Good afternoon:
assessment is rescheduled to Monday due to short class period
Check your calendars: switch Apr 20 and Apr 23

When bell rings, have notebooks out as we have a lot to cover in a short period of time. Finale seniors dismissed at 2:20p and not a minute before

Upcoming dates:
- M 4/23 assessment
- F 4/27 take home assessment due (getting it today)
- F 5/4 roller coasters due; 2016 AP mult choice packet due

Constant air volume

(no, but the rates
are related to each other)

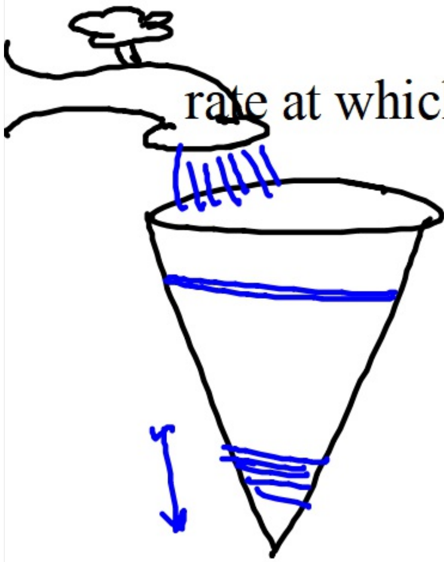
Is the surface area growing at a constant rate??

Water pouring into a cup

constant rate of water leaving faucet

related, but not equal

rate at which depth changes?



Understanding "derivative with respect to"

Suppose x and y are functions of time t. Find dy/dt when $3x^2+5y^2=12$

$$\frac{d}{dt}\left(3x^2+5y^2\right)=\left(12\right)\frac{d}{dt}$$

$$6x\frac{dx}{dt}+10y\frac{dy}{dt}=0$$

$$10y\frac{dy}{dt}=-6x\frac{dx}{dt}$$

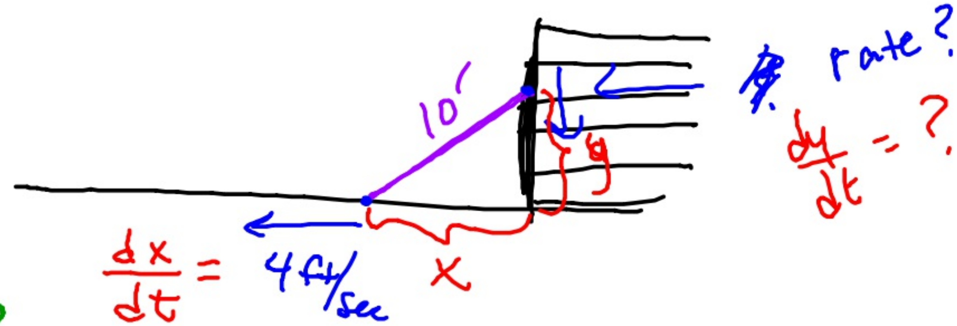
$$\frac{dy}{dt}=\frac{-6x\cdot\frac{dx}{dt}}{10y}$$

Implicit differentiation, doing d/dt to both sides instead of d/dx

The Falling Ladder Problem

slippery mess. A gust of wind of constant velocity nudges the ladder so that the base of the ladder slides away from the wall at a rate of 4 feet per second. How fast is the top of the ladder sliding down the wall when the base of the ladder is 8 feet from the wall?

D diagram
R rate
* E equation
D derivative ($\frac{d}{dt}$)
S Substitute, Solve



$8^2 + y^2 = 10^2$

$y = 6$

$x^2 + y^2 = 10^2$

$\frac{d}{dt}(x^2 + y^2) = (100)\frac{d}{dt}$

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

* Everything in Eq. except unknown should be known *

$2(8)\cdot 4 + 2(6)\cdot\frac{dy}{dt} = 0$

$64 + 12\frac{dy}{dt} = 0$

$\frac{dy}{dt} = -\frac{64}{12} \rightarrow -5.333$ ft/s

D Diagram

R Rates (label given information, needed information)

E Equation (geometry formula, usually. Be sure needed info is only unknown)

D Differentiate (with respect to TIME)

S Substitute, then solve

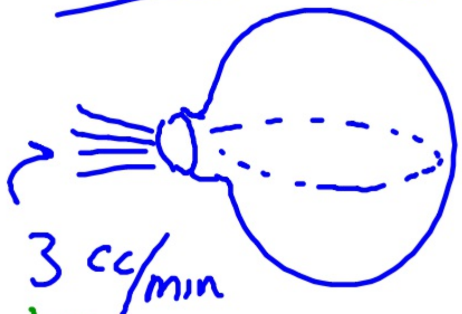
(you should write these down)

A spherical balloon is being inflated by a pump at a rate of 3 cubic centimeters per minute. At what rate is the radius of the balloon changing when the diameter of the balloon is 4 cm?

DREDS

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

$D = 4 \Rightarrow r = 2$



3 cc/min

$\frac{dV}{dt}$

$\frac{d}{dt}\left(V_S = \frac{4}{3}\pi r^3\right) dt$

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

← Stopped here in class

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

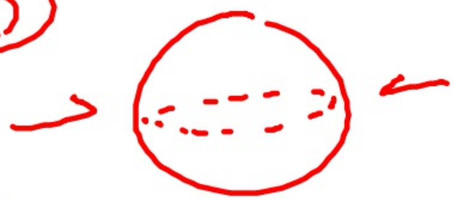
$3 = 16\pi \cdot \frac{dr}{dt}$

$\frac{3}{16\pi} = \frac{dr}{dt}$

cm/min

A spherical snowball melts such that its radius decreases at a rate of 2 in/min. At what rate is the volume of the snowball changing when the radius is 3 inches?

(D)



(R) $\frac{dV}{dt} = ?$

$\frac{dr}{dt} = -2$

$r = 3$

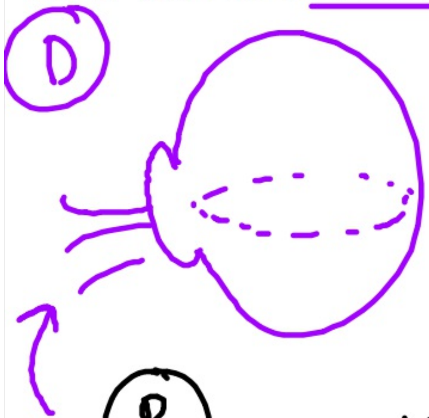
(E) $V = \frac{4}{3}\pi r^3$

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

(S) $\frac{dV}{dt} = 4\pi \cdot 3^2 \cdot -2$

$= -72\pi \ \text{in}^3/\text{min}$

A balloon (Sph.) is being inflated such that its radius grows at a rate of 2 in per minute. How fast is the surface area changing when the balloon's volume is $32/3\,\pi$ in^3?



$\frac{dr}{dt} = 2$ in/min

$V = \frac{32}{3}\pi$

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

(R) $S = 4\pi r^2$

(D) $\frac{dS}{dt} = 8\pi r \cdot \frac{dr}{dt}$

Need this!

$V = \frac{32}{3}\pi = \frac{4}{3}\pi r^3$ (Sph. Vol)

$32\pi = 4\pi r^3$

$32 = 4r^3$

$8 = r^3$

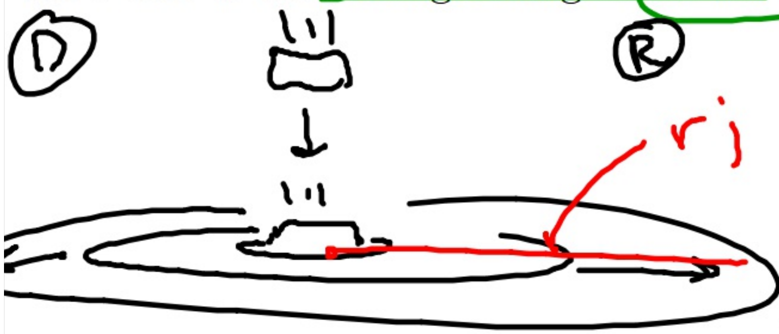
$2 = r$

(S) $\frac{dS}{dt} = 8\pi \cdot 2 \cdot 2$

$= 32\pi$ in^2/min

A ripple forms in a pond. It is expanding such that its radius grows by 2 inches per second. How fast is the area growing when the ripple's circumference is 32π in?

(D)



(R) $r;\ \frac{dr}{dt} = 2$

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

$C = 32\pi$

$C = 2\pi r$

(E) $A = \pi r^2$

(S)

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

? given! ✓

$\frac{dA}{dt} = 32\pi \cdot 2$

$= 64\pi \text{ in}^2/\text{s}$