Calculus Related Rates W.S. #3 Name key

① A circle has a radius of 8" which is changing at a rate of 3 $\frac{in}{min}$. Find the rate the area and circumference are changing at.

$r = 8$ $\frac{dr}{dt} = 3 \frac{in}{min}$

$A = \pi r^2$

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

$= 2\pi(8)(3)$

$\frac{dA}{dt} = 48\pi \frac{in^2}{min}$

$C = 2\pi r$

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

$= 2\pi(3)$

$\frac{dC}{dt} = 6\pi \frac{in}{min}$

② A right circular cone has a height of 10' and radius 6' where $\frac{dh}{dt} = -12 \frac{in}{sec}$ and $\frac{dr}{dt} = 6 \frac{ft}{sec}$. Find the rate the Volume is changing at.

$\frac{dh}{dt} = -12 \frac{in}{sec} = -1 \frac{ft}{sec}$

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

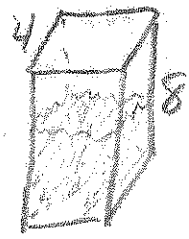
$\frac{dV}{dt} = \frac{1}{3}\pi 2r \frac{dr}{dt} h + \frac{1}{3}\pi r^2 \frac{dh}{dt}$

$\frac{dV}{dt} = \frac{1}{3}\pi 2(6)(6)(10) + \frac{1}{3}\pi(36)(-1)$

$= 240\pi - 12\pi$

$\frac{dV}{dt} = 228\pi \frac{ft^3}{sec}$

③ A rectangular well is 6' Long, 4' wide and 8' deep, If water is running into the well at a rate of 3 $\frac{ft^3}{sec}$, Find how fast the water is rising.



$\frac{dV}{dt} = 3 \frac{ft^3}{sec}$ $\frac{dh}{dt} = ?$

$V = lwh$

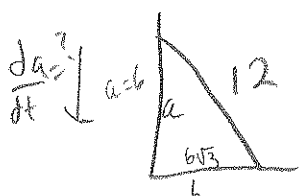
$V = 24h$

$\frac{dV}{dt} = 24 \frac{dh}{dt}$

$3 = 24 \frac{dh}{dt}$

$\frac{1}{8} \frac{ft}{sec} = \frac{dh}{dt}$

④ A 12' Ladder stands against a vertical wall, If the Lower end of the ladder is being pulled away from the wall at a rate of 2 $\frac{Ft}{sec}$. How Fast is the top of the ladder coming down the wall at the instant it is 6' above the ground?



$6^2 + b^2 = 12^2$

$b^2 = 144 - 36$

$b^2 = 108$

$b = \sqrt{108} = 6\sqrt{3}$

$a^2 + b^2 = 12^2$

$2a\frac{da}{dt} + 2b\frac{db}{dt} = 0$

$12\frac{da}{dt} + 12\sqrt{3}(2) = 0$

$\frac{da}{dt} = -2\sqrt{3} \frac{ft}{sec}$