   iv. $v_y^2 = v_{0y}^2 + 2\,a_y \Delta y$

   d. How much time does it take the ball to reach the ground?

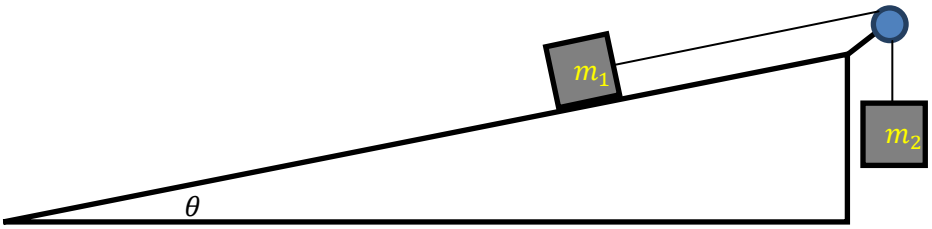
Solution (2 pts):

   e. What is h?

Solution (2 pts):

2. A block of mass m_1 is located on a *frictionless* ramp. The angle between the ramp and the floor is $\theta = 17^o$. It is connected to a second block of mass m_2 by a massless cord over a frictionless pulley as shown in the diagram.
   a. Select a coordinate system and complete the free-body diagram. *Include your coordinate system(s) on the diagram*. (Hint: Will it be easier to give each block its own coordinate system?)

Diagram (2pts):



   b. Let's consider the motion of the blocks (Hint: $F_{net} = ma = \sum F$):
      i. Can this system be in equilibrium?
      ii. Use Newton's laws to describe the forces on m_1.

Equilibrium:
F_1:
F_2:

      iii. Use Newton's laws to describe the forces on m_2.

   c. If the system is in *equilibrium*, what is the ratio $\frac{m_1}{m_2}$?

Solution (5 pts):