

## STUDY GUIDE FOR MATH 302 MIDTERM 1

These are the sorts of questions you should know how to solve for the first midterm.

- (1) Verify that  $y(x) = 3e^x - \sin x$  gives a solution to the differential equation  $(y' - y)^2 = 1 - 2 \sin x \cos x$ .
- (2) Verify that the equation  $xy + 169 = \cos(xy) + y$  gives an implicit solution to the differential equation

$$\frac{y'}{xy' + y} = 1 + \sin(xy).$$

- (3) Find a 1-parameter family of solutions for the differential equation  $(2x - y + 1) dx + (x + y) dy = 0$ .
- (4) Find a 1-parameter family of solutions for the differential equation

$$\frac{dy}{dx} = \frac{3x^2 + e^x}{y^3 - e^y}.$$

- (5) Find a particular solution for the differential equation

$$3y^2 dx + (xy + y^2) dy = 0$$

satisfying the initial condition  $y(0) = 1$ .

- (6) Find a particular solution for the differential equation

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

satisfying the initial condition  $y(\pi/2) = \pi$ .

- (7) Find a 1-parameter family of solutions for the differential equation

$$(ye^y + 1) dx + (e^y + ye^y) dy = 0.$$

(Hint: you might try to solve this by separation of variables, but that leads to a nasty integral. Instead, look for an integrating factor which is a function of  $x$  and turn it into an exact differential equation.)

- (8) Be able to write and solve differential equations describing real world situations. In other words: be able to solve word problems! Look in lessons 13–17 for examples.