

Homework Related rates

Date _____

For each problem, use implicit differentiation to find $\frac{dy}{dx}$ at the given point.

1) $x^2 + 2y^3 = 5y^2$ at $(-2, 2)$

2) $4x - 2x^2y^3 = 2x^3y^3$ at $(1, 1)$

Solve each related rate problem.

- 3) A hypothetical square shrinks so that the length of its sides are changing at a rate of -3 m/min. At what rate is the area of the square changing when the sides are 14 m each?

4) A hypothetical cube shrinks so that the length of its sides are decreasing at a rate of 3 m/min. At what rate is the volume of the cube changing when the sides are 4 m each?

5) Water slowly evaporates from a circular shaped puddle. The radius of the puddle decreases at a rate of 4 in/hr. Assuming the puddle retains its circular shape, at what rate is the area of the puddle changing when the radius is 14 in?

Answers to Homework Related rates

$$1) \left. \frac{dy}{dx} \right|_{\substack{x=-2 \\ y=2}} = 1 \qquad 2) \left. \frac{dy}{dx} \right|_{\substack{x=1 \\ y=1}} = -\frac{1}{2}$$

3) $A =$ area of square $s =$ length of sides $t =$ time

Equation: $A = s^2$ Given rate: $\frac{ds}{dt} = -3$ Find: $\left. \frac{dA}{dt} \right|_{s=14}$

$$\left. \frac{dA}{dt} \right|_{s=14} = 2s \cdot \frac{ds}{dt} = -84 \text{ m}^2/\text{min}$$

4) $V =$ volume of cube $s =$ length of sides $t =$ time

Equation: $V = s^3$ Given rate: $\frac{ds}{dt} = -3$ Find: $\left. \frac{dV}{dt} \right|_{s=4}$

$$\left. \frac{dV}{dt} \right|_{s=4} = 3s^2 \cdot \frac{ds}{dt} = -144 \text{ m}^3/\text{min}$$

5) $A =$ area of circle $r =$ radius $t =$ time

Equation: $A = \pi r^2$ Given rate: $\frac{dr}{dt} = -4$ Find: $\left. \frac{dA}{dt} \right|_{r=14}$

$$\left. \frac{dA}{dt} \right|_{r=14} = 2\pi r \cdot \frac{dr}{dt} = -112\pi \text{ in}^2/\text{hr}$$