10.1 Slope Fields

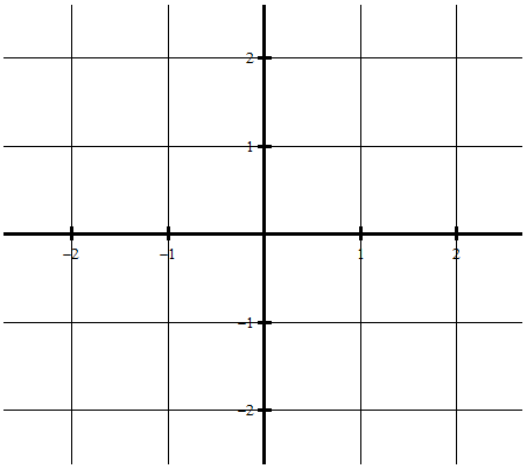
NOTES

CALCULUS

Write your questions here!

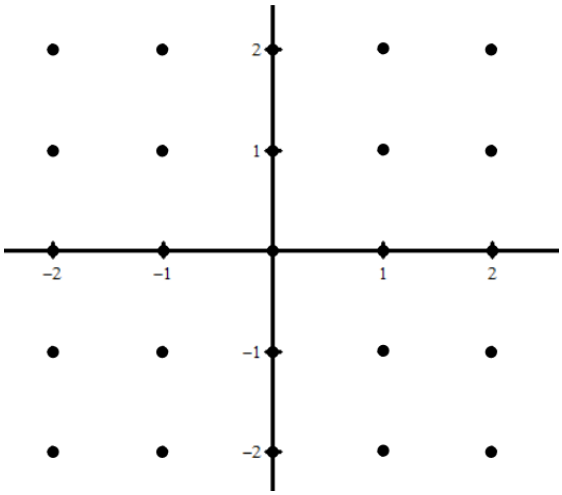
Differential Equations = equation that involves a derivative

$$\frac{dy}{dx} = 2x$$



Create a Slope Field

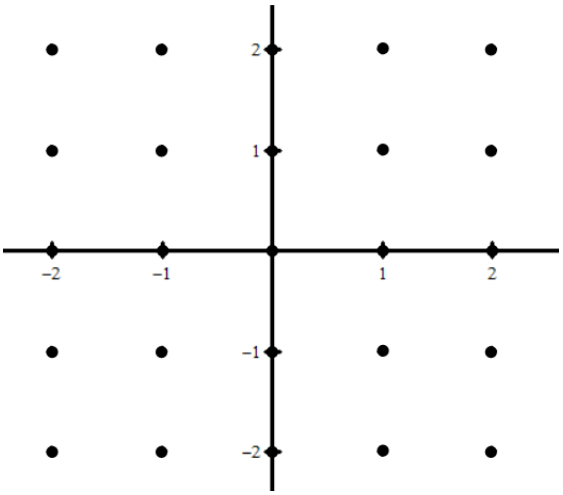
$$\frac{dy}{dx} = xy$$



What is the slope at (1, -2)

Create a Slope Field

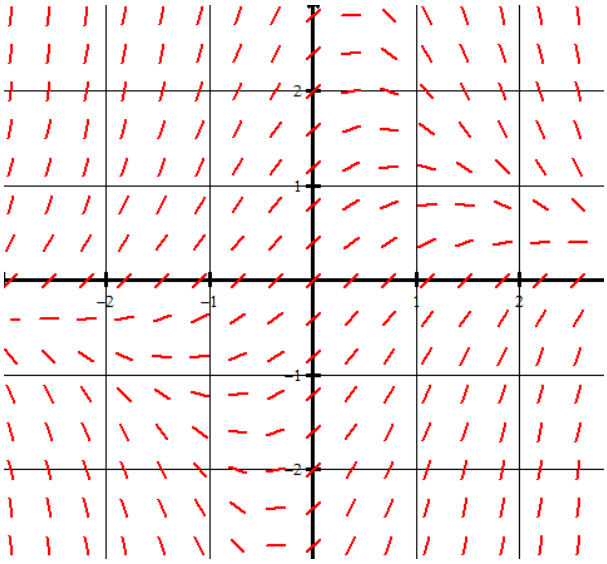
$$\frac{dy}{dx} = y - 2x$$



Let f be the function that satisfies the given differential equation. Write an equation for the tangent line to the curve $y = f(x)$ through the point $(1, -2)$.

Particular Solution

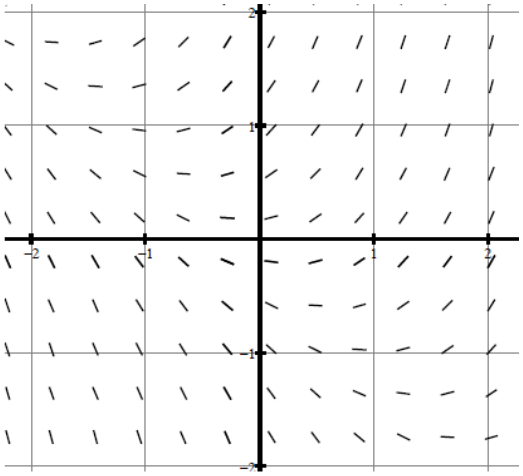
The figure below shows the slope for the differential equation $\frac{dy}{dx} = 1 - xy$



(A) Sketch the graph of a particular solution that contains $(0,2)$.

(B) Sketch the graph of a particular solution that contains $(1,-1)$.

Shown below is the slope field for which differential equation?



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

SUMMARY:

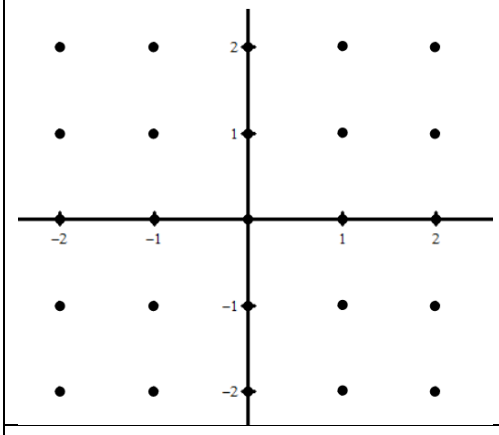
Now, summarize your notes here!

10.1 Slope Fields

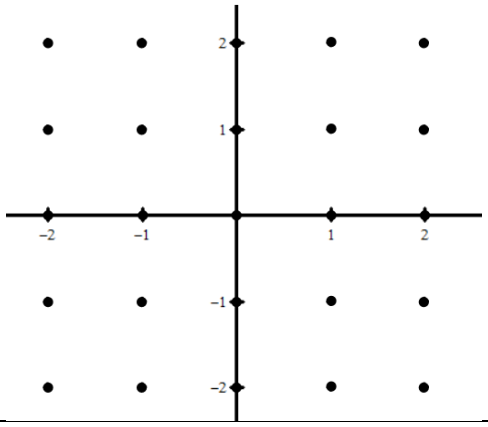
PRACTICE

Draw a slope field for each of the following differential equations.

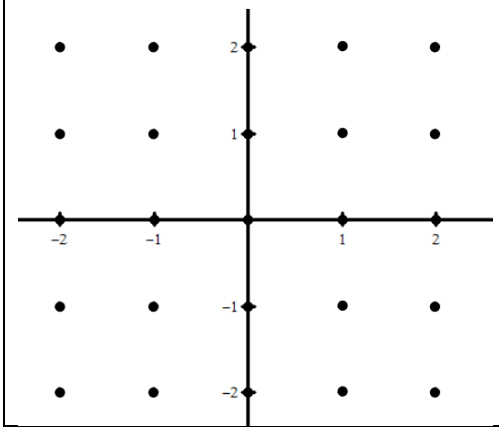
1. $\frac{dy}{dx} = x + 1$



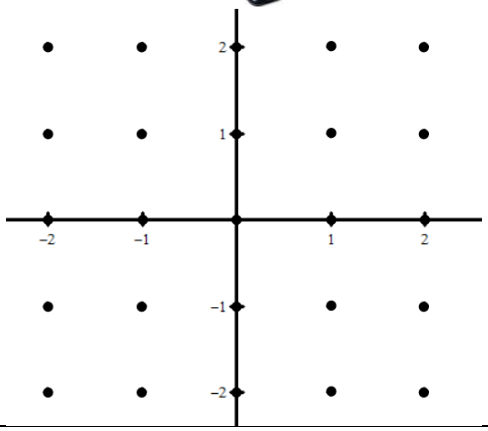
2. $\frac{dy}{dx} = 2y$



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

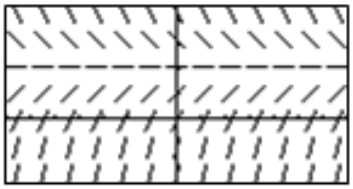


4. $\frac{dy}{dx} = \cos x$

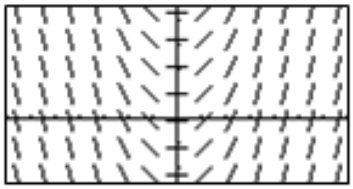


Match the slope fields with their differential equations.

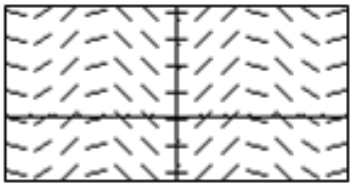
(A)



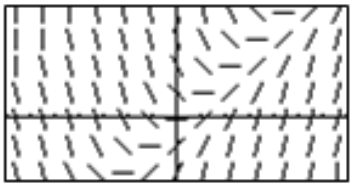
(B)



(C)



(D)



7. $\frac{dy}{dx} = \sin x$

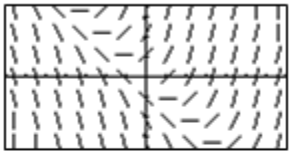
8. $\frac{dy}{dx} = x - y$

9. $\frac{dy}{dx} = 2 - y$

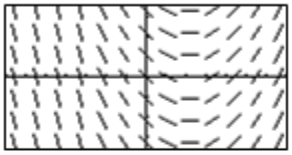
10. $\frac{dy}{dx} = x$

Match the slope fields with their differential equations.

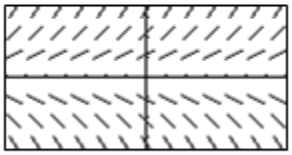
(A)



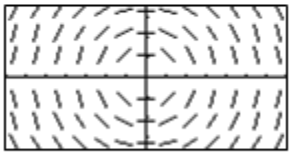
(B)



(C)

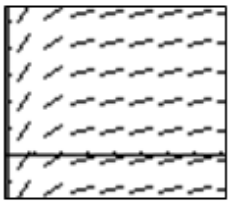


(D)



11. $\frac{dy}{dx} = .5x - 1$ 12. $\frac{dy}{dx} = .5y$ 13. $\frac{dy}{dx} = -\frac{x}{y}$ 14. $\frac{dy}{dx} = x + y$

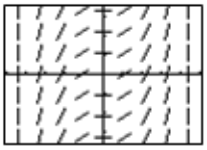
15.



The slope field from a certain differential equation is shown above. Which of the following could be a specific solution to that differential equation?

(A) $y = x^2$ (B) $y = e^x$ (C) $y = e^{-x}$ (D) $y = \cos x$ (E) $y = \ln x$

16.



The slope field for a certain differential equation is shown above. Which of the following could be a specific solution to that differential equation?

(A) $y = \sin x$ (B) $y = \cos x$ (C) $y = x^2$ (D) $y = \frac{1}{6}x^3$ (E) $y = \ln x$

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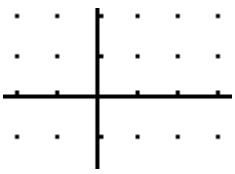
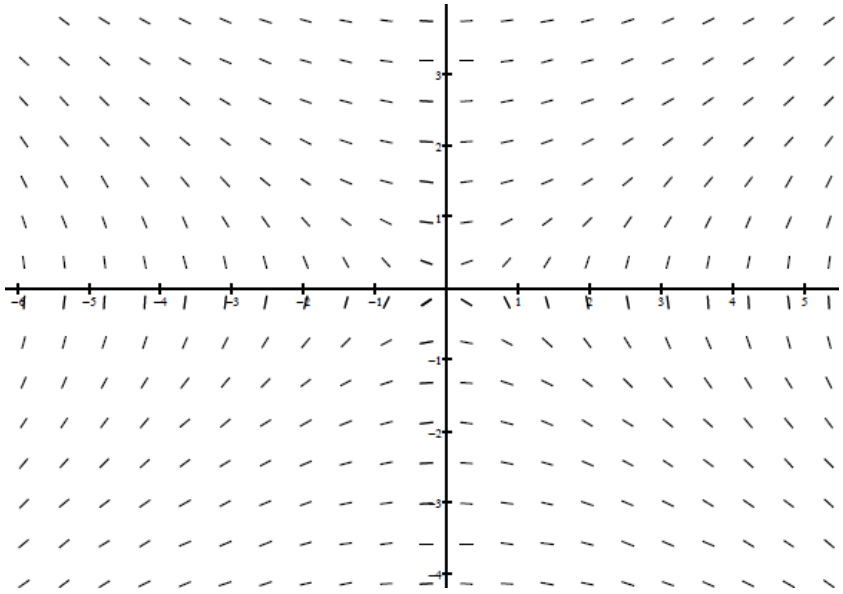
17. Consider the differential equation given by $\frac{dy}{dx} = \frac{xy}{2}$.

(a) On the axes provided, sketch a slope field for the given differential equation.



(b) Let f be the function that satisfies the given differential equation. Write an equation for the tangent line to the curve $y = f(x)$ through the point (1, 1). Then use your tangent line equation to estimate the value of $f(1.2)$.

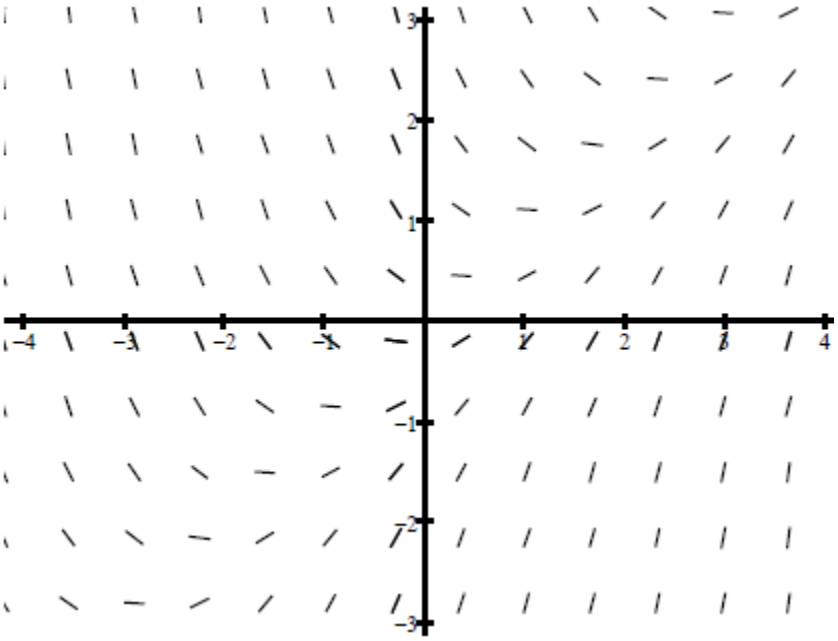
18. The figure below shows the slope field for the differential equation $\frac{dy}{dx} = \frac{x}{2y}$



a) Calculate $\frac{dy}{dx}$ at the point $(3,2)$ and verify that the result agrees with the figure.

b) Sketch the graph of the particular solution of the differential equation that contains the point $(1,2)$.

19. The figure below shows the slope field for the differential equation $\frac{dy}{dx} = x - y$

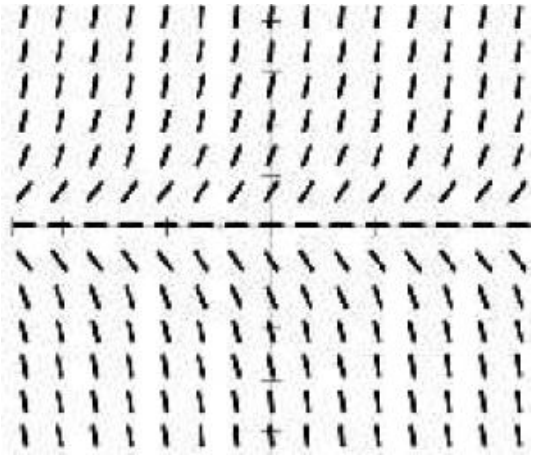


a) State a point where $\frac{dy}{dx} = 0$. Find $\frac{d^2y}{dx^2}$ and use it to verify if your point is a max or min.

b) Sketch the graph of the particular solution of the differential equation that contains the point $(-3,-1)$.

MULTIPLE CHOICE

1.



The slope field for a differential equation is shown at right. Which statement is true for all solutions of the differential equation?

I. For $x < 0$, all solutions are decreasing.
II. All solutions level off near the x-axis.
III. For $y > 0$, all solutions are increasing

(A) I only (B) II only (C) III only
(D) II and III only (E) I, II, and III

2.

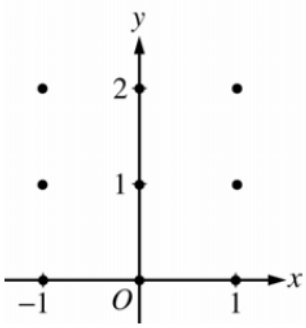
The slope field for the differential equation $\frac{dy}{dx} = \frac{x^2y + y^2}{4x + 2y}$ will have vertical segments when

(A) $y = 2x$ (B) $y = -2x$ (C) $y = -x^2$ only (D) $y = 0$ only (E) $y = 0$ or $y = -x^2$

FREE REPSONSE **Your score:_____ out of 7 points**

Question 5

Consider the differential equation $\frac{dy}{dx} = \frac{1}{2}x + y - 1$.



(a) On the axes provided, sketch a slope field for the given differential equation at the nine points indicated.
(Note: Use the axes provided in the exam booklet.)

(b) Find $\frac{d^2y}{dx^2}$ in terms of x and y. Describe the region in the xy-plane in which all solution curves to the differential equation are concave up.

(c) Let $y = f(x)$ be a particular solution to the differential equation with the initial condition $f(0) = 1$. Does f have a relative minimum, a relative maximum, or neither at $x = 0$? Justify your answer.