

For full credit, you must show all work and circle your final answer.

- 1 Use implicit differentiation to find $\frac{dy}{dx}$.

$$x^2 + y^2 = 16$$

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$$\Rightarrow 2x + 2y \frac{dy}{dx} = 0$$

$$\Rightarrow 2y \frac{dy}{dx} = -2x$$

$$\Rightarrow \frac{dy}{dx} = -\frac{x}{y}$$

- 2 The volume of a cylinder is given by $V = \pi r^2 h$, where r is its radius and h is the height. Suppose the radius is changing at a rate of 2 in/sec and the height is changing at a rate of 3 in/sec. Find the rate of change of the volume when the height is 2 inches and the radius is 4 inches.

$$V = \pi r^2 \cdot h \quad \frac{dr}{dt} = 2 \quad \frac{dh}{dt} = 3$$
$$r = 4 \quad h = 2$$

$$\Rightarrow \frac{dV}{dt} = \pi r^2 \cdot \frac{dh}{dt} + h \cdot 2\pi r \cdot \frac{dr}{dt}$$

$$\Rightarrow \frac{dV}{dt} = \pi(4)^2(3) + (2)(2\pi)(4)(2)$$

$$\Rightarrow \frac{dV}{dt} = 80\pi$$