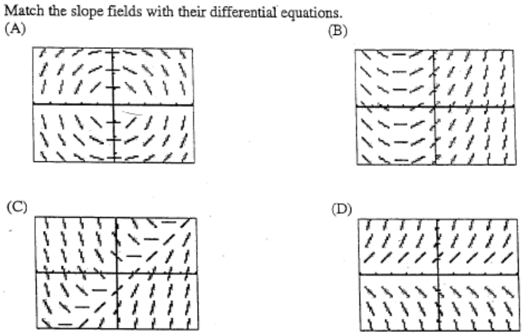
Matching Slope Fields

Match the slope fields with their differential equations.



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

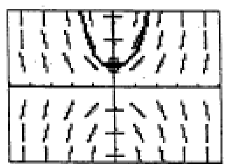
16. $\frac{dy}{dx} = y$

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

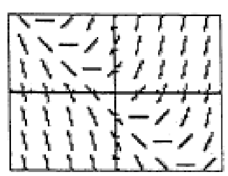
18. $\frac{dy}{dx} = -\frac{x}{y}$

Drawing Particular Solutions

19. The calculator drawn slope field for the differential equation $\frac{dy}{dx} = xy$ is shown in the figure below. The solution curve passing through the point (0, 1) is also shown.
    (a) Sketch the solution curve through the point (0, 2).
    (b) Sketch the solution curve through the point $(0, -1)$.



20. 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 $(-3, 0)$.



A.P.-ish Problem

Let $\frac{dy}{dx} = -xy^2$, and let $y = f(x)$ be the particular solution with initial condition $f(-1) = 2$.

(a) Write an equation for the tangent line to the graph of f at x = -1.

(b) Describe the points in the xy-plane for which the slopes will be negative.

(c) Find the particular solution $y = f(x)$ to the given differential equation with initial condition $f(-1) = 2$.

CSI: Grand Rapids

A murder victim is found at 9pm. The temperature of the body is measured at 90° F. One hour later, the temperature of the body is 89° F. The temperature of the room has been maintained at a constant 70° F. Assuming that the body cools according to Newton's Law of Cooling and the differential equation

$$\frac{dT}{dt} = k(T - 70),$$

Find a particular solution (you may choose when t=0 is) and determine the approximate time of the murder.

Random Derivative/Integrals

a. $f(x) = x^2 \cdot 2^{5x+1}$…find $f'(x)$

b. $g(x) = \log_6(x^2 + e^{2x})$…find $g'(x)$

c. $\int \cos 2x \cdot 4^{\sin 2x} dx =$

Derivatives of Inverses

Let $f(x) = x^3 - \frac{4}{x}$. If $g(x) = f^{-1}(x)$, find $g'(6)$.

Solving Differential Equations

Let $y' = \frac{x}{y}$.

a. Find the equation of the general solution.

b. Find the equation of the particular solution passing through (0, 1).

c. Using the Slopefld program, sketch the slope field for the diffEQ and the solution from part b. Verify that your solution follows the slope filed.

Exponential Change DiffEQ

The amount of radiation $R(t)$ in a certain liquid decreases at a rate proportional to the amount present.

a. Write a differential equation describing this relationship:

When the liquid is first found, the amount of radiation is 10^6 rads. After 150 seconds the radiation has dropped to 10^2 rads.

b. Express *R* as a function of *t*.

c. To the nearest second, when will the amount of radiation drop below 10 rads? Justify your conclusion analytically.

d. What is the half-life of this liquid?