Assingment - Chapter 3

Problem 1)

A web page designer creates an animation in which a dot on a computer screen has a position

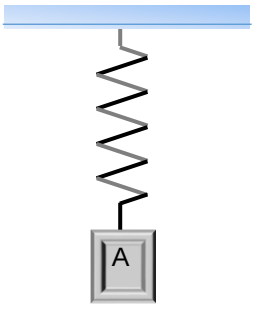
$$\underline{\boldsymbol{r}} = [4.0\text{ cm} + (2.5\text{ cm/s}^2)\,t^2]\,\underline{\boldsymbol{i}} + (5.0\text{ cm/s})t\,\underline{\boldsymbol{j}}$$

a) Find the magnititude and direction of the dot's average velocity between t = 0 and t = 2.0 s.
b) Find the magnititude and direction of the instanteneous velocity at t =0 s, t = 1.0 s , and t = 2.0 s.
c) Sketch the dot's trajectory from t = 0 to t = 2.0 s, and show the velocities calculated in part (b).

Problem 2)

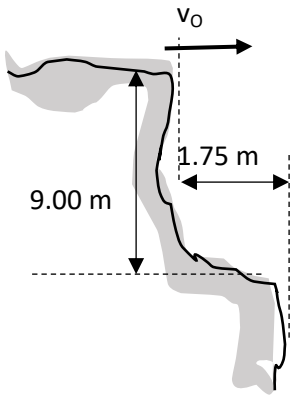
The vertical motion of mass A is defined by the relation x = 10 sin 2t + 15 cos 2t + 100, where x and t are expresse in mm and seconds, respectively. Determine

a) the position, velocity and acceleration of A when t = 1 s,
b) the maximum velocity and acceleration of A.



Problem 3)

A daring 510-N swimmer dives off a clif with running horizontal leap, as shown. What must be her minimum speed be just as she leaves the top of the cliff so that she will miss the edge at the bottom, which is 1.75 m wide and 9.00 m below the top of the cliff ?



Problem 4)

The acceleration of an object is given by $a_x(t) = At^2 - Bt^3$, where A = 1.2 m / s^4, and B = 0.15 m / s^5. The object is at rest at the origin at t = 0.

a) Find its position and velocity as fucntion of time.
b) Calculate the maximum velocity it attains.

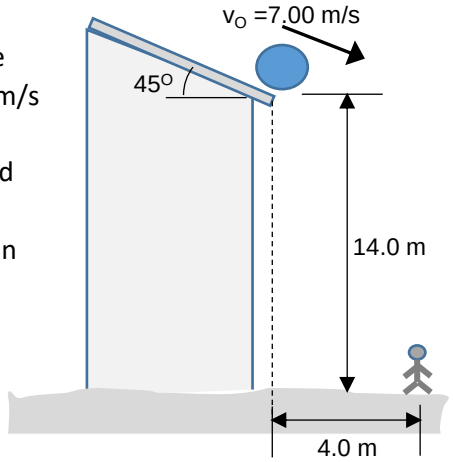
Problem 5)

A snowball rolls off a barn roof that slopes downward as shown. The edge of the roof is 14.0 m above ground and the snow ball has a speed of 7.00 m/s as it rolls off the roof. Ignore air resistance :

(a) How far from the edge of the barn does the snowball strikes the ground if it does not stike anything else while falling?

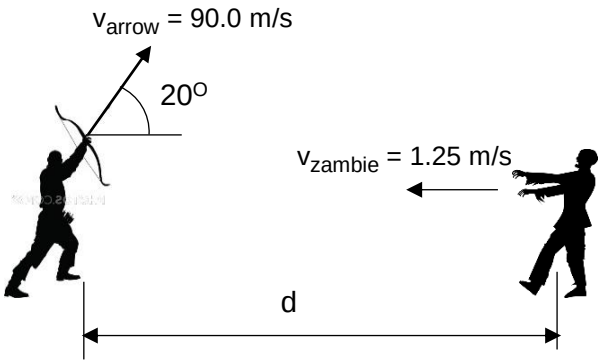
(b) Draw x-t, y-t, v_x-t, and v_y-t graphs (just sketch, no values) for the motion of the snowball.

(c) A man 1.9 m tall is standing 4.0 m from the edge of the barn. Will he be hit by the snowball?



Problem 6)

It is apocalyptic future, and zombies are trying to take over the world. In an effort to save the people, our hero aims his bow at a zombie that is slowly approacing them. The zombie is walking towards them at 1.25 m/s. He fires the arrow at 20^O above the horizon, hits the zombie, and saves the day.



a. Given that the bow will fire an arrow at a speed of 90.0 m/s, and assuming that the arrow beging and ends at the same height, how far away is the zombie (distance d) when our hero fires the shot?

b. Find the direction and magnitude of the arrow's velocity relative to the zombie just before the arrow hits him.
