

$$\textcircled{2} \text{ b) } xy^2 = 45 \quad \text{if } y = 3 \quad \text{and } \frac{dy}{dt} = 6$$

$$x(3)^2 = 45$$

$$9x = 45$$
$$\boxed{x = 5}$$

$$xy^2 = 45$$

$$x \frac{d}{dt} y^2 + \frac{dx}{dt} y^2 = 0$$

$$(5)(2)(3)(6) + \frac{dx}{dt} (3)^2 = 0$$

$$180 + 9 \frac{dx}{dt} = 0$$

$$9 \frac{dx}{dt} = -180$$

$$\boxed{\frac{dx}{dt} = -20}$$

Review Sheet

$$\textcircled{2} \quad y = \sqrt{x^2 + 2x} = (x^2 + 2x)^{1/2}$$

$$y' = \frac{1}{2} (x^2 + 2x)^{-1/2} (2x + 2)$$

$$y' = \frac{x+1}{(x^2 + 2x)^{1/2}}$$

$$y'' = \frac{(x^2 + 2x)^{1/2} (1) - (x+1) \left(\frac{1}{2}\right) (x^2 + 2x)^{-1/2} (2x+2)}{[(x^2 + 2x)^{1/2}]^2}$$

$$y'' = \frac{(x^2 + 2x)^{1/2} - (x+1)^2 (x^2 + 2x)^{-1/2}}{(x^2 + 2x)}$$

$$y'' = \frac{(x^2 + 2x)^{-1/2} [(x^2 + 2x)' - (x+1)^2]}{(x^2 + 2x)}$$

$$y'' = \frac{x^2 + 2x - (x^2 + 2x + 1)}{(x^2 + 2x)^{3/2}}$$

$$y'' = \frac{-1}{(x^2 + 2x)^{3/2}}$$

$$\textcircled{2} \quad y = \sqrt{x^2 + 2x} = (x^2 + 2x)^{1/2}$$

$$y' = \frac{1}{2}(x^2 + 2x)^{-1/2} (2x + 2)$$

$$y' = (x+1)(x^2 + 2x)^{-1/2}$$

$$y'' = (x+1)\left(-\frac{1}{2}\right)(x^2 + 2x)^{-3/2} (2x + 2) + 1(x^2 + 2x)^{-1/2}$$

$$y'' = -(x+1)^2 (x^2 + 2x)^{-3/2} + (x^2 + 2x)^{-1/2}$$

$$y'' = (x^2 + 2x)^{-3/2} \left[-(x+1)^2 + (x^2 + 2x) \right]$$

$$y'' = \frac{-\cancel{x^2} - \cancel{2x} - 1 + \cancel{x^2} + \cancel{2x}}{(x^2 + 2x)^{3/2}}$$

$$y'' = \frac{-1}{(x^2 + 2x)^{3/2}}$$

$$\textcircled{4} \quad -3xy^2 - x^3 = 3y$$

$$-3x \cdot 2yy' - 3y^2 - 3x^2 = 3y'$$

$$-6xyy' - 3y^2 - 3x^2 = 3y'$$

$$y'(-6xy - 3) = 3x^2 + 3y^2$$

$$y' = \frac{3x^2 + 3y^2}{-6xy - 3}$$

$$y' = \frac{3(x^2 + y^2)}{-3(2xy + 1)}$$

$$y' = -\frac{x^2 + y^2}{2xy + 1}$$