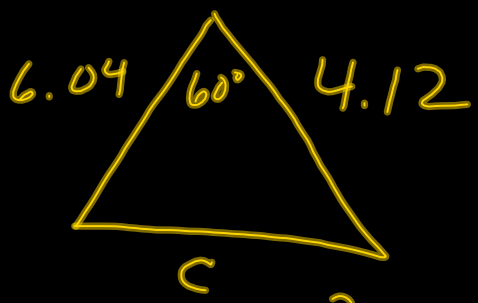
AP Calculus AB
Wednesday, October 31, 2012

Today's Essential Question: How do I solve related rates problems?

HW...related rates packet

Formative Quiz at the beginning of class



$c^2 = 4.12^2 + 6.04^2 - 2(4.12)(6.64)\cos 60°$

$c \approx 5.345$

3. The circumference of a circle is increasing at a rate of $\frac{2\pi}{5}$ inches per minute. When the radius is 5 inches, how fast is the area of the circle increasing? Be sure to include units in your final answer.

$\frac{dC}{dt} = \frac{2\pi}{5}$ in/min $r = 5$ in $\frac{dA}{dt} = ?$

Solution: $C = 2\pi r$ $A = \pi r^2$

$\frac{dC}{dt} = 2\pi \cdot \frac{dr}{dt}$

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

$\frac{2\pi}{5} = 2\pi \cdot \frac{dr}{dt}$

$\frac{dA}{dt} = 2\pi \cdot 5 \cdot \frac{1}{5}$

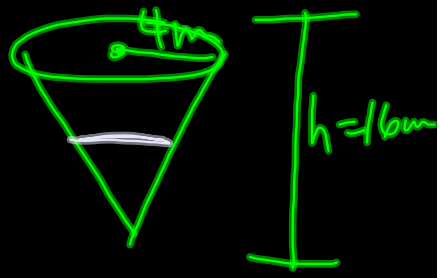
$\frac{dr}{dt} = \frac{1}{5}$ in/min

$\frac{dA}{dt} = 2\pi \frac{\text{in}^2}{\text{min}}$

Example 10) Water is draining from a conical tank at the rate of 2 meter^3/min. The tank is 16 meters high and its top radius is 4 meters. How fast is the water level falling when the water level is a) 12 meters high, b) 2 meters high?

h

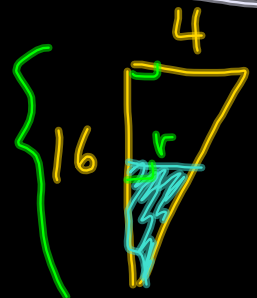
$\frac{dV}{dt} = -2\frac{m^3}{min}$



Find $\frac{dh}{dt}$ when $h=12m$

$V=\frac{1}{3}\pi r^2 h$

$\frac{dV}{dt} = \frac{1}{3}\pi\left[r^2\frac{dh}{dt} + h\cdot 2r\frac{dr}{dt}\right]$



what is r? r=3 when h=12

what is $\frac{dr}{dt}$?

$\frac{r}{h} = \frac{1}{4}$

$r = \frac{1}{4}h$

$\frac{dr}{dt} = \frac{1}{4}\frac{dh}{dt}$

$-2 = \frac{1}{3}\pi\left[9\frac{dh}{dt} + 12\cdot 6\cdot\frac{1}{4}\frac{dh}{dt}\right]$

$-2 = \frac{1}{3}\pi\left[27\frac{dh}{dt}\right]$

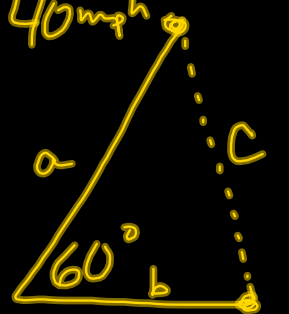
$-2 = 9\pi\frac{dh}{dt}$

$\frac{-2}{9\pi}\frac{m}{min} = \frac{dh}{dt}$

3) Two cars are riding on roads that meet at a 60 degree angle. Car A is 3 miles from the intersection traveling at 40 mph and car B is 2 miles away from the intersection traveling at 50 mph. How fast are the two cars separating if a) they are both traveling away from the intersection and b) car A is traveling away from the intersection and car B is traveling towards it?

$\frac{da}{dt} = 40\text{mph}$

Find $\frac{dc}{dt}$



$\frac{dB}{dt}$ 50mph

$c^2 = a^2 + b^2 - 2ab\cos 60°$

$c^2 = a^2 + b^2 - ab$

$2c \cdot \frac{dc}{dt} = 2a \cdot \frac{da}{dt} + 2b \cdot \frac{db}{dt} - \left(a\frac{db}{dt} + b \cdot \frac{da}{dt}\right)$