

1992 AB4/BC1
Solution

$$\begin{aligned} \text{(a)} \quad \frac{dy}{dx} - \sin y \frac{dy}{dx} &= 1 \\ \frac{dy}{dx} (1 - \sin y) &= 1 \\ \frac{dy}{dx} &= \frac{1}{1 - \sin y} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{dy}{dx} \text{ undefined when } \sin y &= 1 \\ y &= \frac{\pi}{2} \\ \frac{\pi}{2} + 0 &= x + 1 \\ x &= \frac{\pi}{2} - 1 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad \frac{d^2 y}{dx^2} &= \frac{d\left(\frac{1}{1 - \sin y}\right)}{dx} \\ &= \frac{-\left(-\cos y \frac{dy}{dx}\right)}{(1 - \sin y)^2} \\ &= \frac{\cos y \left(\frac{1}{1 - \sin y}\right)}{(1 - \sin y)^2} \\ &= \frac{\cos y}{(1 - \sin y)^3} \end{aligned}$$