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**FINAL:**

Please show all your work in the test. Guessed answers are NOT acceptable. You may use calculators. Good luck!

(25 pt) 1) Solve:

$$(x e^{(y/x)} - y) dx + x dy = 0, \quad y(1) = 0.$$

(25 pt) 2) Solve:

$$\frac{dy}{dx} + x y = x, \quad y(0) = 2.$$

(30 pt) 3) Give the general solutions of:

a)  $4y'' - 12y' + 5y = 0$

b)  $y^{(5)} - y^{(3)} = 0$

(30 pt) 4) Find the general solution of

$$y''' - y'' = 6x$$

(30 pt) 5) Find the general solution of

$$x^2 y'' - x y' + y = x, \quad x > 0$$

(30 pt) 6) Solve using the Laplace transform technique

$$y' - y = e^{-t}\mathcal{U}(t - 1)$$

$$y(0) = 1$$

(30 pt) 7) Solve the system of differential equations

$$x' = 2y + 2$$

$$y' = x - y$$