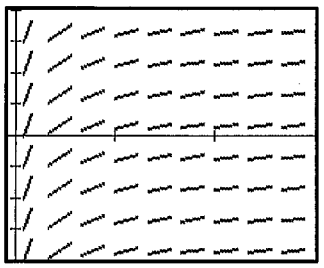
7.4 Reasoning Using Slope Fields

Calculus

Practice

The slope field from a certain differential equation is shown for each problem. The multiple choice answers are either differential equations OR a specific solution to that differential equation.

1.



(A) $y = \ln x$

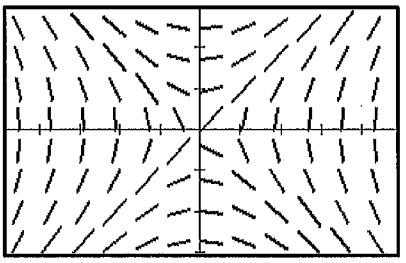
(B) $y = e^x$

(C) $y = e^{-x}$

(D) $y = \cos x$

(E) $y = x^2$

2.



(A) $\frac{dy}{dx} = x + y$

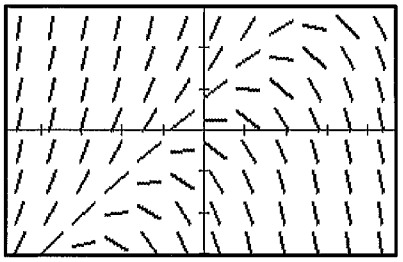
(B) $\frac{dy}{dx} = \frac{x}{y}$

(C) $\frac{dy}{dx} = \frac{y}{x}$

(D) $\frac{dy}{dx} = (x-1)y$

(E) $\frac{dy}{dx} = x(y-1)$

3.



(A) $\frac{dy}{dx} = y - x$

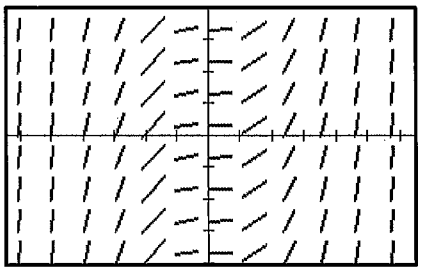
(B) $\frac{dy}{dx} = -\frac{x}{y}$

(C) $\frac{dy}{dx} = -\frac{y}{x}$

(D) $\frac{dy}{dx} = y(x-1)$

(E) $\frac{dy}{dx} = x(y-1)$

4.



(A) $y = \sin x$

(B) $y = \cos x$

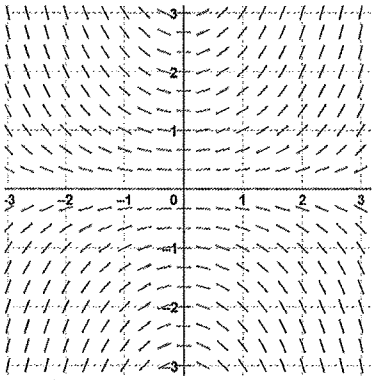
(C) $y = x^2$

(D) $y = \frac{1}{6}x^3$

(E) $y = \frac{1}{4}x^4$

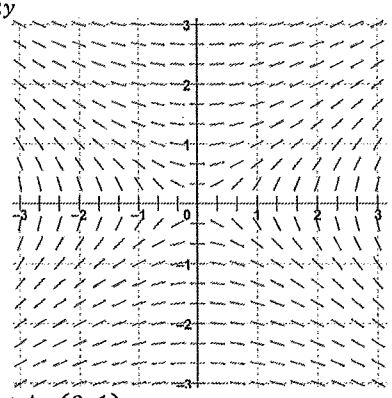
For each slope field, plot and label the points A and B and sketch the particular solution that passes through each of those points. (Two separate solutions for each slope field.)

5. $\frac{dy}{dx} = \frac{xy}{2}$



Point A: $(0, 1)$
Point B: $(-2, -1)$

6. $\frac{dy}{dx} = \frac{x}{2y}$



Point A: $(0, 1)$
Point B: $(-2, 0)$

2

Calculus

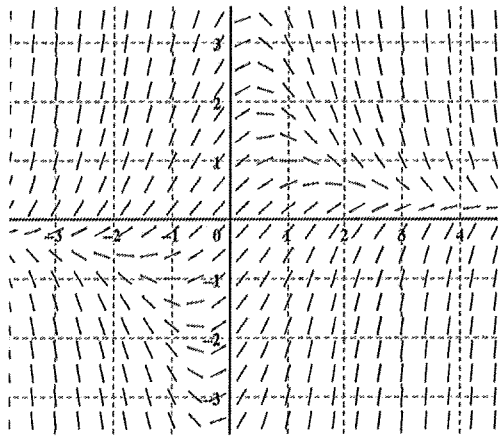
7.4 Reasoning Using Slope Fields

Notes

Write your questions and thoughts here!

Identify the particular solution that goes through a point.

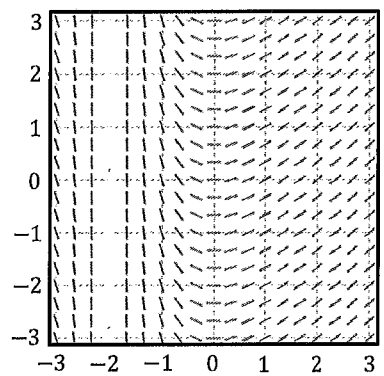
1. The figure to the right shows the slope for the differential equation $\frac{dy}{dx} = 1 - xy$.
   a. Sketch the graph of a particular solution that contains $(0, 2)$. Label this point as Point A.
   b. Sketch the graph of a particular solution that contains $(-1, -2)$. Label this point as Point B.



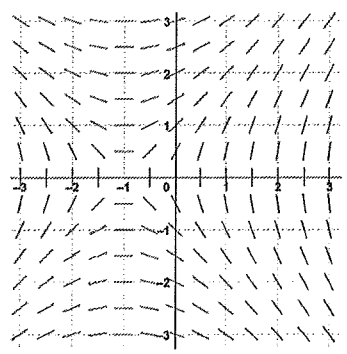
2. The slope field for a certain differential equation is shown to the right. Which of the following could be a solution to the differential equation with the initial condition $y(0) = 0$?

   (A) $y = \frac{x}{x^2-4}$ (C) $y = e^{x+2}$

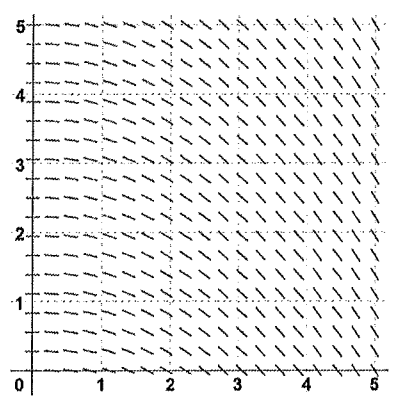
   (B) $y = \frac{\tan x}{2+x}$ (D) $y = \frac{x^2}{2+x}$



3. Consider the differential equation $\frac{dy}{dx} = \frac{x+1}{y}$ and its slope field shown. Describe all points in the xy-plane, $y \neq 0$, for which $\frac{dy}{dx} = -1$.



4. Explain why the following could not be a slope field for the differential equation $\frac{dy}{dt} = -0.3y$

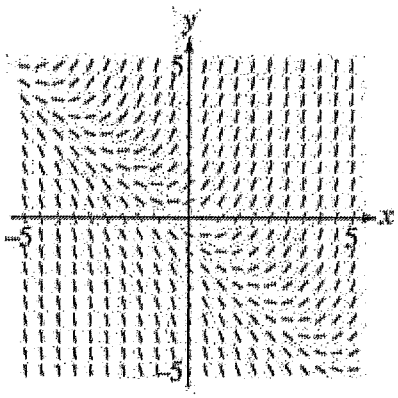


3

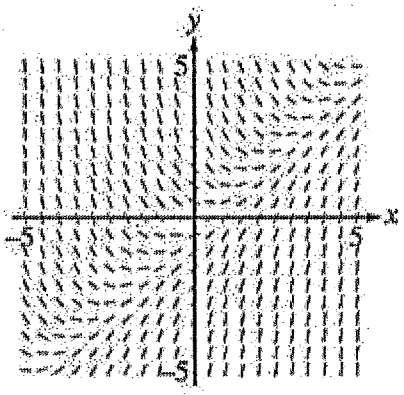
3. (calculator not allowed)

Which of the following is a slope field for the differential equation $\frac{dy}{dx} = \frac{x}{y}$?

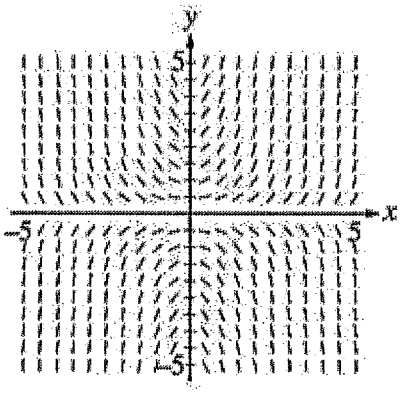
(A)



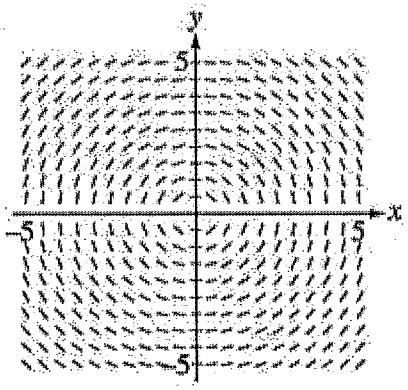
(B)



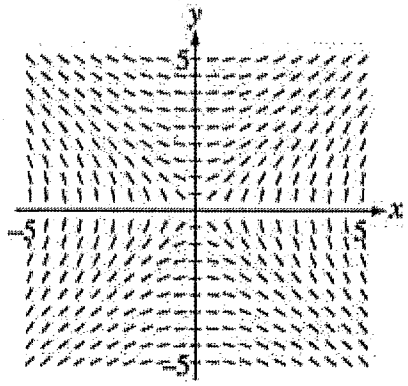
(C)



(D)

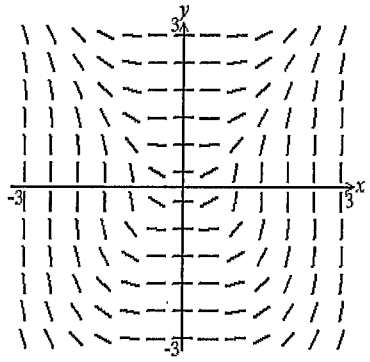


(E)



4

4. (calculator not allowed)



Shown above is a slope field for which of the following differential equations?

(A) $\frac{dy}{dx} = \frac{x}{y}$

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

(C) $\frac{dy}{dx} = \frac{x^3}{y}$

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

(E) $\frac{dy}{dx} = \frac{x^3}{y^2}$

5. (calculator not allowed)

Which of the following is the solution to the differential equation $\frac{dy}{dx} = 3\cos(2x)$ with the initial condition $y\left(\frac{\pi}{2}\right) = 2$?

(A) $y = -\frac{3}{2}\sin(2x) + 2$

(B) $y = \frac{3}{2}\sin(2x) + 2$

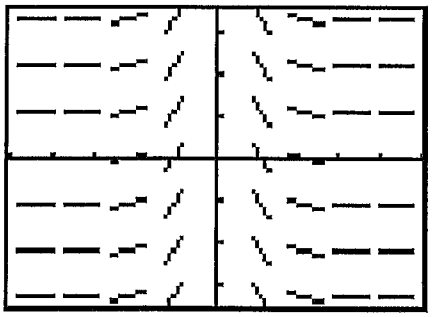
(C) $y = \frac{3}{2}\sin(2x) - 2$

(D) $y = 3\sin(2x) + 5$

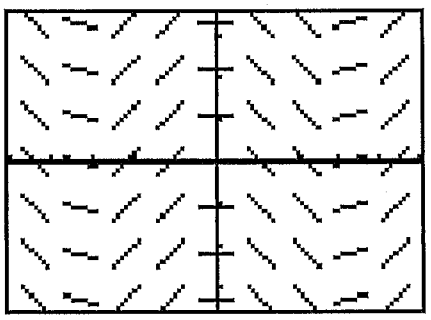
5

For 7 – 12, match each slope field with the **equation** that the slope field could represent.

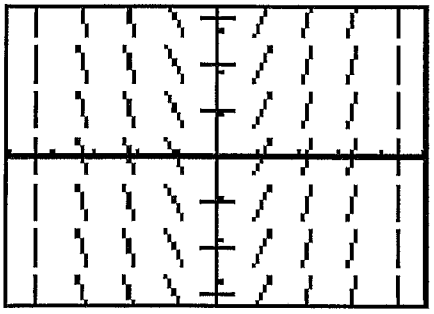
7.



8.



9.



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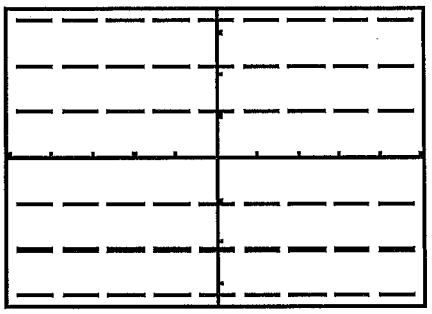

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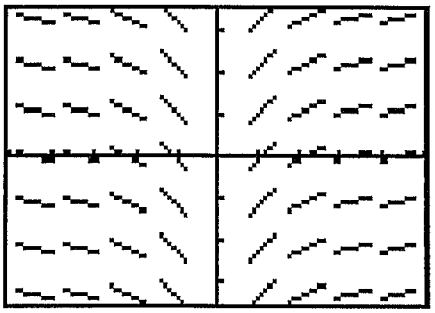
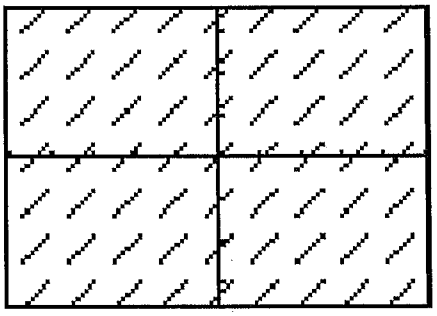


12.



(A) $y = 1$

(B) $y = x$

(C) $y = x^2$

(D) $y = \frac{1}{6}x^3$

(E) $y = \frac{1}{x^2}$

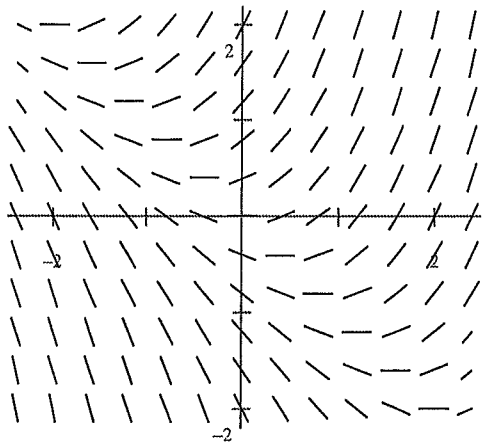
(F) $y = \sin x$

(G) $y = \cos x$

(H) $y = \ln|x|$

6

10.
1998 BC 24



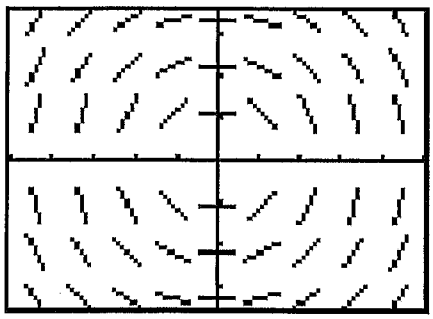
Shown above is the slope field for which of the following differential equations?

(A) $\frac{dy}{dx} = 1 + x$ (B) $\frac{dy}{dx} = x^2$ (C) $\frac{dy}{dx} = x + y$ (D) $\frac{dy}{dx} = \frac{x}{y}$ (E) $\frac{dy}{dx} = \ln y$

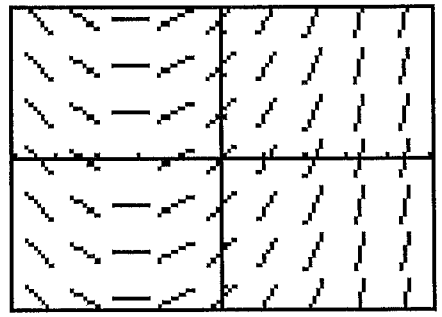
7

For 13 – 16, match the slope fields with their differential equations.

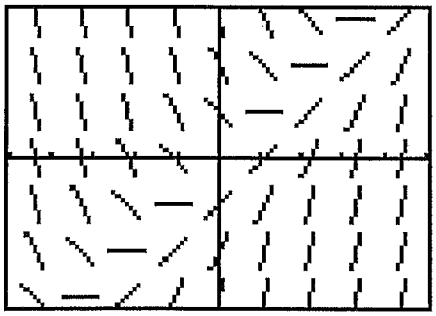
13.



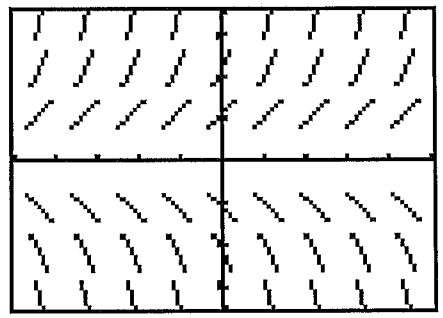
14.



15.



16.



(A) $\frac{dy}{dx} = \frac{1}{2}x + 1$

(B) $\frac{dy}{dx} = x - y$

(C) $\frac{dy}{dx} = y$

(D) $\frac{dy}{dx} = -\frac{x}{y}$

17. The calculator-drawn slope field for the differential equation $\frac{dy}{dx} = x + y$ is shown in the figure below.

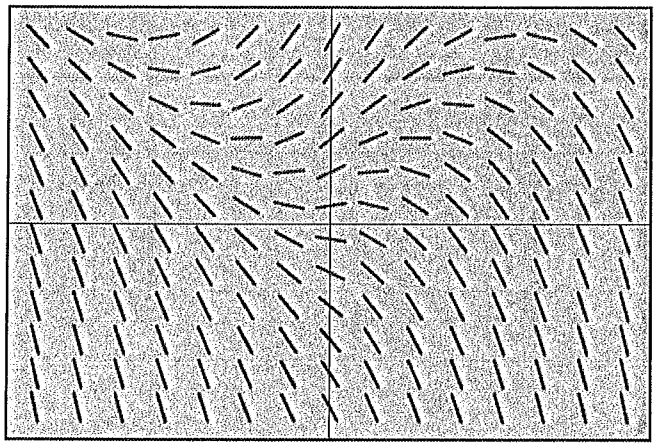
(a) Sketch the solution curve through the point $(0,1)$.

(b) Sketch the solution curve through the point $(-3,0)$.

(c) Approximate $y(-3.1)$ using the equation of the tangent line to $y = f(x)$ at the point $(-3,0)$.

8

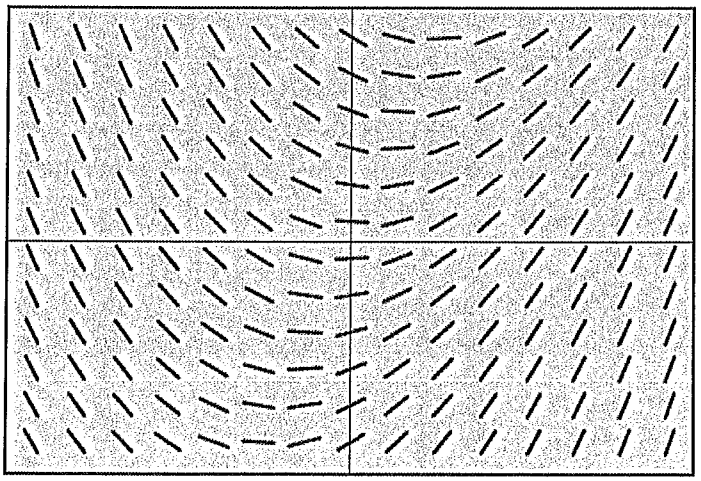
22. Which of the following differential equations would produce the slope field shown below?



[–3, 3] by [–1.98, 1.98]

(A) $\frac{dy}{dx} = y - |x|$ (B) $\frac{dy}{dx} = |y| - x$ (C) $\frac{dy}{dx} = |y - x|$ (D) $\frac{dy}{dx} = |y + x|$ (E) $\frac{dy}{dx} = |y| - |x|$

23. Which of the following differential equations would produce the slope field shown below?



(A) $\frac{dy}{dx} = y - 3x$ (B) $\frac{dy}{dx} = y - \frac{x}{3}$ (C) $\frac{dy}{dx} = y + \frac{x}{3}$ (D) $\frac{dy}{dx} = x + \frac{y}{3}$ (E) $\frac{dy}{dx} = x - \frac{y}{3}$