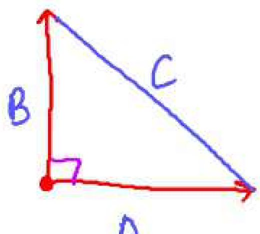
	Consider the curve defined by the equation $2y^3 + 6x^2y - 12x^2 + 6y = 1$ with $\frac{dy}{dx} = \frac{4x - 2xy}{x^2 + y^2 + 1}$ b) Write an equation of each horizontal tangent to the curve c) The line through the origin with slope -1 is tangent to the curve at point P. Find the x and y-coordinates of P. d) Find $\frac{d^2y}{dx^2}$ in terms of x and y.

$2(4)(40) + 2(3)(30) = 2(5)\frac{dC}{dt} \rightarrow 500 = 10\frac{dC}{dt}$ $\boxed{\frac{dC}{dt} = 50 \text{ m/hr}}$

① Draw picture - only label constants ② Label all info ③ Find Eq. ④ Take derivative	C) Truck A travels east at 40 mi/hr. Truck B travels north at 30 mi/hr. How fast is the distance between the trucks changing 6 minutes later?



$A^2 + B^2 = C^2$

$2A\frac{dA}{dt} + 2B\frac{dB}{dt} = 2C\frac{dC}{dt}$

$\frac{dA}{dt} = 40$ mph $\quad \frac{dB}{dt} = 30$ mi/hr

Find $\frac{dC}{dt}$ when $t = 6$ min $\quad t = \frac{6}{60} = \frac{1}{10}$ hr

$A = 4$m $\quad B = 3$m

Don't use until derivative has been taken.

$4^2 + 3^2 = C^2$

$16 + 9 = C^2$

$25 = C^2$

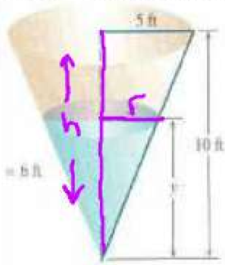
$5 = C$

D) Water runs into a conical tank at the rate of 9 ft³/min. The tank stands point down and has a height of 10 ft and a base radius of 5 ft. How fast is the water level rising when the water is 6 ft deep?

$\frac{dV}{dt} = 9$ ft³/min

If full $h = 10$ $r = 5$

Find $\frac{dh}{dt}$ when $h = 6$



$\frac{r}{h} = \frac{5}{10}$

$\frac{10r}{10} = \frac{5h}{10}$

$r = \frac{1}{2}h$

$h = 2r$

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

$V = \frac{1}{3}\pi \left(\frac{1}{2}h\right)^2 h$

$V = \frac{1}{12}\pi h^3$

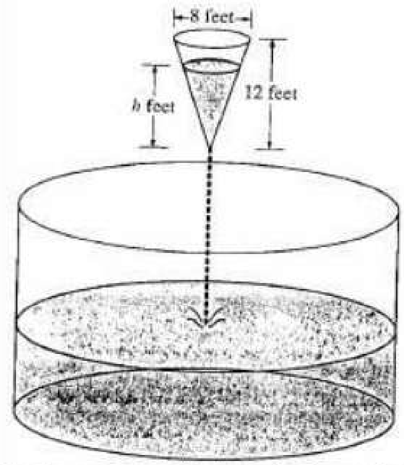
$\frac{dV}{dt} = \frac{1}{4}\pi h^2 \frac{dh}{dt}$

$9 = \frac{1}{4}\pi (6)^2 \frac{dh}{dt}$

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

$\frac{dh}{dt} = \frac{1}{\pi}$ ft/min

21. Water is draining from a conical tank with height 12 feet and diameter 8 feet into a cylindrical tank that has a base with area 400π square feet. The depth, h, in feet, of the water in the conical tank is changing at the rate of (h - 12) feet per minute. Volume of a cone: $V = \frac{1}{3}\pi r^2 h$



A) Write an expression for the volume of water in the conical tank as a function of h.

B) At what rate is the volume of water in the conical tank changing when h = 3? Indicate units of measure.

C) Let y be the depth, in feet, of the water in the cylindrical tank. At what rate is y changing when h = 3? Indicate units of measure.

What you'll Learn About:
How to use derivatives to find limits in an indeterminate form

Why L'Hopitals Works

Sketch the graph of two curves with the following characteristic $f(2) = g(2) = 0$.

a) Write the tangent line for $f(x)$

b) Write the tangent line for $g(x)$

c) $\lim_{x \to 2} \frac{f(x)}{g(x)}$

d) $\lim_{x \to 0} \frac{2x^2}{x^2}$

2) $\lim_{x \to 0} \frac{\sin(5x)}{x}$

	4) $\lim_{x\to 1}\frac{\sqrt[3]{x}-1}{x-1}$ 49) $\lim_{x\to 1}\frac{x^3-1}{4x^3-x-3}$ A) $\lim_{x\to\infty}\frac{x^3-1}{4x^3-x-3}$ 27) $\lim_{x\to\infty}\frac{\ln(x^5)}{x}$ 35) $\lim_{x\to\infty}\frac{\log_2(x)}{\log_3(x+3)}$ 33) $\lim_{x\to 0}\frac{\sin(x^2)}{x}$