a) $\dot{x} + 2x = e^{3t}$

Integrating factor $u = e^{\int 2 \, dt}$
$$= e^{2t}$$

$$\Rightarrow \int \frac{d}{dt}(ux) = \int u e^{3t}$$

$$xe^{2t} = \frac{e^{5t}}{5} + C$$

$$\therefore \quad x = \frac{e^{3t}}{5} + Ce^{-2t} \quad (\text{general})$$

$$x = \frac{1}{5} e^{3t} \qquad (Be^{3t})$$

b) $\dot{x} + 2x = e^{3it}$

Guess that $x = Ae^{3it}$.

$$\Rightarrow 3i Ae^{3it} + 2(Ae^{3it}) = e^{3it}$$

$$3iA + 2A = 1$$

$$A = \frac{1}{2+3i}$$

$$\therefore x = \frac{1}{2+3i} e^{3it}$$

$$= \frac{2-3i}{4+9} e^{3it}$$

$$= \frac{2}{13} e^{3it} - \frac{3}{13} i e^{3it}$$

$$\times \quad = \frac{2}{13} e^{3it} - \frac{3}{13} e^{\frac{\pi}{2}i} e^{3it}$$

$$= \frac{2}{13} e^{3it} - \frac{3}{13} e^{(1+\frac{\pi}{2})it}$$