Math 274 Quiz 1 **Name:** ____________________

Sections: 1.1-1.3, Phase Line Point values in $\boxed{\text{boxes}}$.

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1. Consider the initial value problem
$$\frac{dy}{dx} = -y^2, \qquad y(1) = 2. \tag{1}$$

   (a) $\boxed{2}$ Verify $y(x) = \dfrac{1}{x+c}$, where c is an arbitrary constant, is a one-parameter family of solutions to $\dfrac{dy}{dx} = -y^2$.

   (b) $\boxed{2}$ Does Theorem 1 (Existence/Uniqueness) apply to the initial value problem (1)? Why, or why not?

   (c) $\boxed{2}$ Solve the initial value problem (1), i.e. find c so that $y(x) = \dfrac{1}{x+c}$ satisfies the initial data[1].

[1] The solution to an initial value problem is not a number, so your solution should not be of the form $c = 7$ with a box around it. What type of thing is a solution to an intial value problem?

2. $\boxed{4}$ For each of the following equations, label the equilibria and classify each as a sink, source, or node on the phase line. Include direction arrows. Additionally, for each, predict the asymptotic behavior as $t \to \infty$ of the solution satisfying $y(0) = -0.5$.

(a) $\dfrac{dy}{dt} = -y^2$

(b) $\dfrac{dy}{dt} = 1 - y^2$