PRACTICE EXAM I

MAT 209 · SPRING 2009

You must show all work to get full credit.

Problem 1 (10 points)**.** Solve the differential equation

$$\frac{dy}{dx} = xy$$

subject to the initial condition $y(0) = 2$.

Problem 2 (10 points)**.** Solve the differential equation

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

subject to the initial condition $y(0) = 3$.

Problem 3 (10 points)**.** Consider the initial value problem

$$\frac{dy}{dx} = x^3 - y$$

where $y(0) = 1$. Use the Eulers method with step size 0.25 to find the approximate value of $y(1)$. (Compute your answer to 3 decimal places.)

Problem 4 (10 points)**.** Consider the initial value problem

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

where $y(0) = 1$. Use the Modified Eulers method with step size 0.5 to find the approximate value of $y(1)$. (Compute your answer to 3 decimal places.)

Problem 5 (10 points)**.** Use geometric analysis to analyze the differential equation

$$\frac{dy}{dx} = -y^2 + 9y - 14$$

Your answer should include:

a) a graph of $g(y)$ vs. y , where $g(y)$ is the derivative of y as a function of y.
b) sketches of the solution curves $y(t)$ for the initial value problem $y(0) = 3$ and all steady state solutions.
c) show concavity and show the y of all inflection points for solution curves.
d) stability analysis for all steady state solutions.

Date: March 16, 2009 *Due Date*: Monday, March 16, 2009.

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