

April 30

Find the derivative in terms of x:

$$x^2y = 4x + 7y$$

$$\begin{aligned} 2x dy + y dx^2 &= 4dx + 7dy \\ dy x^2 - 7dy &= 4dx - 2x dy \\ dy(x^2 - 7) &= dx(4 - 2xy) \\ \frac{dy}{dx} &= \frac{4 - 2xy}{x^2 - 7} \end{aligned}$$

April 30

Students will verbally explain how to solve relate rate problems

(using the words: rates, relationships, values, etc...)

Raymond walks at a rate of 3 ft/sec.
How fast is Cyrus walking when Raymond is 6 feet from "Home".

How fast when Raymond is 8 feet from "Home"?



rates

$$\begin{aligned} \frac{dR}{dt} &= 3 \\ \frac{dC}{dt} &=? \\ \frac{dH}{dt} &= 0 \end{aligned}$$

relationships

$$R^2 + C^2 = H^2$$

values

$$\begin{aligned} H &= 10 \\ R &= 6 \\ C &= 8 \end{aligned}$$

$$6^2 + C^2 = 10^2$$

$$2R \frac{dR}{dt} + 2C \frac{dC}{dt} = 2H \frac{dH}{dt}$$

$$2(6)(3) + 2(8)(\frac{dC}{dt}) = 2(10)(0)$$

$$36 + 16(\frac{dC}{dt}) = 0$$

$$16(\frac{dC}{dt}) = -36$$

$$\frac{dC}{dt} = \frac{-36}{16} = -\frac{9}{4} = -2.25 \text{ ft/sec}$$

- ① differentials
- ② divide by dt
- ③ substitute
- ④ solve

Problem A

Air is being blown into a sphere at a rate of 6 cubic inches per minute. How fast is the radius changing when the radius of the sphere is 2 inches?



rates

$$\frac{dV}{dt} = 6$$

$$\frac{dr}{dt} = ?$$

relationships

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

values

$$r = 2$$

$$V = \frac{4}{3}\pi(2)^3 = \frac{32}{3}\pi$$

$$\frac{dV}{dt} = \frac{4}{3}\pi r^2 \frac{dr}{dt}$$

$$= 4\pi r^2 (\frac{dr}{dt})$$

$$6 = \frac{4}{3}\pi(2)^2(\frac{dr}{dt})$$

$$\frac{6}{16\pi} = \frac{16\pi(\frac{dr}{dt})}{16\pi}$$

$$\frac{dr}{dt} = \frac{6}{(16\pi)} = 0.119 \text{ in/min}$$

- ① differentials
- ② divide by dt
- ③ substitute
- ④ solve

Problem B

An observer is tracking a plane flying at 5000 feet. The plane flies directly over the observer on a horizontal path at a 10,000 ft/min. What is the rate of change of the distance between the observer and the plane when the plane has traveled 7000 feet?



rates relationships values