

Name _____ NetID _____

MATH 308 Exam I Spring 2008

Section 511 Maple Computations P. Yasskin

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At the top of your worksheet put:

> **restart**;

Your name.

Your NetID.

MATH 308 Sec 511 Exam 1

Feb 24, 2009

> **with(plots): with(DEtools):**

Number each problem and part.

1. (15 points) Consider the differential equation $\frac{dy}{dx} + \frac{y}{x} = 2x^2y^2$.

a. (5 pts) Find the general solution.

b. (3 pts) Find the specific solution satisfying the initial condition $y(1) = \frac{1}{2}$.

c. (4 pts) Plot the direction field of the differential equation for $0 \leq x \leq 2$.
Adjust the vertical range to a reasonable value.

d. (3 pts) Add to the direction field the solutions satisfying each of the initial conditions

$$y(1) = \frac{1}{4}, \quad y(1) = \frac{1}{2}, \quad y(1) = 1, \quad y(1) = 2$$

2. (15 points) Consider the initial value problem $\frac{dy}{dx} = \frac{x^2}{y^2} - 1$ with $y(1) = 2$.

a. (5 pts) Use Euler's method to estimate $y(2)$ using 5 steps. Suppress the output of the do loop. Plot the 6 points connected by straight line segments. What is the estimated $y(2)$?

b. (3 pts) Use Euler's method to estimate $y(2)$ using 100 steps. Suppress the output of the do loop. Plot the 101 points connected by straight line segments. What is the estimated $y(2)$?

c. (5 pts) Find a formula for $\frac{d^2y}{dx^2}$ in terms of only x and y . Compute $\left. \frac{d^2y}{dx^2} \right|_{x=1}$.

d. (2 pts) Are your estimates for $y(2)$ using Euler's method, larger or smaller than the correct value? Why? This requires no new computations. It requires a sentence response.