

Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. BOX final short answers. Always simplify expressions.

$$\frac{dy}{dx} = x - y \quad y(x) = C e^{-x} + x - 1 \quad y(0) = 10$$

- Verify that $y(x)$ satisfies the given differential equation.
- Determine a value of the constant C so that $y(x)$ satisfies the given initial condition.
- Box for final result for $y(x)$. Then check that it satisfies the initial condition.

Organize your work as though you were playing professor.

$$a) \quad y = C e^{-x} + x - 1$$

$$\frac{dy}{dx} = C e^{-x}(-1) + 1 + 0 = -C e^{-x} + 1$$

$$\frac{dy}{dx} = x - y \rightarrow -C e^{-x} + 1 = x - (C e^{-x} + x - 1)$$

$$= \overset{0}{x} - \overset{0}{C e^{-x}} - \overset{0}{x} + 1$$

$$= -C e^{-x} + 1 \quad \checkmark$$

$$b) \quad y(0) = 10 \Leftrightarrow x=0, y=10$$

$$y = C e^{-x} + x - 1 \rightarrow 10 = C e^{-0} + 0 - 1 = C - 1$$

$$C = 10 + 1 = 11$$

$$\boxed{C=11}$$

$$c) \quad \boxed{y = 11e^{-x} + x - 1}$$

$$10 = 11e^{-0} + 0 - 1$$

$$= 11 - 1 = 10 \quad \checkmark$$