47. $25x^2+16y^2+200x-160y+400=0$

$25(x^2+8x+16)-400+16(y^2-10y+25)-400+400=0$

$25(x+4)^2+16(y-5)^2=400$

$\frac{25(x+4)^2}{400}+\frac{16(y-5)^2}{400}=\frac{400}{400}$

$\frac{(x+4)^2}{4^2}+\frac{(y-5)^2}{5^2}=1$ ellipse

$50x+32y\cdot y'+200-160y'=0$

$y'(32y-160)=-200-50x$

$y'=\frac{-200-50x}{32y-160}=\frac{-50(4+x)}{32(y-5)}$

$y'=0$ when $x=-4$
$(-4,0)$ & $(-4,10)$

$(y-5)^2=5^2$
$y-5=\pm 5$
$y=10$ & 0

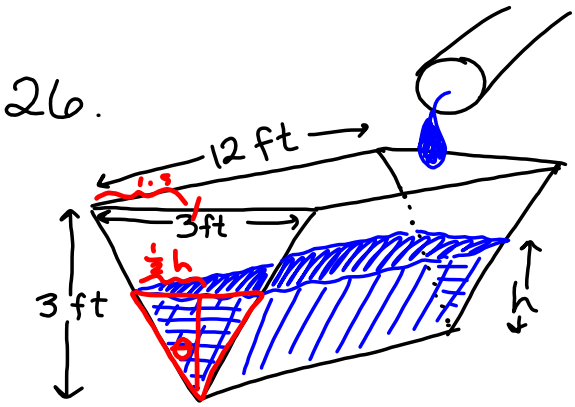
y' is undefined when $y=5$
$(0,5)$ & $(-8,5)$

$(x+4)^2=4^2$
$x+4=\pm 4$
$x=0$ & -8

$\frac{d^2y}{dx^2}=y''$ $\frac{d^ny}{dx^n}=y^{(n)}$

$\frac{dy}{dx}=y'$

26.



V = area of ∇ $\times$ 12

$V = \frac{1}{2}h^2 \cdot 12$

$V = 6h^2$

(a) $\frac{dV}{dt} = 2\ ft^3/min$

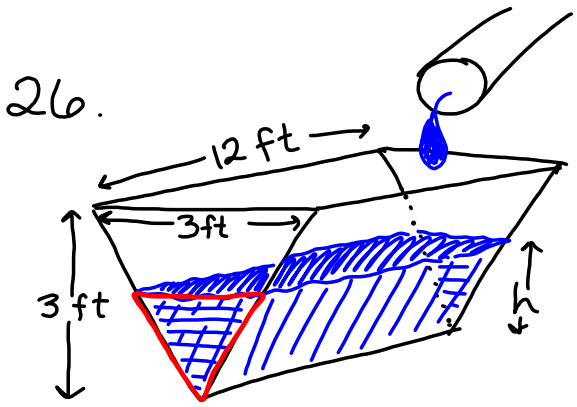
$\frac{dh}{dt} = ?$ when $h = 1$ ft

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

$\frac{dh}{dt} = \frac{12h}{\frac{dV}{dt}} = \frac{12 \cdot 1}{2}$

$= \boxed{6\ ft/min}$

26.



$V = 6h^2$

(b) $\frac{dh}{dt} = \frac{3}{8}$ in/min

when $h = 2$ ft

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

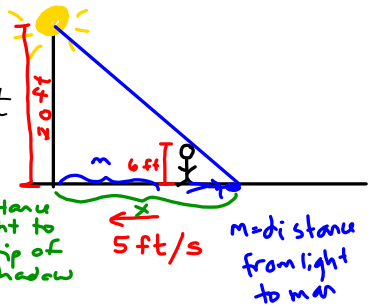
$\frac{dV}{dt} = 12h \cdot \frac{dh}{dt} = 12\ ft\,(2ft)\left(\frac{3\ in}{8\ min}\right)\cdot\frac{1\ ft}{12\ in}$

$= \frac{3}{4}\ ft^3/min$

36. A man 6 ft tall walks toward a light that is 20 ft above the ground at a rate of 5 ft/s. When he is 10 ft from the base of the light,

(a) at what rate is the tip of his shadow moving? $\frac{dx}{dt} = ?$ x = distance from light to tip of shadow

(b) at what rate is the length of his shadow changing? m = distance from light to man



(a) $\frac{20}{x} = \frac{6}{s}$

$20s = 6x$

$10s = 3x$

$x = \frac{10}{3}s$

$\frac{dx}{dt} = \frac{10}{3} \cdot \frac{ds}{dt}$

$\frac{20}{x} = \frac{6}{x-m}$

$20(x-m) = 6x$

$20x - 20m = 6x$

$14x = 20m$

$x = \frac{10}{7}m$

$\frac{dx}{dt} = \frac{10}{7} \cdot \frac{dm}{dt}$

$= \frac{10}{7}(-5\,ft/s)$

$= -\frac{50}{7}\,ft/s$

Homework since Test #2 (Material for Test #3)

2.5 # 1-39 odd; 43, 47 - Implicit Differentiation ✓ → due Wed

2.6 # 15-23 odd - Related Rates ✓

2.6 # 25, 27, 35 - Related Rates (more challenging problems) ✓ → next fri

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

3.4 #11-25 odd - Inflection Points and Concavity