Calc AB

Lesson 46

9/29/15

Agenda: 9/29/15

Period 3

Period 4

HW Leader:

Lesson 46

Related rates

Quiz 5 on Friday Lessons 39-47, no 46

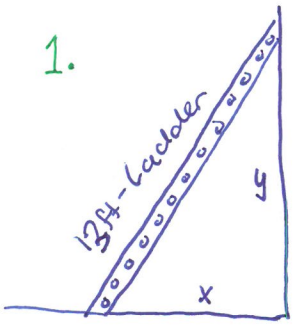
Related rates problems

- Given rates of one or more quantities
- Solve for another rate related to these

Ex. A 13-foot ladder leans against a wall but the base of the ladder begins slipping away from the wall at a rate of 2 feet per second. Find the rate at which the top of the ladder is falling when the base of the ladder is 12 feet from the wall.

1. Draw a picture, label variables, knowns
2. Write down given rates and which to find.
3. Relate variables in an equation
4. Differentiat to relate rates

1.



y = height on wall

x = distance from wall

2. $\frac{dx}{dt} = 2$ f/s find $\left.\frac{dy}{dt}\right|_{x=12}$ relate x and y

3. $x^2 + y^2 = 13^2$ $x = 12$, $y = 5$

4. $2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

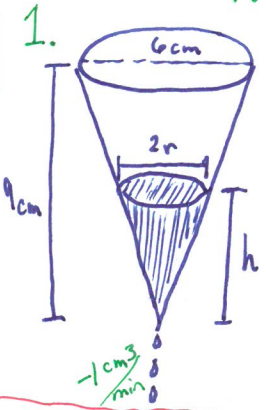
$2(12)(2) + 2(5)\left.\frac{dy}{dt}\right|_{x=12} = 0$

$\left.\frac{dy}{dt}\right|_{x=12} = \frac{-24}{5}$ ft/s

The top of the ladder is falling at a rate of $\frac{24}{5}$ ft/s.

Ex 46.3 An inverted cone of height 9 cm and diameter 6 cm is leaking water at a rate of 1 cm^3/min. Find the rate at which the water level h is changing when h = 3 cm.

1.



2. $\frac{dV}{dt} = -1\ cm^3/min$ find $\left.\frac{dh}{dt}\right|_{h=3}$ relate V and h

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

$V = \frac{1}{3}\pi\frac{h^3}{9}$

$\therefore \frac{dV}{dt} = \pi\frac{h^2}{9}\frac{dh}{dt}$ $\quad -1 = \pi\left(\frac{9}{9}\right)\left.\frac{dh}{dt}\right|_{h=3}$

$\left.\frac{dh}{dt}\right|_{h=3} = -\frac{1}{\pi}$ cm/min

The water level is draping at a rate of $\frac{1}{\pi}$ cm/min.

$r = \frac{h}{3}$

h = height of water

r = radius

V = volume

Calc AB

Lesson 46

9/30/15

Agenda: 9/30/15

Hw Leader: None

Lesson 46:

Related rates

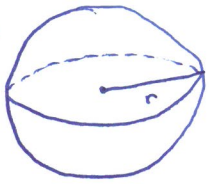
Quiz 5 on Friday

★ Handout
Related rates WS

Ex. A snowball is melting at a rate of $\frac{1}{2}$ cm^3/min. Find the rate of change of the surface area when the volume is 36π cm^3.

2. $\frac{dV}{dt} = -\frac{1}{2}\ \frac{cm^3}{min}$ find $\left.\frac{dA}{dt}\right|_{V=36\pi}$ relate V and A

1.



V = Volume
A = Surface Area
r = radius

3. $V = \frac{4}{3}\pi r^3$ $A = 4\pi r^2$

$r = \left(\frac{3}{4\pi}V\right)^{1/3}$ $A = 4\pi\left(\frac{3}{4\pi}V\right)^{2/3}$

4. $\frac{dA}{dt} = 4\pi\left(\frac{2}{3}\right)\left(\frac{3}{4\pi}V\right)^{-1/3}\cdot\frac{3}{4\pi}\frac{dV}{dt}$

$\left.\frac{dA}{dt}\right|_{V=36\pi} = \frac{8\pi}{3}\left(3\cdot\frac{36\pi}{4\pi}\right)^{-1/3}\cdot\frac{3}{4\pi}\left(-\frac{1}{2}\right)$

$= -\left(27\right)^{-1/3} = -\frac{1}{3}\ cm^2/min$

The surface area is decreasing at a rate of $\frac{1}{3}$ cm^2 per min.

Test 3

- 15 minutes No Calculator
  7 multiple choice Questions

  Derivatives - Simplify first if possible!
  Limits
  Area under the curve
  HA/VA
  Characteristics of f using f'

- 15 minutes 1 FRQ with a Calculator
  Don't Simplify, Leave exact (really don't need a calculator)
  Like the above example

- 20 minutes Non-AP no Calculator
  - implicit differentiation
  - Derivatives/antiderivatives
  - polynomial/rational functions