

Instructor: Leopoldo P. Franca

NAME: \_\_\_\_\_

**FINAL:**

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

(25 pt) 1) Solve:

$$\frac{dy}{dx} = \frac{y}{\ln y}, \quad y(0) = e.$$

(25 pt) 2) Solve:

$$\frac{dy}{dx} + \frac{y}{x} = \frac{\cos x}{x}, \quad y\left(\frac{\pi}{2}\right) = \frac{4}{\pi}, \quad x > 0.$$

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

a)  $y'' - 5y' + 6y = 0$

b)  $9y^{(4)} + 4y''' = 0$

(30 pt) 4) Find the general solution of

$$9y'' + y = x$$

(30 pt) 5) Find the general solution of

$$x^2 y'' + 2x y' - 6y = x^2, \quad x > 0$$

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

$$y'' + y = \delta(t - \pi) + 1$$

$$y(0) = 0, \quad y'(0) = 0$$

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

$$x' = x + 2y + \cos t$$

$$y' = 3x + 2y$$