

# MTH 3311 Test #1

SPRING 2021

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

(b)  $y'' + x \sin(y) = \sin(x)$

(c)  $y''' + 2xy'' + \sqrt{y} = 6x - 6$

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

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

2. Show that the function  $y = c_1e^{-x} + c_2e^{2x} + 4x^2 + 3x + 2$  is a solution of the differential equation  $y'' - y' - 2y = -8x^2 - 14x + 1$

3. Solve:  $y' = \frac{e^x e^{-y}}{e^x + 1}$ ; subject to the initial condition  $y(0) = 1$  (Assume that  $x \geq 0$ )

Use the “Separation of Variables” Method

4. Solve:  $x \frac{dy}{dx} + 2y = x^3$ , with initial condition  $y(1) = 0$ , using the “Integrating Factor” Method

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

$$(\cos(x) + 6xy^4) dx + (12x^2y^3 + 30y^6) dy = 0$$

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