DLI Physics Name_Brandon Mechanics Problem Set 1

Applied Derivatives in Mechanics

Date 9/18/2017

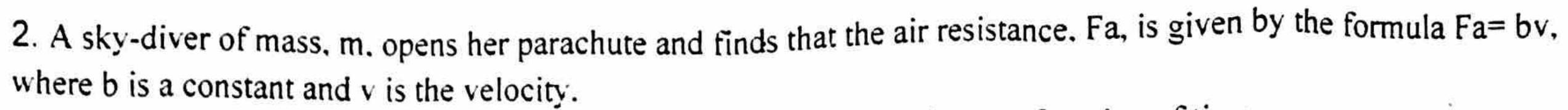
1. A honeycrisp apple moves in a straight line with its position, x, given by the following equation:

 $x(t) = t^4 - 4t^3 + 2t^2 + 3t + 6$

- Find its position after 1 second.
- b. Find its velocity after 2 seconds.
- c. Find its acceleration after 3 seconds.
- d. What is the rate of change of the acceleration at 1 second.
- e. Use Python to graph the position, velocity and acceleration as functions of time from t=0 to t=4 seconds.
- f. Use Python to graph the rate of change of acceleration vs. time.

a)
$$x(t) = 1^4 - 4(1)^3 + 2(1)^2 + 3(1) + 6 = 8m$$

b)
$$v(+)=4+^3-12+^2+4++3 \rightarrow v(2)=4(8)-12(4)+4(2)+3=[-5^m/s]$$



- a. Set up, but do not solve a differential equation for her velocity as a function of time.
- b. Set up, but do not solve a differential equation for distance as a function of time.
- c. Find the terminal velocity in terms of m, b, and g.
- d. If in a different situation the formula for air resistance were Fa= bv +cv², where c is another constant find the terminal velocity in terms of the above plus c.
- e. If you are in Calc 2, solve the differential equations from parts b and c.

a.
$$bv-mg = mv'$$

b. $bd-mg = md'$

C. $bv-mg = ma$
 $V=-mg$
 $V=-mg$

d.
$$cv^{2}-bv-mg=0$$

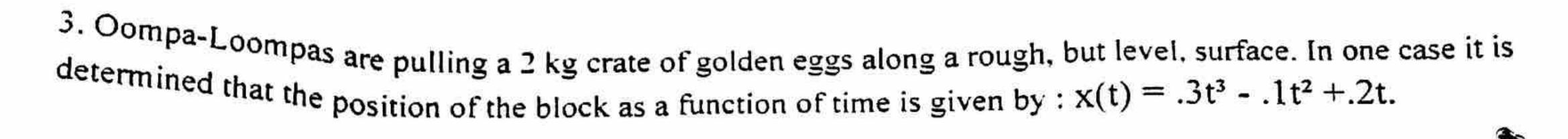
$$V = -b + \sqrt{b^{2} + (c)(mg)} = V = \frac{b + \sqrt{b^{2} + 4cmg}}{2c}$$

$$\frac{dv}{(\frac{bv}{m} + g)} = -dt$$

$$\frac{V(t) - V_{T}}{-V_{T}} = \frac{-b/m}{e} + 1 = e^{-b/m}$$

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$$V(t) = (e^{-b+/m} - 1)V_{T}$$



- a. Find the speed of the block at t = 2 sec.
- b. Find an expression for acceleration as a function of time.
- c. Find an expression for force as a function of time. $(\bar{a} = \frac{\bar{E}}{m})$
- d. Find the initial kinetic energy of the block $(KE = \frac{1}{2}mv^2)$
- e. Find the change in kinetic energy of the block from t = 0 to t = 2 sec.
- f. Another lab group determines that the Oompa-Loompa force as a function of distance is given by

 $F(x)=x^2+2x+2$ and the block is pulled at an angle of 15° to the horizontal-

Find the change in kinetic energy from x = 0 to x = 2 meters.

g. For the above group find a differential equation for power (Power = the time rate of change of kinetic energy).

$$a_{1}, q_{1}^{2}, q_{1}^{2}, q_{1}^{2}, q_{2}^{2}, q_{3}^{2}, q_{4}^{2}, q_{1}^{2}, q_$$

$$b.1.8+-.2=a(+)$$

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$$d, \frac{1}{2}(2)(.9+^2-.2++.2)^2 | KE; = .04 J$$

$$f \cdot \int_{x+2x+2}^{2} = \frac{x^3}{3} + x^2 + 2x^2 \rightarrow \frac{8}{3} + 4 + 4 = \frac{32}{3} + 4 + 4 = \frac{32$$

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