

**Math 240 - Final Exam B**

May 12, 2022

Name \_\_\_\_\_

Score \_\_\_\_\_

**Show all work to receive full credit.** All integration must be done by hand.

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1. (10 points) Argue that the equation has a unique solution through any point where  $x \neq 0$ . Then solve the equation.

$$\frac{1}{x} \frac{dy}{dx} - \frac{2y}{x^2} = x \cos x, \quad x > 0$$

2. (10 points) Solve the initial value problem.

$$y'' + 3y' + 2y = \sin x; \quad y(0) = 0, \quad y'(0) = 0$$

3. (10 points) State the recurrence relation that describes the coefficients of the power series solution centered at  $x = 0$ .

$$y' + (x + 2)y = 0$$

4. (10 points) Use Laplace transform techniques to solve the initial value problem. (See the note below for future use.)

$$y'' - 2y' + 5y = -8e^{-t}; \quad y(0) = 2, \quad y'(0) = 12$$

Note: The PFD of your  $Y(s)$  should be  $\frac{3s + 5}{s^2 - 2s + 5} - \frac{1}{s + 1}$ .