

Sec.2.6

p.152 - 154: Guidelines for Solving Related-Rate Problems; Examples 1 - 3
p.157:

$$(u^n)' = n u^{n-1} \cdot u'$$

Using Related Rates In Exercises 3-6, assume that x and y are both differentiable functions of t . Find the required values of dy/dt and dx/dt .

5. $xy = 4$

(a) $\frac{dy}{dt}$ when $x = 8$

$\frac{dx}{dt} = 10$

$$y = \frac{4}{8} = \frac{1}{2}$$

$$8y = 4$$

$$\frac{dx}{dt} \cdot y + x \cdot \frac{dy}{dt} = 0 \rightarrow 10 \cdot \frac{1}{2} + 8 \cdot \frac{dy}{dt} = 0 \rightarrow 8 \frac{dy}{dt} = -5$$

$$\frac{dy}{dt} = -\frac{5}{8}$$

6. $x^2 + y^2 = 25$

(b) $\frac{dx}{dt}$ when $x = 4, y = 3$

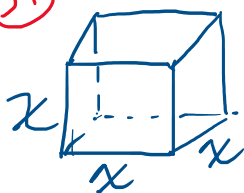
$\frac{dy}{dt} = -2$

$$2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 0 \rightarrow 4 \frac{dx}{dt} + 3(-2) = 0$$

$$\frac{dx}{dt} = \frac{6}{4} = \frac{3}{2}$$

16. Surface Area All edges of a cube are expanding at a rate of 6 centimeters per second. How fast is the surface area changing when each edge is (a) 2 centimeters and

(S1)



$$\frac{dx}{dt} = 6 \text{ cm/sec}, x = 2 \text{ cm}, \frac{dA}{dt} = ?$$

(S2) $A = 6x^2$

(S3) $\frac{dA}{dt} = 6 \cdot 2x \frac{dx}{dt} = 12x \frac{dx}{dt}$

(S4) $\frac{dA}{dt} = 12(2)(6) = 144 \text{ cm}^2/\text{sec}$

14. Radius A spherical balloon is inflated with gas at a rate of 800 cubic centimeters per minute.

(a) Find the rate of change of the radius when $r = 30$ centimeters



(S1) $\frac{dV}{dt} = 800 \text{ cm}^3/\text{min}, r = 30 \text{ cm} \rightarrow \frac{dr}{dt} = ?$

(S2) $V = \frac{4}{3} \pi r^3$

(S3) $\frac{dV}{dt} = \frac{4}{3} \pi \cdot 3r^2 \cdot \frac{dr}{dt} = 4\pi r^2 \frac{dr}{dt}$

(S4) $800 = 4\pi \cdot (30^2) \cdot \frac{dr}{dt} \rightarrow 800 = 4\pi \cdot 900 \cdot \frac{dr}{dt}$
 $8 = 36\pi \frac{dr}{dt} \rightarrow \frac{dr}{dt} = \frac{8}{36\pi} = \frac{2}{9\pi} \text{ cm/min}$

$$\delta = 36\pi \frac{\ddot{x}}{\dot{x}} \rightarrow \frac{\ddot{x}}{\dot{x}} = \frac{\ddot{x}}{36\pi} = \frac{1}{9\pi} \text{ cm/s}^2$$

OR $\approx 0.01 \text{ cm/s}^2$ ✓