

MT305.01: Advanced Calculus for Science Majors
Examination 1
February 10, 2012

Do all of your work in the blue booklets. Please label your answers clearly, as I will not have time to perform extensive searches for answers. No credit will be given for answers without explanations.

Cheating will result in a failing grade.

Calculators may not be used during this examination.

The problems are not arranged in order of increasing difficulty, so you might want to read all of them before beginning.

1. (18 points) Suppose that $2\frac{dx}{dt} + x + 1 = 0$, and $x(0) = 3$. Find an explicit expression for x in terms of t .
2. (18 points) Suppose that $\frac{dy}{dx} = \sin(y - x)$, and $y(0) = 1$. Find an implicit definition for y in terms of x .
3. (18 points) Suppose that $\frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$ and $y(1) = 2$. Find an explicit expression for y in terms of x .
4. (20 points) Suppose that $\frac{dy}{dt} + y = ty^2$, with $y(0) = 1$. Make the substitution $x = y^{-1}$ and solve the differential equation, finding an explicit expression for y in terms of t .
5. (26 points) Solve the differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 13y = e^{-2x}$ for y as a function of x .