

Prob.	1	2	3	4	5	6	7	8	Total
Score									

**Math 46, Final Exam**

*Friday, 6/16, 11:30 AM – 2:30 PM.*

**Name:** \_\_\_\_\_

- *This is a close book exam. The total points are 100.*
- *In each problem, you have to show every step of your calculation.*
- *You are only allowed to use calculator to perform basic numerical calculations.*

1. (10 points) Solve the separable differential equation

$$y' - y^2 \cos x = 0.$$

2

2. (15 points) Solve the initial value problem:

$$(1 + \sin x)y' + y \cos x = 1, \quad y(0) = 1.$$

**3.** (10 points) To find the time constant of a newly built house, an experiment was conducted as follows: The outside temperature was  $90^{\circ}\text{F}$ . When the air conditioning was turned off at noon, the room temperature of the house was measured to be  $50^{\circ}\text{F}$ . After two hours, the room temperature was raised to  $70^{\circ}\text{F}$ . Determine the time constant using the result of this experiment.

4

4. (10 points) Solve the initial value problem:

$$y'' + y = e^x, \quad y(0) = 0, y'(0) = 0.$$

**5.** (15 points) A 2 lb weight is attached to a frictionless spring, which in turn is suspended from the ceiling. The weight stretches the spring  $1/8$  ft and comes to rest in its equilibrium position. The weight is then pulled down an additional  $1/12$  ft and released with an initial upward velocity of  $1/12$  ft/sec. How long it takes for the weight to reach its maximal displacement the first time?

6

**6.** (10 points) Find two linearly independent solutions of the differential equation

$$y'' + y' = 0.$$

7. (15 points) Solve the following initial value problem using Laplace transform:

$$y'' + 3y' + 2y = e^{-x}, \quad y(0) = 0, y'(0) = 0.$$

8

8. (15 points) Solve the following initial value problem using Laplace transform:

$$4y'' + y = 3, \quad y(0) = 1, y'(0) = 1/2.$$