

# Math 240 - Quiz 7

March 23, 2023

Name key

Score \_\_\_\_\_

Show all work to receive full credit. Supply explanations when necessary.

1. (10 points) Solve the following initial value problem:

$$y'' - 2y' = 2e^x + 4x + 8; \quad y(0) = 1, \quad y'(0) = 3.$$

Homog. eqn:  $y'' - 2y' = 0$

$$r^2 - 2r = 0 \Rightarrow r = 0, r = 2$$

$$y_c(x) = c_1 + c_2 e^{2x}$$

Nonhomog. eqn:  $g(x) = 2e^x + 4x + 8$

$$y_p(x) = A e^x + x(Bx + C)$$

$$\begin{array}{ll} \#2 & \#1 \\ s=0, \alpha=1 & n=1, s=1 \end{array}$$

$$y_p(x) = A e^x + Bx^2 + Cx$$

$$y_p'(x) = A e^x + 2Bx + C$$

$$y_p''(x) = A e^x + 2B$$

Subs into

$$y_p''(x) - 2y_p'(x) = 2e^x + 4x + 8 \quad \text{to get:}$$

$$(A - 2A)e^x + (2B - 4Bx - 2C) = 2e^x + 4x + 8$$

$$A = -2, \quad B = -1, \quad 2B - 2C = 8$$

$$C = -5$$

$$y(x) = c_1 + c_2 e^{2x} - 2e^x - x^2 - 5x$$

$$y(0) = 1 \Rightarrow c_1 + c_2 - 2 = 1$$

$$y'(0) = 3 \Rightarrow 2c_2 - 2 - 5 = 3$$

$$c_2 = 5$$

$$c_1 = -2$$

$$y(x) = 5e^{2x} - 2e^x - x^2 - 5x - 2$$