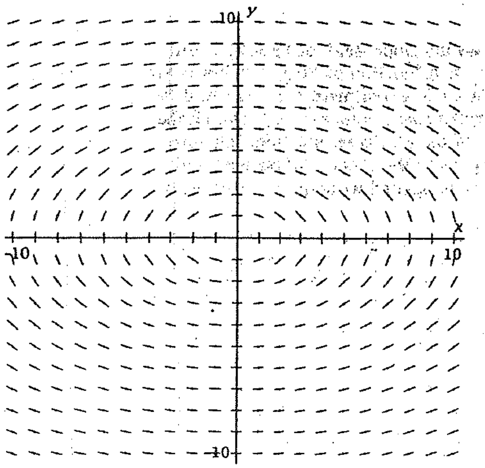
Name: ______________ Group Members: ______________________

Exploration 7-4a: Introduction to Slope Fields

Date: ________

Objective: Find graphically a particular solution of a given differential equation, and confirm it algebraically.



The figure above shows the slope field for the differential equation

$$\frac{dy}{dx} = -\frac{0.36x}{y}$$

1. From the differential equation, find the slope at the points (−5, −2) and (−8, 9). Mark these points on the figure. Tell why the slopes are reasonable.

2. Start at the point (0, 6). Draw a graph representing the particular solution of the differential equation which contains that point. The graph should be "parallel" to the slope lines and be some sort of average of the slopes if it goes between lines. Go both to the right and to the left. Where does the graph seem to go after it touches the *x*-axis? What geometric figure does the graph seem to be? Why should you not continue below the *x*-axis?

3. Start at the point (−5, −2) from Problem 1 and draw another particular solution of the differential equation. How is this solution related to the one in Problem 2?

4. Solve the differential equation algebraically. Find the particular solution that contains (0, 6). Verify that the graph really *is* the figure you named in Problem 2.

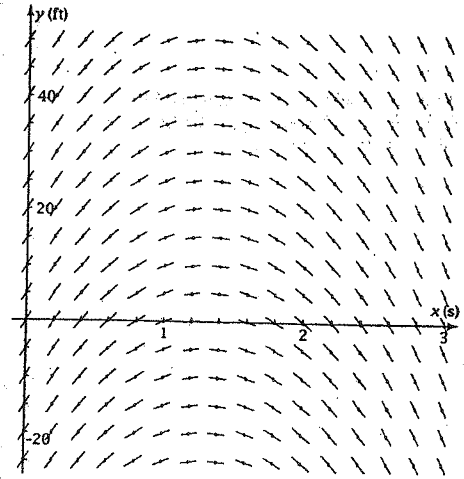
Name: ______________ Group Members: ______________________

Exploration 7-4b: Slope Field Practice

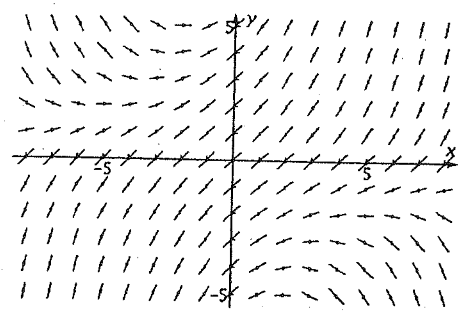
Date: ________

Objective: Solve a differential equation graphically, using its slope field, and make interpretations about various particular solutions.

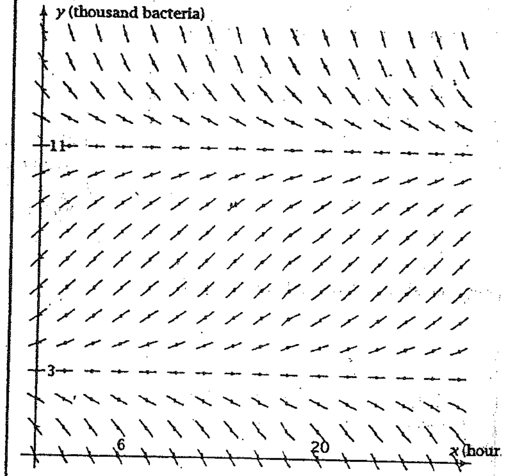
1. The figure shows the slope field for the vertical displacement, *y*, in feet, as a function of *x*, in seconds, since a ball was thrown upward with a particular initial velocity. Sketch *y* as a function of *x* if the ball starts at $y = 5$ ft when $x = 0$. Approximately when will the ball be at its highest? Approximately when will it hit the ground? If the ball is thrown starting at $y = -20$ when $x = 0$, at approximately what two times will it be at $y = 0$?



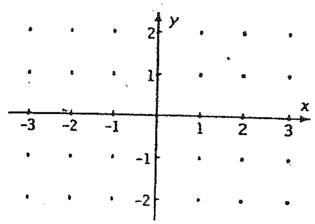
2. Sketch the particular solutions for these initial conditions: (−7, 2), (−5, −1), and (8, −4). Describe the difference in the patterns.



3. The figure shows the slope field for bacteria count *y*, in thousands, as a function of time, *x*, in hours. $x = 0$, $y = 15$. At $x = 6$, a treatment reduces *y* to 4. At $x = 20$, another treatment reduces *y* to 2. Sketch the three branches of the particular solution. Tell what eventually happens to the number of bacteria and what would have happened without the treatments.



4. Plot the slope field for $\frac{dy}{dx} = \frac{x}{y}$ at the grid points. On the slope field, plot the particular solutions for the initial conditions (2, 1), (0, −1), and (−2, −1).



IB Math 2: More Practice of Slope Field: Name: ______________ Period: ______

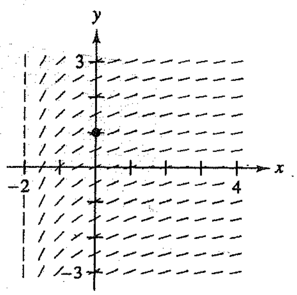
In these exercises, a differential equation, a point, and a slope field are given.

(a) Sketch two approximate solutions, one of which passes through the given point.

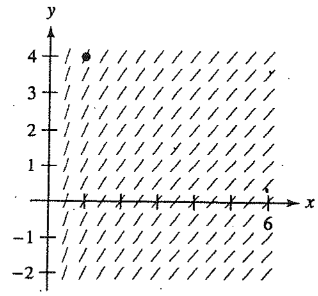
(b) Use integration to find the particular solution of the differential equation.

(c) Use graphing utility to graph the solutions from (a) and (b), and sketch the graphs to compare the results.

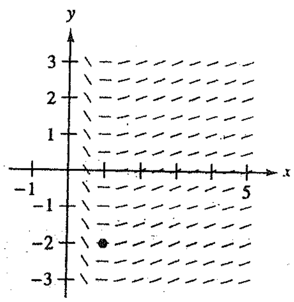
1. $\frac{dy}{dx} = \frac{1}{x+2}$, $(0, 1)$



2. $\frac{dy}{dx} = 1 + \frac{1}{x}$, $(1, 4)$



3. $\frac{dy}{dx} = \frac{\ln x}{x}$, $(1, -2)$



4. $\frac{dy}{dx} = \sec x$, $(0, 1)$