Math 274 Homework **Name:** ____________________

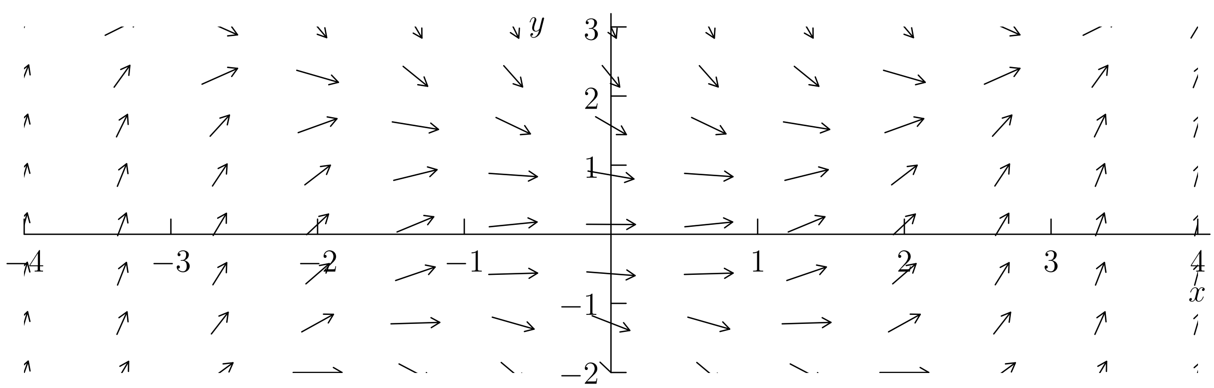
Sections: 1.1-1.3, Phase Line Point values in boxes.

Due: May 2018

1. [2] Verify $\phi(x) = \dfrac{x}{\ln|x| + c}$, where c is an arbitrary constant, is a one-parameter family of solutions to

$$\frac{dy}{dx} = \frac{y(x-y)}{x^2}.$$

2. [2] The direction field for $\frac{dy}{dx} = f(x,y)$ is shown below.



Sketch the solution curves satisfying the following initial data.

(a) $y(0) = 0$ (b) $y(-1) = 2$ (c) $y(0) = -1$

3. [2] 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 $y(0) = 0.9$.

(a) $y' = y^4 - y^2$

(b) $y' = y^4 - y^2 + 0.1$

4. $\boxed{1}$ Review Integration by Parts and evaluate

$$\int x^2 e^{-3x}\, dx.$$

5. $\boxed{1}$ Review Partial Fraction Decomposition and evaluate

$$\int \frac{2}{y^2 - 1}\, dy.$$

6. $\boxed{1}$ Read section 2.2 in your text. The differential equation

$$\frac{dy}{dx} = \frac{x^2 y^2 - x^2}{2e^{3x}} \tag{1}$$

is separable, find an implicit general solution. You should find the integrals above useful.

7. $\boxed{1}$ Verify that both $y \equiv 1$ and $y \equiv -1$ are solutions to (1). Both solutions were lost when we solved the equation; when were they lost?