

Exam #1

Math 421-A

Friday, March 1, 2002

For full credit show all work. When in doubt, explain your reasoning.

1. Find all critical points for the following autonomous differential equation, construct a phase diagram, and determine if the critical points are stable, unstable, or neither:

$$\frac{dx}{dt} = x^4 - 16x^2$$

2. Describe the differences between a general solution and a particular solution.
3. Describe the differences between local and cumulative error in using Euler's method.
4. Solve the following population model:

$$\frac{dP}{dt} = 0.01P$$

where $P(2) = 1000$.

5. Solve the following differential equation:

$$y' + \frac{y}{x} = 2$$

6. Verify that the following equation is exact, and then solve it:

$$(\cos x + 2x \sin y) dx + (x^2 \cos y + \sin y) dy = 0$$

7. Solve the following differential equation, where $y(3) = 4$.

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

8. Solve the following differential equation:

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