

# MTH 3311 Test #1

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Name \_\_\_\_\_

Show CLEARLY how you arrive at your answers.

1. Classify the following according to **order** and **linearity**. If an equation is **not linear**, explain why.

(a)  $y'' + x^2yy' = \sin(x)$

(b)  $y^{(5)} + x^2y'' - 2xy = 3x^2 + 2x$

(c)  $e^xy''' - 3xy' + 2x^2y = \tan(x)$

(d)  $y''' + 2xy'' + \frac{1}{y} = 6x - 6$

(e)  $y^{(3)} - y'' + 4xy = \frac{x}{x^2+1}$

2. Show that the function  $y = c_1e^x + c_2e^{-2x} + 3x^2 + 2x$  is a solution of the differential equation  $y'' + y' - 2y = -6x^2 + 2x + 8$

3. Solve:  $\sqrt{x^2 - 16} \frac{dy}{dx} = \frac{x}{2y}$ ; subject to the initial condition  $y(5) = 2$  (Assume that  $x > 4, y > 0$ )

Use the "Separation of Variables" Method

4. Solve:  $(x^2 + 1) \frac{dy}{dx} + 3xy = 6x$ , using the “Integrating Factor” Method

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

$$(2e^{2x} + 15x^2y^2) dx + (10x^3y + \sin(y)) dy = 0$$

6. Solve:  $2xy \frac{dy}{dx} = 4x^2 + 3y^2$  using the substitution  $v = \frac{y}{x}$ . (Assume that  $x, y > 0$ )