

Name _____
Student I.D. _____

Math 2250-4

Quiz 4

February 1, 2013

1) Consider the following linear drag initial value problem:

$$\frac{dv}{dt} = -20 - 2v.$$

$$v(0) = 0.$$

1a) Use a phase diagram to determine the limiting velocity $\lim_{t \rightarrow \infty} v(t)$ for the solution to this IVP.

(2 points)

1b) Solve the initial value problem above. (Your solution should be consistent with the correct answer to part (a) above.)

(6 points)

1c) Use Newton's Law to convert the following information below into a differential equation initial value problem - your IVP should end up being equivalent to the IVP at the top of this page, if you keep track of your units correctly.

A cannister is suspended underwater, at the surface of a deep body of water. At time $t = 0$ the cannister is released, to descend into the depths. The cannister weighs 320 pounds on dry land but because of its volume it is also subject to a buoyancy force of 120 pounds when underwater. In addition, while descending the cannister is subject to a drag force of 20 pounds for each foot per second of speed. Specifying that "up" is the positive direction, derive the IVP for the cannister's velocity after release. (Hint: recall that a dry-land weight of 32 pounds = mg corresponds to a mass of 1 slug in the English system.)

(2 points)