1. The direction field for a system of differential equations is given below.
   (a) Starting at the point labelled A, draw the solution curve.
   (b) Sketch the curves $x(t), y(t)$ from the solution curve in part a.

2. Find the equilibrium points of the system:
   \[
   \frac{dx}{dt} = y, \quad \frac{dy}{dt} = x - x^3 - y.
   \]
3. Match the direction field with the system. Explain your answers.

(a) 
\[ \frac{dx}{dt} = -x + 1, \quad \frac{dy}{dt} = y \]

(b) 
\[ \frac{dx}{dt} = -1 + x, \quad \frac{dy}{dt} = y \]

(c) 
\[ \frac{dx}{dt} = 1 - x^2, \quad \frac{dy}{dt} = -y \]

(d) 
\[ \frac{dx}{dt} = 2y, \quad \frac{dy}{dt} = x \]

(e) 
\[ \frac{dx}{dt} = x + y, \quad \frac{dy}{dt} = x \]

(f) 
\[ \frac{dx}{dt} = 2x, \quad \frac{dy}{dt} = y \]
My answer is:
My reasons for choosing this answer are:
My answer is:
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4. Find the solution to the initial value problems.
   
   (a) 
   \[
   \frac{dx}{dt} = xy, \quad \frac{dy}{dt} = y + 1, \quad x(0) = 1, \ y(0) = 0.
   \]

   (b) 
   \[
   \frac{dY}{dt} = \begin{bmatrix} 4 & -2 \\ 1 & 1 \end{bmatrix} Y, \quad Y(0) = (3, -1).
   \]

5. Find the general solution to the differential equation \( Y' = AY \) where \( A \) is given below.
   
   (a) 
   \[
   A = \begin{bmatrix} 0 & 1 \\ -2 & -2 \end{bmatrix}
   \]

   (b) 
   \[
   A = \begin{bmatrix} 2 & 1 \\ -1 & 4 \end{bmatrix}
   \]