Name _____ Group _____ Date _____

Exploration 45: Euler's Method

Objective: Given a differential equation, find an approximation to a particular solution by a numerical method.

1. For the differential equation

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

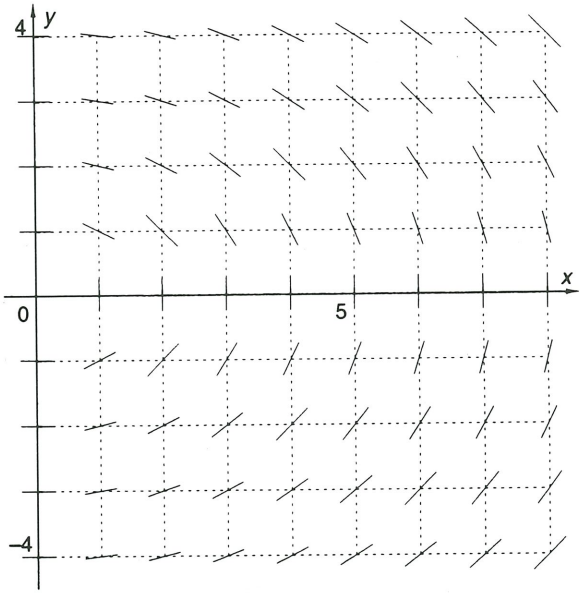
calculate the slope at the point (0, 3). Then calculate dy if $dx = 0.5$. Use the result to estimate the value of y at $x = 0.5$.

2. Calculate the slope at (0.5, y) from Problem 1. Then calculate dy if $dx = 0.5$. Use the result to estimate the value of y at $x = 1$.

3. Repeat the computations in Problems 1 and 2 for values of x from 1.5 through 7. Record the values in the table. This technique is called **Euler's method** for solving differential equations.

x	y	Slope	dy
0	3	0	0
0.5	3	–0.0833. . .	–0.0416. . .
1	2.9583. . .		
1.5			
2			
2.5			
3			
3.5			
4			
4.5			
5			
5.5			
6			
6.5			
7			

4. The graph below shows the slope field for this differential equation from $x = 0$ through $x = 7$. Plot the y-values from Problems 1 through 3 on this graph paper. For which values of x does the numerical solution by Euler's method seem to follow the slope field? For which values of x is the numerical solution clearly wrong?



5. Solve the differential equation in Problem 1 algebraically. Plot the particular solution that contains (0, 3). Explain why Euler's method gives meaningless answers for larger values of x.

6. What did you learn as a result of doing this Exploration that you did not know before?