

QUIZ 1

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1. 6 points A particle moves along a line, with velocity  $v = \frac{ds}{dt}$  and initial position given by:

$$v = 1 + e^{-2t}, \quad s(0) = 1$$

Find the particle's position at time  $t$ .

2. 6 points A sailboat is running along a straight course with the wind providing a constant force of 100 lb. The only other force acting on the boat is water resistance, equal to 8 times the boat's speed. The boat starts at time  $t = 0$  with speed 2 feet/sec.
- (a) Write down an Initial Value Problem (differential equation + initial condition) describing the boat's speed.
- (b) What is the maximum velocity in feet per second?

3. 8 points Consider the following autonomous differential equation:

$$\frac{dy}{dt} = y^2 + 2y - 3$$

- (a) Identify the equilibrium values. Which are stable and which are unstable?
- (b) Construct a phase line. Identify the signs of  $y'$  and  $y''$ .
- (c) Sketch several (significant) solution curves.

[You may answer all parts in one big diagram.]