Warm Up

If the length of a square is growing at a rate of 2cm/sec, what would the original length have to be if the *area* of the square is increasing at a rate of 12cm^2/sec?

Questions From Homework

④ Given:

$\frac{dA}{dt} = 150\ cm^2/s$

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

$A = 1256\ cm^2$

① Find r:

$A = 4\pi r^2$

$\frac{1256}{4\pi} = \frac{4\pi r^2}{4\pi}$

$100 = r^2$

$\pm 10 = r$

$r = 10\ cm$

$A = 4\pi r^2$

$\frac{dA}{dt} = 8\pi r \frac{dr}{dt}$

$150 = 8\pi(10)\frac{dr}{dt}$

$150 = 80\pi \frac{dr}{dt}$

$\frac{150}{80\pi} = \frac{dr}{dt}$

$0.5968\ cm/s = \frac{dr}{dt}$

⑭ Given:

$\frac{dr}{dt} = 10\ cm/s$

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

$t = 4\ sec$

① Find r

$r = 10\ cm/s \times 4\ s$

$r = 40\ cm$

$A = \pi r^2$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$

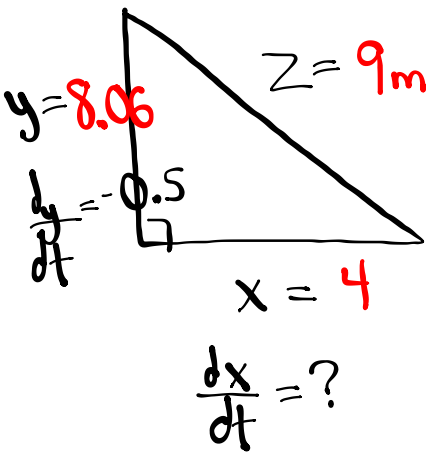
$\frac{dA}{dt} = 2\pi(40)(10)$

$\frac{dA}{dt} = 800\pi\ cm^2/s = 2513.27$

Related Rates
(Lampposts and Ladders)

A ladder 9m long is set against a wall and begins to slide down. The top of the ladder slides down at a rate of 0.5m/s. How quickly is the bottom sliding away from the wall when it is 4m from the wall to begin with?

(Hint: draw a diagram)



(1) Find y

$x^2 + y^2 = z^2$

$(4)^2 + y^2 = (9)^2$

$16 + y^2 = 81$

$y^2 = 65$

$y = \pm 8.06\text{m}$

$y = 8.06\text{m}$

(2) Find $\frac{dx}{dt}$

$x^2 + y^2 = (9)^2$

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

$2(4)\frac{dx}{dt} + 2(8.06)(-0.5) = 0$

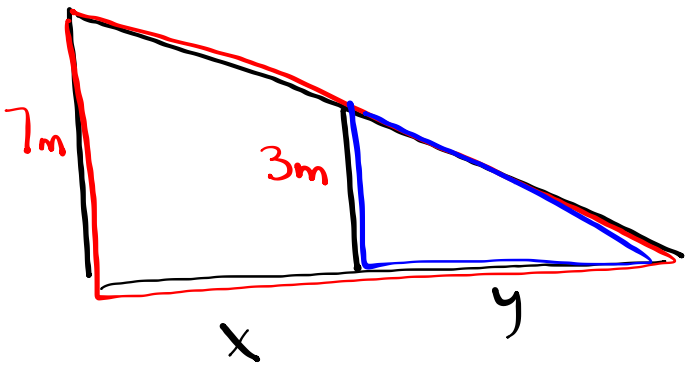
$8\frac{dx}{dt} - 8.06 = 0$

$8\frac{dx}{dt} = 8.06$

$\frac{dx}{dt} = 1.01\text{ m/s}$

Bigfoot is 3m tall and walks curiously towards a lamppost that is 7m tall. If he walks at a rate of 2m/s, at what rate is the length of his shadow changing?

draw a diagram
Let x = distance between Bigfoot and lamppost
Let y = length of shadow



Use Similar Δ's

$$\frac{x+y}{7}\ \begin{matrix}(\text{base})\\(\text{height})\end{matrix} = \frac{y}{3}\ \begin{matrix}(\text{base})\\(\text{height})\end{matrix}$$

$$3(x+y) = 7y$$

$$3x+3y = 7y$$

$$3x = 4y$$

$$\frac{dx}{dt} = -2\text{m/s}$$ ↑ towards

$$3\frac{dx}{dt} = 4\frac{dy}{dt}$$

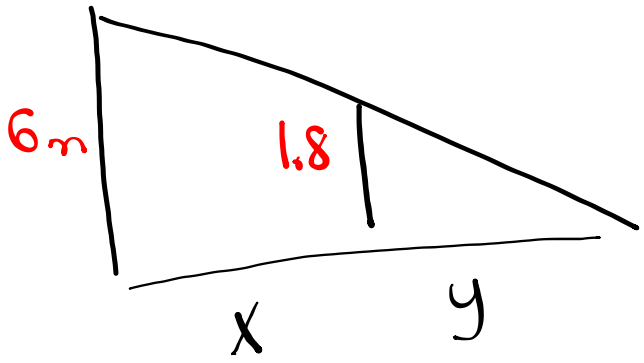
$$3(-2) = 4\frac{dy}{dt}$$

$$-6 = 4\frac{dy}{dt}$$

$$-1.5\text{m/s} = \frac{dy}{dt}$$

A man is 1.8m tall and walks away from a 6m lamppost at a rate of 2m/s. How fast is his shadow changing when he is 5m from the post?

draw a diagram
Let x = distance between man and lamppost
Let y = length of shadow



$\frac{dx}{dt} = +2 m/s$ ← away

← Ignore

Use similar Δ's

$$\frac{x+y}{6} = \frac{y}{1.8}$$

$$1.8x + 1.8y = 6y$$

$$1.8x = 4.2y$$

$$1.8\frac{dx}{dt} = 4.2\frac{dy}{dt}$$

$$1.8(2) = 4.2\frac{dx}{dt}$$

$$3.6 = 4.2\frac{dx}{dt}$$

$$0.86 m/s = \frac{dx}{dt}$$

Homework