Teacher Notes

Activity 13

Introduction to Slope Fields

Objectives

- Understand what a slope field represents in terms of $\frac{dy}{dx}$
- Create a slope field for a given differential equation

Materials

- TI-84 Plus / TI-83 Plus
- Graph paper

Teaching Time

- 40 minutes

Abstract

This activity can be used as students' first introduction to the idea of slope fields.

Management Tips and Hints

Prerequisites

- Students should have a basic background in differentiation and be familiar with the basic language of differential equations.
- Students need not have studied any special techniques of antidifferentiation or symbolic solutions to differential equations, such as separation of variables.

This activity could be used as part of the introduction to antiderivatives in general.

Student Engagement

If you have an overhead projection device for the graphing handheld, then a particularly effective classroom activity is to project a grid of points (select **GridOn** in the **FORMAT Menu** with no functions selected) directly onto the board. Several students can come up one at a time and draw in one of the line segments making up the slope field for a particular:

$$\frac{dy}{dx}$$

You can then graph one or more potential solutions directly onto the student-made slope field to see how they fit.

Evidence Of Learning

Students should be able to create their own slope fields for a given differential equation and grid points using paper and pencil.

Common Student Errors/Misconceptions

Students often think that the graph of the expression for $\frac{dy}{dx}$ should fit the slope field represented by $\frac{dy}{dx}$.

For example, if $\frac{dy}{dx} = x^2$, students may expect parabolas to fit the slope field instead of cubics.

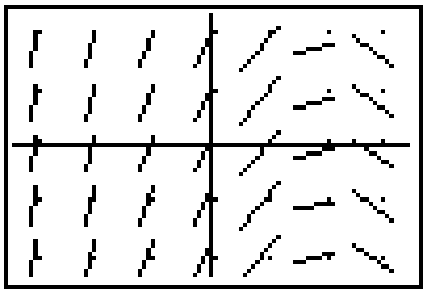
Extensions

A great way to illustrate the Fundamental Theorem of Calculus is to plot a slope field for $\frac{dy}{dx} = f(x)$ and then to plot functions of the form:

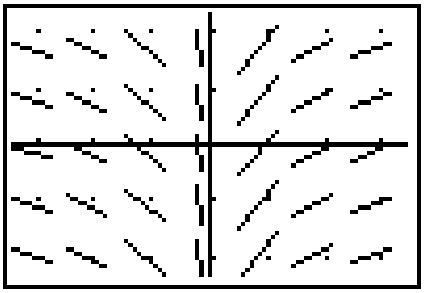
$$F(x) = \int_a^x f(t)dt$$

Activity Solutions

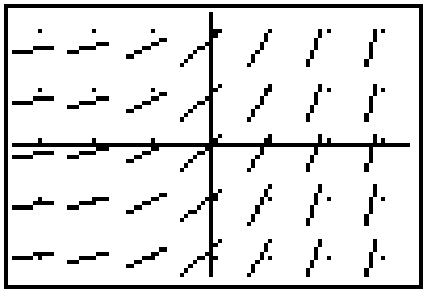
1. $\frac{dy}{dx} = 2 - x$



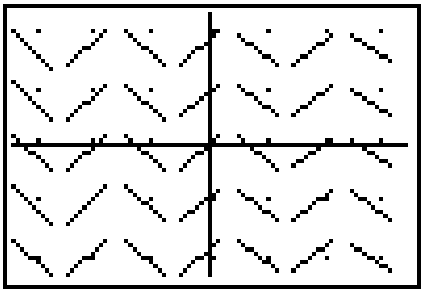
2. $\frac{dy}{dx} = \frac{1}{x}$



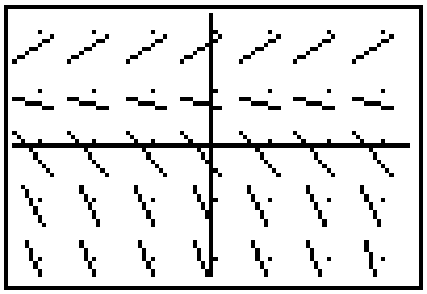
3. $\frac{dy}{dx} = 2^x$



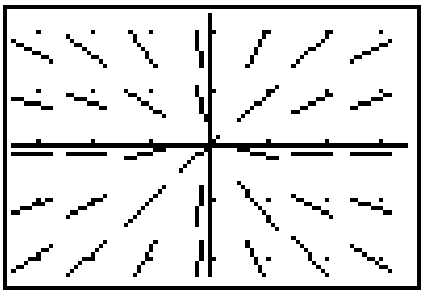
4. $\frac{dy}{dx} = \cos(\pi x)$



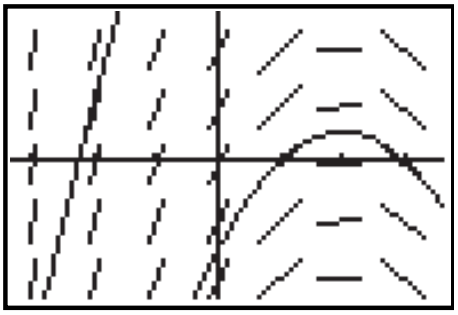
5. $\frac{dy}{dx} = y - 1$



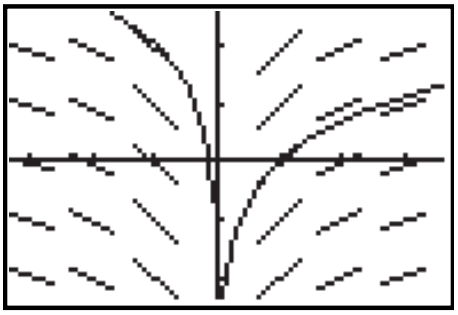
6. $\frac{dy}{dx} = \frac{y}{x}$



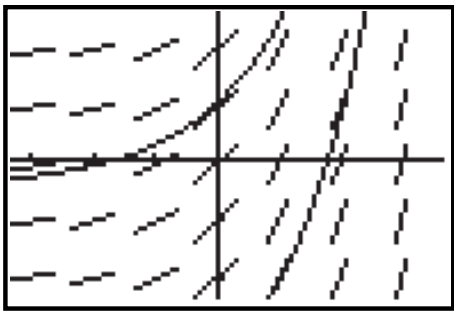
7. *g* (left), *f* (right)



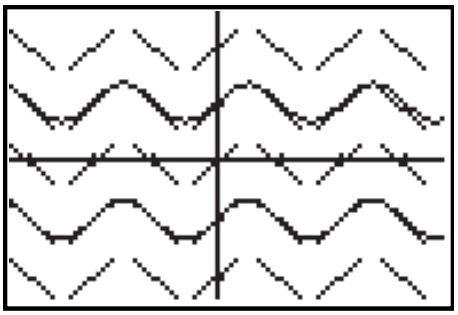
8. *g* (left), *f* (right)



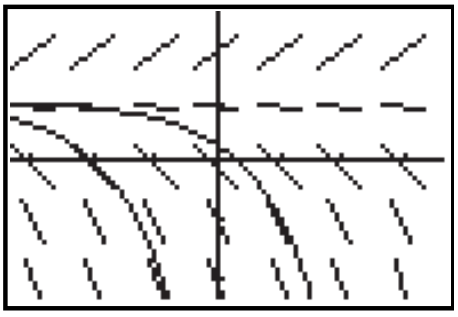
9. *f* (left), *g* (right)



10. *f* (lower), *g* (upper)



11. *f* (upper), *g* (lower)



12. *f, g* (same graph)