

# MTH 3311 Differential Equations Test #1

SPRING 2017

Pat Rossi

Name \_\_\_\_\_

**Instructions.** Show clearly how you arrive at your answers.

1. Classify the following according to **order** and **linearity**.

(a)  $y^{(3)} - x(y'')^3 - 5x^2y' + 6y = e^x$

(b)  $y' = 2xy$

(c)  $\frac{d^2y}{dx^2} + x^3\frac{dy}{dx} = 9x^2 + 3x$

(d)  $3y'' - y' - 10xy^3 = 10$

(e)  $3y''' - y'' - 10xy' = 10 \sin(x)$

2. Solve:  $\frac{dy}{dx} = x^2y$ ; Subject to the initial condition:  $y(0) = 8$ . (Assume  $x, y \geq 0$ ).

3. Show that the function  $y = c_1e^{-3x} + c_2e^{2x} + x^2$  is a solution of the differential equation  $y'' + y' - 6y = -6x^2 + 2 + 2x$

4. Solve:  $y - x^2 \frac{dy}{dx} = -xy$ ;  $y(1) = 1$ . (Assume that  $x, y > 0$ )

5. Solve:  $\frac{1}{x^2}y' + 3y = 10$

6. Determine whether or not the equation is exact. If the equation is exact, solve it.

$$(1 + 3x^2 \sin(y)) dx + (x^3 \cos(y)) dy = 0$$

7. Solve:  $(xy + y^2) dx - x^2 dy = 0$  Solve, using the substitution  $v = \frac{y}{x}$