May 5

How is implicit differentiation similar to related rate problems?

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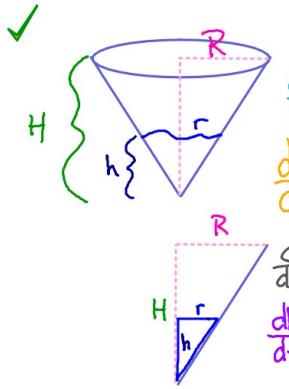
Students will verbally explain how to solve relate rate problems

(using the words:
rates, relationships, values, etc...)

Junior class meeting Thursday May 8th at lunch in room 115. We need a little more $$ for a prom deposit. Come to the meeting with a restaurant night set up and earn extra credit!

Problem D

Water is flowing into an inverted right circular cone at a rate of 3 cubic inches per minute. The cone is 16 inches tall and its base has a radius of 4 inches. At the moment the water has a depth of 5 inches, how fast is the radius at the surface of the water increasing?



rates

$\frac{dV}{dt} = 3$

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

$\frac{dH}{dt} = \frac{dR}{dt} = 0$

$\frac{dh}{dt} = 4\left(\frac{dr}{dt}\right)$

relationships

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

$\frac{H}{R} = \frac{h}{r}$

$\frac{16}{4} = \frac{h}{r}$

$16r = 4h$

$16(1)\frac{dr}{dt} = 4\frac{dh}{dt}$

$\frac{16\left(\frac{dr}{dt}\right)}{4} = \frac{4\left(\frac{dh}{dt}\right)}{4}$

$4\left(\frac{dr}{dt}\right) = \frac{dh}{dt}$

values

$H = 16$

$h = 5$

$R = 4$

$r = 1.25$

$\frac{16}{4} = \frac{5}{r}$

$16r = 20$

$r = \frac{20}{16} = \frac{5}{4} = 1.25$

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

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

$3 = \frac{1}{3}\pi\left(2(1.25)\left(\frac{dr}{dt}\right)(5) + 4\left(\frac{dr}{dt}\right)(1.25)^2\right)$

$3 = \frac{1}{3}\pi\left(12.5\left(\frac{dr}{dt}\right) + 6.25\left(\frac{dr}{dt}\right)\right)$

$\frac{3}{\frac{1}{3}\pi(18.75)} = \frac{\frac{1}{3}\pi(18.75)\frac{dr}{dt}}{\frac{1}{3}\pi(18.75)}$

$\frac{dr}{dt} = .1527 \text{ in/min}$

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#1, 2, 3, 5 – 8, 9,
11, 13, 16, 17, 21, 25

$V = (\text{area of base})(\text{height})$