

# MTH 3311 Test #1

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Pat Rossi

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

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

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

(d)  $y''' + 2xy'' + xyy' + xy = 6x - 6$

(e)  $y^{(3)} + 6y'' + \sin(x)y = \frac{1}{\sqrt{9-x^2}}$

2. Show that the function  $y = \sin(2x)$  is a solution of the differential equation:

$$y'' + y' + 4y = 2 \cos(2x)$$

3. Solve:  $(x^2 + 7) \frac{dy}{dx} = xy$ ; subject to the initial condition  $y(3) = 12$  (Assume that  $x > 0, y > 0$ )

4. Solve:  $\frac{1}{\cos(x)} \frac{dy}{dx} + 3y = 10$ , using the “Integrating Factor” Method

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

$$(8 \cos(x) + 12x^2y^2) dx + \left(8x^3y + \frac{6}{y}\right) dy = 0$$

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