

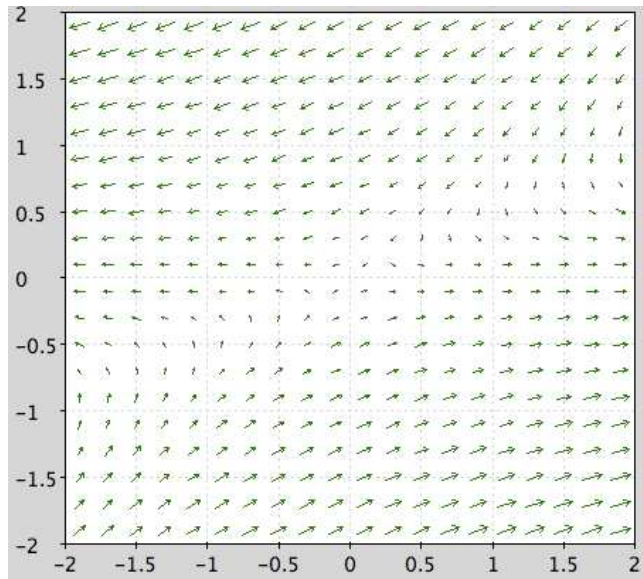
MathQuest: Differential Equations

Phase Portraits and Vector Fields of Systems

1. If we were graphing a vector field in the phase plane of the linear system $Y' = \begin{bmatrix} -4 & 2 \\ 2 & 4 \end{bmatrix} Y$, what slope would we graph when $y_1 = 1$ and $y_2 = 2$?

- (a) 0
- (b) ∞ (vertical)
- (c) 1
- (d) None of the above

2. Which linear system matches the direction field below?



(a)

$$\begin{aligned}x' &= y \\y' &= 2y - x\end{aligned}$$

(b)

$$\begin{aligned}x' &= x - 2y \\y' &= -y\end{aligned}$$

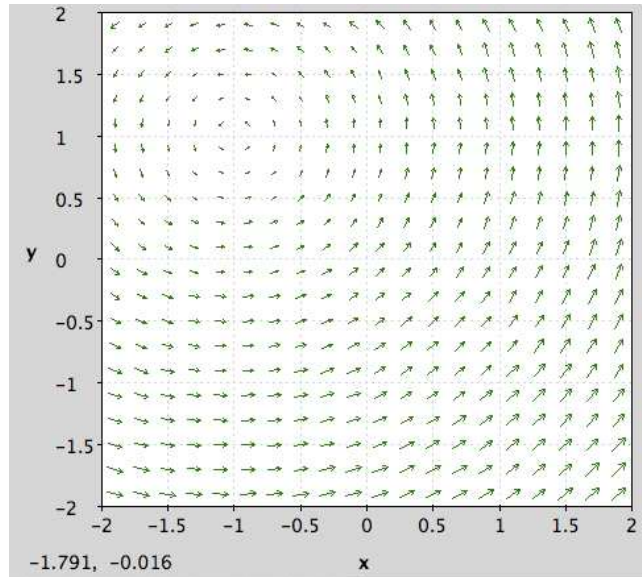
(c)

$$\begin{aligned}x' &= x^2 - 1 \\y' &= -y\end{aligned}$$

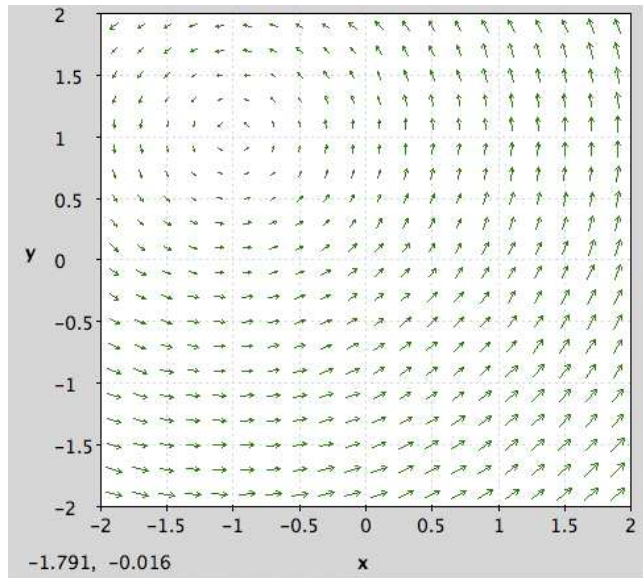
(d)

$$\begin{aligned}x' &= x + 2y \\y' &= -y\end{aligned}$$

3. Suppose you have the direction field below. At time $t = -2$, you know that $x = -2$ and $y = -.25$. What do you predict is the value of y when $t = 0$?

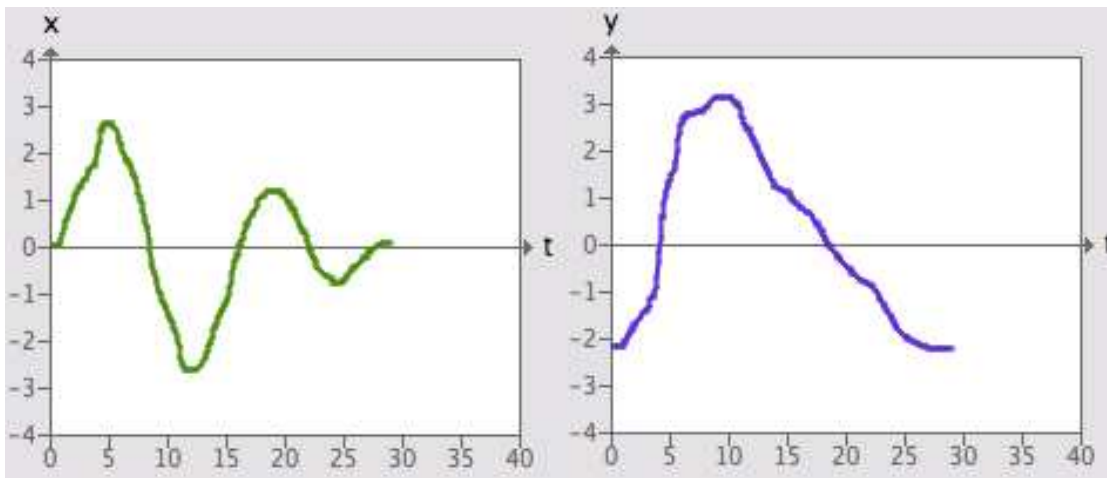


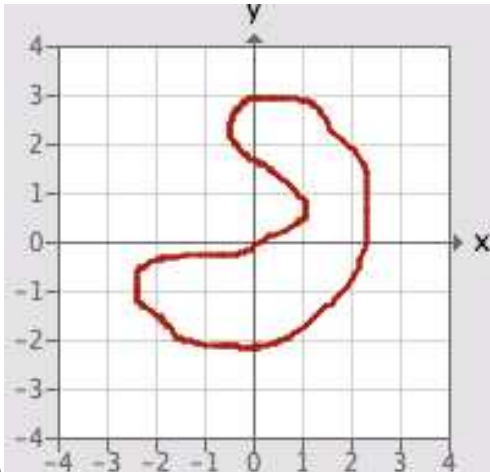
- (a) $y \approx -1$
(b) $y \approx 1$
(c) $y \approx 0$
(d) We cannot tell from the information given.
4. Suppose you have the direction field below. We know that at time $t = 0$, we have $x = -2$ and $y = -.25$. The pair $(x(t), y(t))$ is a solution that satisfies the initial conditions. When $y(t) = 0$, about what should $x(t)$ be equal to?



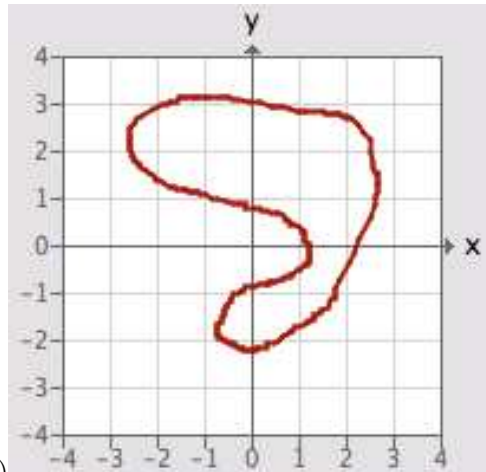
- (a) $x \approx -2$
- (b) $x \approx -1$
- (c) $x \approx 0$
- (d) $x \approx 1$
- (e) We cannot tell from the information given.

5. Which of the following solution curves in the phase plane might correspond to the solution functions $x(t)$ and $y(t)$ graphed below.

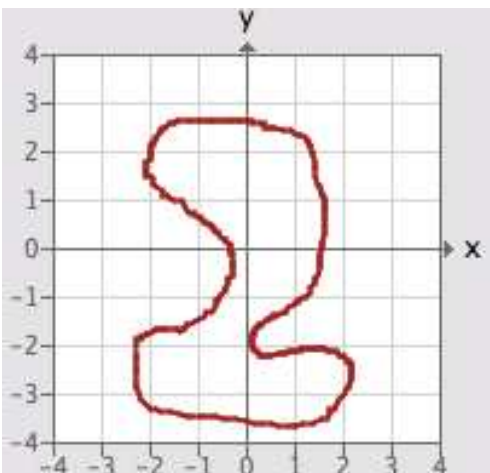




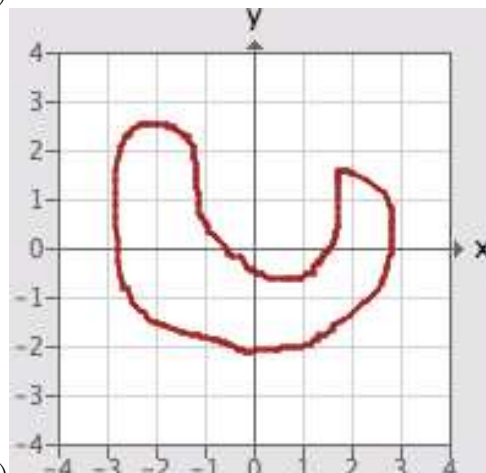
(a)



(b)



(c)



(d)