This week in lab, we talked about using antidifferentiation to go from acceleration to velocity, then to position, of an object moving under gravitational force. We used the following second order differential equation:
$$h''(t) = -g,$$
where g is acceleration under gravity.

1. If a rock is thrown upward from a 100 meter cliff with initial velocity 10 meters per second, find how long it takes to hit the ground at the bottom of the cliff. Recall that $g = 9.8$ meters per second per second.

Recall that Newton's law says that
$$F = ma,$$
where F is force, m is mass, and a is acceleration.

2. Suppose now that for a certain object moving along a straight line, $\frac{F}{m} = 2$ meters per second per second. Suppose also that the object is 2 meters to the right of a reference point at time 0 seconds, moving to the left at 1 meter per second.

   (a) By setting up and solving an appropriate initial value problem, find expressions for $s(t)$ and $s'(t)$, the position and velocity of the object at time t respectively.

(b) Fill the blanks and circle the correct answers in the following description of the motion of this object. Show your work below.

- At time 0 seconds, the object is _____ meters to the right/left of the reference point. It is moving to the right/left at a speed of _____ meters per second.

- The object then continues to move to the right/left with increasing/decreasing speed for _____ seconds.

- At time _____ seconds, the object comes to an instantaneous stop _____ meters to the left/right of the reference point.

- Following that, the object moves to the right/left with increasing/decreasing speed.

- The object passes the reference point at time _____ seconds/The object never passes the reference point.

You should now be able to complete the last three questions from the lab. When you're asked to describe the motion of an object, follow the template above:

- Note the object's initial position, speed, and direction of motion.

- Next, note how long it moves in the initial direction, and whether it is slowing down or speeding up.

- Then write down every point at which it stops instantaneously, the subsequent direction of motion, and whether it is speeding up or slowing down following the instantaneous halt.

- Lastly, note all the times it passes the reference point (position 0), if at all.