

## Lesson 7.3: Slope Fields

### Slope Fields

A \_\_\_\_\_ is a graphical representation of a set of slopes obtained from a \_\_\_\_\_. Remember, a differential equation involves a \_\_\_\_\_. That derivative represents the slopes for a function.

Even if you cannot separate variables and integrate, you can still use a differential equation to plot the slopes for a function.

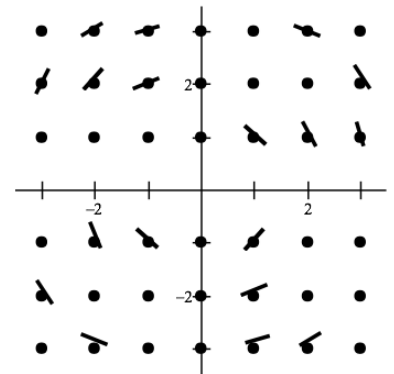
Examples:

- Find the slopes given by the differential equation  $\frac{dy}{dx} = \frac{-x}{y}$  at the following points:
  - (3, 2)
  - (-1, 3)
  - (-2, -1)
  - (2, -2)

Why can't you find the slopes when  $y = 0$ ?

- Find and plot the slopes given by  $\frac{dy}{dx} = \frac{-x}{y}$  for each remaining marked point (dot) in the coordinate plane at the right.
- In Example 2, you made what is known as a slope field. Starting at the point (0, 1), follow the flow of the slopes to sketch the solution sketch the solution curve containing (0, 1).

Your graph should be "parallel" to the slope lines and be like an "average of slopes" whenever it goes between lines.



Your solution curve must represent a function whose domain is the largest possible open interval containing the given point. Sketch the solution curve passing through (-1, 1) and one passing through (0, -3).

4. Solve the differential equation  $\frac{dy}{dx} = \frac{-x}{y}$ .

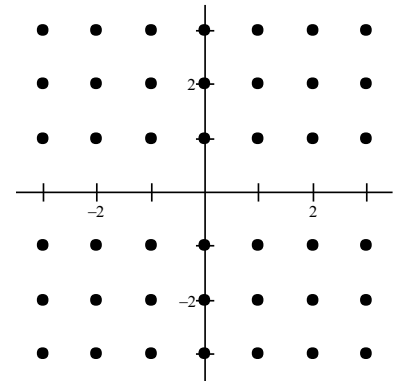
**Note:** Solving for  $y$  yields  $y = \underline{\hspace{2cm}}$  or  $y = \underline{\hspace{2cm}}$ .

Find the **particular solution** for this differential equation whose graph passes through the point  $(0, 1)$ .

Find the **particular solution** for this differential equation whose graph passes through the point  $(0, -3)$ .

5. For the differential equation  $y' = \frac{1}{y}$ :

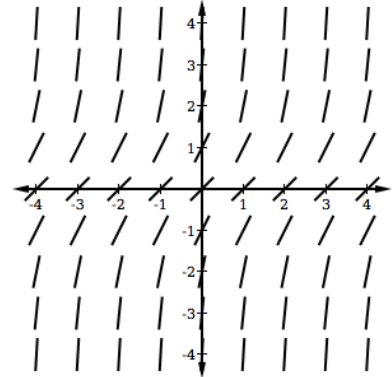
- Draw the slope field in the dot coordinate plane at the right.
- Graph the particular solutions passing through the points  $(-2, -1)$  and  $(2, 2)$  as a function of  $x$ .
- Solve the differential equation.



- Write as functions the particular solutions for the differential equation whose graphs pass through  $(-2, -1)$  and  $(2, 2)$ .

6. Which of the following differential equations below matches the slope field shown at the right?

- a.  $y' = x$                       d.  $y' = 1 + y^2$   
 b.  $y' = y$                         e.  $y' = 1 + x^2$   
 c.  $y' = x - y$



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

- a.  $y = e^x$                         d.  $y = -\ln(x)$   
 b.  $y = e^{-x}$                       e.  $y = \ln(x)$   
 c.  $y = -e^x$

