1. Compute $\det A$ where

$$A = \begin{bmatrix} 3 & 2 & 1 \\ 0 & 1 & -1 \\ 1 & -2 & 6 \end{bmatrix}. $$

2. Find the general solution to the differential equation

$$x^2 y'' - xy' - 8y = 0.$$ 

3. Find the general solution to the differential equation

$$y' + xy = 3x.$$ 

4. For what values of $p$ is $A$ invertible where

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & p & -1 \\ p & 1 & -1 \end{bmatrix}. $$

5. Find the eigenvalues and eigenvectors of $A$ where

$$A = \begin{bmatrix} 9 & -1 & -7 \\ -2 & 2 & -2 \\ -7 & -1 & 9 \end{bmatrix}. $$

6. Circle the phase portrait below which is consistent with the first order, nonlinear, autonomous system

$$\frac{dx}{dt} = y(y - 1)(2x - 3),$$

$$\frac{dy}{dt} = x(2y - 1)(x - 3).$$