Related Rates W.S

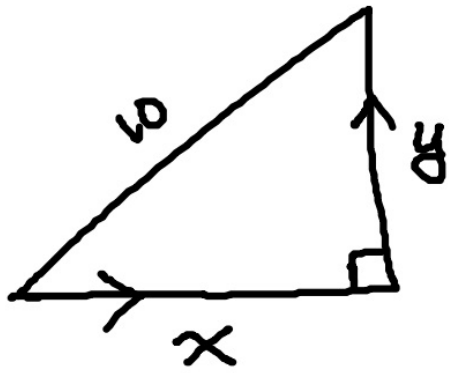
① $\frac{d}{dt}(A = \pi r^2)$

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

$$\frac{dA}{dt} = 2\pi (50)(1)$$

$$\boxed{\frac{dA}{dt} = 100\pi \ \frac{cm^2}{s}}$$

(2)



$$x^2 + y^2 = 100$$

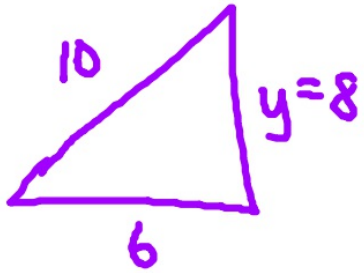
$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

$$(6)(-1) + (8)\frac{dy}{dt} = 0$$

$$8\frac{dy}{dt} = 6$$

$$\frac{dy}{dt} = \frac{6}{8} = \boxed{\frac{3}{4}\ \frac{FT}{MIN}}$$

FREEZE:



Related Rates Recipe:

1. Make a drawing - label parts that change with a **variable**; label parts that do not change with a **number**.

2. Create an equation/formula relating the quantities in the drawing.

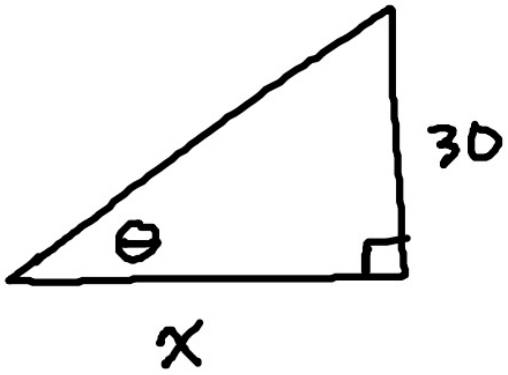
3. Differentiate with respect to t (implicitly.)

4. Plug in values - you may have to freeze the drawing to find missing parts.

5. Solve for the unknown quantity (most often its a rate.)

6. Does the answer make sense? Specifically, the **sign** of the answer.

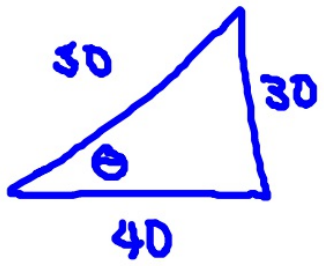
(3)



$$\tan\theta = \frac{30}{x} = 30x^{-1}$$

$$\sec^2\theta \frac{d\theta}{dt} = \frac{-30}{x^2} \cdot \frac{dx}{dt}$$

FREEZE



$\cos\theta = \frac{4}{5}$

$\sec\theta = \frac{5}{4}$

$\sec^2\theta = \frac{25}{16}$

$$\left(\frac{25}{16}\right)\left(-\frac{2^\circ}{HR} \cdot \frac{\pi}{180^\circ}\right) = \frac{-30}{40^2} \cdot \frac{dx}{dt}$$

$$\left(\frac{25}{16}\right)\left(\frac{+\pi}{90}\right)\frac{+1600}{-40^2} = \frac{dx}{dt}$$

$$\frac{dx}{dt} = \frac{25\pi}{27} \frac{FT}{HR} \approx 2.909 \frac{FT}{HR}$$