

#1

$$(a) \frac{dy}{dx} = xe^x; y(1) = 3$$

$$y = xe^x - e^x + C$$

$$y(1) = 3 = 1 \cdot e - e + C$$

$$3 = C$$

$$\boxed{y(x) = xe^x - e^x + 3}$$

$$(b) \frac{dy}{dx} = 2\sin x \cos x; y(0) = 1$$

$$y = C - \frac{1}{2} \cos 2x$$

$$y(0) = 1 = C - \frac{1}{2} \Rightarrow C = \frac{3}{2}$$

$$\boxed{y(x) = \frac{3}{2} - \frac{1}{2} \cos 2x}$$

#2

$$(a) y = \left(-\frac{3}{2}x^{-4} + C\right)^{1/6}$$

$$(b) y = Ce^{2x^2}$$

$$\#3 (a) y' + (-x)y = 0$$

$$y = Ce^{\frac{1}{2}x^2}$$

$$(b) y = Ce^{-x^2} + 1$$

$$\#4 \text{ (a)} \quad \frac{\partial M}{\partial y} = 1 = \frac{\partial N}{\partial x}$$
$$xy + 2 \ln y = C$$

$$\text{(b)} \quad \frac{\partial M}{\partial y} = \sin x \sec^2 y = \frac{\partial N}{\partial x}$$
$$C = \cos x \sec^2 y$$

$$\#5 \text{ (a)} \quad y = x \ln(2 \ln x + C)$$

$$\text{(b)} \quad y = \sqrt{\frac{1}{2}x^5 + Cx^{3/2}}$$

$$\#6 \text{ (a)} \quad y = \frac{C}{x}$$

$$\text{(b)} \quad T(t) = 30 - 60e^{(-\frac{1}{10} \ln 2)t}$$
$$T(t) = 20 \Rightarrow t \approx 25.857 \text{ min}$$