



$$3.1 \quad \text{a) } I \quad \dot{y} - 2y = -14 \quad y(0) = 5$$

$$\dot{y} - 2y = -14 \quad e^{-2t} \cdot \dot{y} - 2e^{-2t}y = -14e^{-2t}$$

$$\frac{d}{dt}(e^{-2t}y) = -14e^{-2t} \quad \int$$

$$e^{-2t}y = \int -14e^{-2t}$$

$$e^{2t}y = 7e^{-2t} + C$$

$$y = 7 + Ce^{2t}$$

$$y(0) = 7 + C = 5 \Rightarrow y = 7 - 2e^{2t}$$

$$-C = -2$$

$$II \quad \dot{y} + 5y = t \quad | \cdot e^{5t}$$

$$e^{5t} \dot{y} + 5e^{5t}y = te^{5t}$$

$$e^{5t}y = \int te^{5t}$$

$$y = \frac{t}{5} - \frac{1}{25} + Ce^{5t}$$

$$y(0) = -\frac{1}{25} + C = 1 \Rightarrow \frac{26}{25}$$

$$y = \frac{t}{5} - \frac{1}{25} + \frac{26}{25}e^{5t}$$

$$III \quad \dot{y} - 3y = -3 \Rightarrow \dot{y} - 3y = -3$$

$$\frac{d}{dt}e^{-3t}y = -3e^{-3t}$$

$$y = 1 + Ce^{3t}$$

$$y = 1 - e^{3t}$$

$$IV \quad \dot{y} - p_0y = q_0 \quad y(0) = y_0$$

$$\frac{d}{dt}e^{-p_0t}y = e^{-p_0t}q_0$$

$$y = \frac{q_0}{p_0} + Ce^{p_0t}$$

$$y = \frac{q_0}{p_0} (1 + y_0 e^{p_0t})$$

$$V \quad \dot{y} = \frac{1}{2}ty + 2y \quad y(0) = -2$$

$$\dot{y} - (\frac{1}{2}t + 2)y = 0$$

$$\frac{d}{dt}e^{-\frac{1}{4}t^2 - 2t}y = 0$$

$$y = -2e^{\frac{1}{4}t^2 + 2t}$$

$$C = -2$$

