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?

$\frac{dl}{dt} = 2\text{cm/sec}$

$l = ?$

$\frac{dA}{dt} = 12\text{cm}^2\text{/sec}$

$A = l^2$

$\frac{dA}{dt} = 2l\frac{dl}{dt}$

$12 = 2l(2)$

$12 = 4l$

$3\text{cm} = l$

The original length would be 3cm.

Questions From Homework

Surface Area + Volumes

④ $\frac{dA}{dt} = 150 \text{cm}^2/\text{sec}$

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

$A = 1256 \text{cm}^2$

find r

$A = 4\pi r^2$

$1256 = 4\pi r^2$

$100 = r^2$

$\pm 10 = r$

$A = 4\pi r^2$

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

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

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

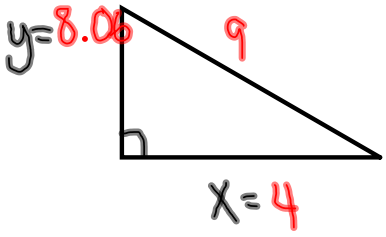
$\frac{150}{80\pi} = \frac{dr}{dt}$

$0.597 \text{cm/sec} = \frac{dr}{dt}$

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)



Given:

$\frac{dy}{dt} = -0.5\ m/s$

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

Find y:

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

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

$16+y^2=81$

$y^2=65$

$y=8.06$

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

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

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

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

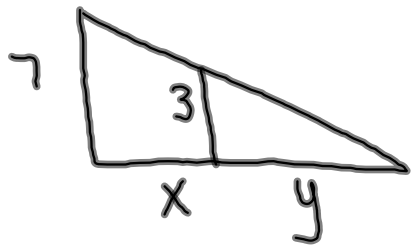
$8\frac{dx}{dt}=8.06$

$\frac{dx}{dt}=1.0075\ m/s$

The bottom of the ladder is sliding away from the wall at a rate of 1.01m/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



Given:

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

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

$\frac{7}{x+y} = \frac{3}{y}$

$7y = 3x + 3y$

$4y = 3x$

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

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

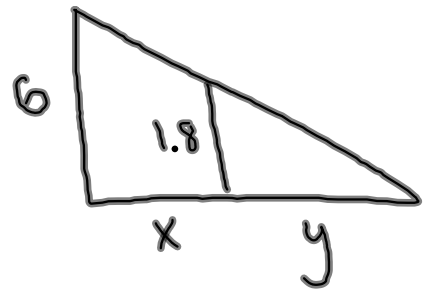
$4\frac{dy}{dt} = -6$

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

The length of his shadow is changing at a rate -1.5m/s.

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



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

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

$$4.2y = 1.8x$$

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

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

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

$$\frac{dy}{dt} = 0.857 \text{ m/s}$$

Given:

$\frac{dx}{dt} = 2$ m/s

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

His shadow is increasing at a rate of 0.857 m/s.

Homework