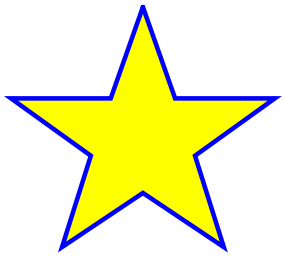
HW #7 (due Fri, 9 Jan)
2.5 # 1-39 odd; 43, 47 - Implicit Differentiation
2.6 # 15-23 odd - Related Rates
2.6 # 25, 27, 35 - Related Rates (more challenging problems)



Quiz #4 - Fri, 9 Jan?

HW #8 (due Fri, 16 Jan)
3.1 # 17-31 odd - Absolute Extrema on an Interval
3.2 # 7-19 odd - Rolle's Theorem
3.2 # 31-37 odd - Mean Value Theorem
3.3 # 11-31 odd - Increasing, Decreasing, and Relative Extrema

Quiz #5 - Fri, 16 Jan?

HW #9 (due Test Day)
3.4 #11-25 odd - Inflection Points and Concavity
3.5 #15-31 odd - Limits at Infinity

Test #3 - Wed, 21 Jan?

2.5 – Implicit differentiation

Find y'' in terms of x and y.

38. $1 - xy = x - y$

$\frac{d}{dx}[1-xy] = \frac{d}{dx}[x-y]$

$0-(xy'+1\cdot y) = 1-y'$

$-xy'-y = 1-y'$

$y'-xy' = 1+y$

$y'(1-x) = 1+y$

$y' = \frac{1+y}{1-x}$

$y'' = \frac{(1-x)(1+y)' - (1+y)(1-x)'}{(1-x)^2}$

$y'' = \frac{(1-x)(y') - (1+y)(-1)}{(1-x)^2}$

$y'' = \frac{(1-x)\left(\frac{1+y}{1-x}\right) + 1+y}{(1-x)^2}$

$y'' = \frac{2+2y}{(1-x)^2}$

40. Find y'' in terms of x & y.

$y^2 = 4x$

$\frac{d}{dx}[y^2] = \frac{d}{dx}[4x]$

$2yy' = 4$

$y' = \frac{4}{2y} = \frac{2}{y}$

$\frac{d}{dx}[y'] = \frac{d}{dx}[2y^{-1}]$

$y'' = -2y^{-2} \cdot y'$

$y'' = \frac{-2}{y^2} \cdot \frac{2}{y}$

$\boxed{y'' = \frac{-4}{y^3}}$

2.6 Related Rates

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

$\frac{dr}{dt} = 2 \text{ in/min}$

$\frac{dV}{dt} = ?$ when $r = 6 \text{ in}$

$\frac{d}{dt}[V] = \frac{d}{dt}\left[\frac{4}{3}\pi r^3\right]$

$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt}$

$\frac{dV}{dt} = 4\pi (6\text{ in})^2 \cdot \frac{2\text{ in}}{\text{min}} = 4\pi(36)\cdot 2 \ \frac{\text{in}^3}{\text{min}}$

$= \boxed{288\pi \ \text{in}^3/\text{min}}$

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

$\frac{dr}{dt} = 2$ in/min

$h = 3r$

$\frac{dV}{dt} = ?$ when $r = 6$ in

~~$\frac{d}{dt}[V] = \frac{d}{dt}\left[\frac{1}{3}\pi r^2 h\right]$~~

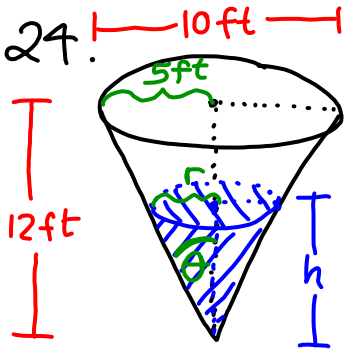
~~$\frac{dV}{dt} = \frac{2}{3}\pi r \cdot \frac{dr}{dt} \cdot h + \left(\frac{1}{3}\pi r^2\right) \cdot \frac{dh}{dt}$~~

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

$V = \pi r^3$

$\frac{dV}{dt} = 3\pi r^2 \cdot \frac{dr}{dt} = 3\pi (6\text{in})^2 \cdot (2\text{in/min}) = 216\pi \text{ in}^3/\text{min}$

24.



$\frac{dV}{dt} = 10 \text{ ft}^3/\text{min}$

$\frac{dh}{dt} = ?$ when $h = 8$ ft

$\frac{r}{h} = \frac{5}{12} \Rightarrow r = \frac{5h}{12}$

$V = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \left(\frac{5h}{12}\right)^2 \cdot h = \frac{1}{3}\pi \cdot \frac{25}{144} \cdot h^3$

$V = \frac{1}{3}\pi \cdot \frac{25}{144} h^3$

$\frac{dV}{dt} = \pi \cdot \frac{25}{144} h^2 \cdot \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{\frac{25\pi h^2}{144}} = \frac{10}{\frac{25\pi (8)^2}{144}}$

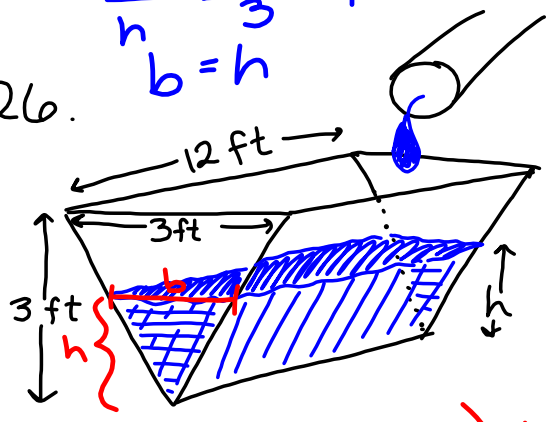
$= \frac{10}{1} \cdot \frac{144}{25\pi \cdot 64} = \frac{9}{10\pi}$

$\frac{dh}{dt} = \frac{9}{10\pi}$ ft/min

$\frac{b}{h} = \frac{3}{3} = 1$

$b = h$

26.



$\frac{2\ ft^3}{min} = \frac{dV}{dt}$

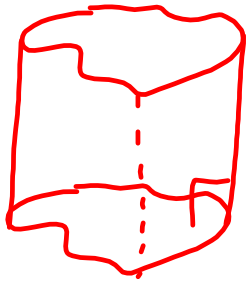
$\frac{dh}{dt} = ?$ when $h = 1$ ft

$V = (\text{area of triangular side}) \cdot \text{length of trough}$

$V = \left(\frac{1}{2}bh\right)(12)$

$V = 6h^2$

$\frac{dV}{dt} = 12h \cdot \frac{dh}{dt}$



Volume of a right prism is area of base times height

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{12h} = \frac{2}{12(1)} = \boxed{\frac{1}{6}\ \frac{ft}{min}}$