Test 2, Spring '09, looks pretty decent.

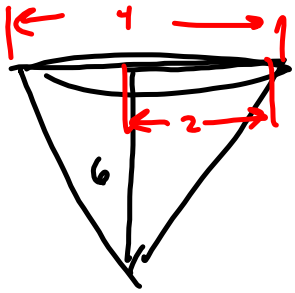
http://www.harryzaims.com/201/201-spring-11/tests/old-tests/test-2-spr-09.pdf

Solutions

http://www.harryzaims.com/201/201-spring-11/tests/old-tests/test-2-spr-09-solns.pdf

OUT: $\frac{dV_O}{dt} = \frac{10000\ cm^3}{min}$

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



9. Water is leaking out of an inverted conical tank at a rate of 10,000 cm^3/min at the same time that water is being pumped into the tank at a constant rate. The tank has height 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of 20 cm/min when the height of the water is 2 m, find the rate at which water is being pumped into the tank.

want IN: $\frac{dV_I}{dt} = ?$

$$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\left(\frac{1}{3}h\right)^2 \pi h = \frac{1}{27}\pi h^3$$

$$\Rightarrow \frac{dV}{dt} = 3\left(\frac{1}{27}\right)\pi h^2 \frac{dh}{dt} = \frac{1}{9}\pi h^2 \frac{dh}{dt}$$

$\frac{130}{\cancel{16900}\ \cancel{260}\ 2} = 65$

$\left.\frac{dh}{dt}\right|_{h=200cm} = \frac{20\ cm}{min} \Rightarrow$

$$\frac{dV}{dt} = \frac{\pi}{9}(200)^2 \cdot (20) = \frac{8\pi}{9} \times 10^5$$

Want IN rate.

$= IN - OUT$

$= IN - 10{,}000 = \frac{8\pi}{9} \times 10^5$

$\frac{1}{a^2}x^2 - \frac{1}{b^2}y^2 = 1$ x-nought

want tan line @ (x_0, y_0)

x'

$\frac{2}{a^2}x - \frac{2}{b^2}yy' = 0$

Assuming y is implicitly a function

$-\frac{yy'}{b^2} = -\frac{x}{a^2}$

Tangent line

$y = f'(x)(x - x_0) + y_0$

$y' = \frac{b^2}{y}\cdot\frac{x}{a^2} = \frac{b^2}{a^2}\cdot\frac{x}{y}$

$= m_{tan} = \left.\frac{dy}{dx}\right|_{x=x_0}$

$y'\Big|_{(x_0,y_0)} = \frac{b^2 x_0}{a^2 y_0} \Rightarrow$ $y = \frac{b^2 x_0}{a^2 y_0}(x - x_0) + y_0$