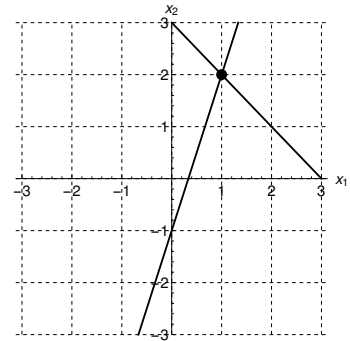


3. [14 points] In the following, the matrices  $\mathbf{A}$  and  $\mathbf{B}$  are  $2 \times 2$  real-valued matrices. The vector  $\mathbf{x}$  is a  $2 \times 1$  vector  $\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$

a. [7 points] If  $\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$  and the solution to  $\mathbf{Ax} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$  is illustrated in the figure to the right, what are the eigenvalues of  $\mathbf{A}$ ?



b. [7 points] Suppose that  $\mathbf{B} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$  and  $\mathbf{B} \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$ . What is the general solution to  $\mathbf{x}' = \mathbf{Bx}$ ?