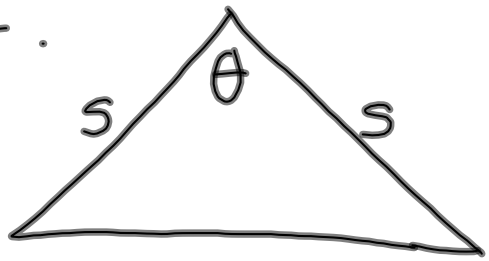
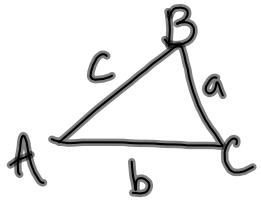
2.6

17.





$\text{area} = \frac{1}{2}ab\sin C$

$= \frac{1}{2}bc\sin A$

$= \frac{1}{2}ac\sin B$

$A = \frac{1}{2}s^2\sin\theta$

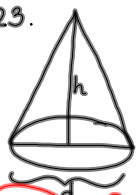
$\frac{d\theta}{dt} = \frac{1}{2}$ rad/min

$\frac{dA}{dt} = \frac{1}{2}s^2 \cdot \cos\theta \cdot \frac{d\theta}{dt}$

$\frac{dA}{dt} = ?$ when $\theta = \frac{\pi}{6}$

$= \frac{s^2}{2} \cdot \cos\frac{\pi}{6} \cdot \frac{1}{2} = \frac{s^2\sqrt{3}}{8}$ $\frac{\text{unit}^2}{\text{min}}$

23.



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

$\frac{dh}{dt} = ?$ when $h = 15$ ft

$d = 3h$ $\quad 2r = 3h$ $\quad r = \frac{3h}{2}$

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

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

$V = \frac{3\pi}{4}h^3$

$\frac{dV}{dt} = \left(\frac{3\pi}{4} \cdot 3h^2\right)\frac{dh}{dt}$

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{\frac{3\pi}{4} \cdot 3h^2}$

$= \frac{10}{\frac{3\pi}{4} \cdot 3(15)^2}$

$= \frac{10}{\frac{\pi}{4} \cdot 225} = \frac{40}{225\pi} = \frac{8}{45\pi}$

$\frac{dh}{dt} = \frac{8}{45\pi}$ ft/min

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

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

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

$\frac{dV}{dt}$ ✓ $\quad \frac{dr}{dt}$? $\quad \frac{dh}{dt}$ ✓

19. $\frac{dV}{dt} = 800 \text{ cm}^3/\text{min}$

$\frac{dr}{dt} = ?$ when $r = 30$ cm

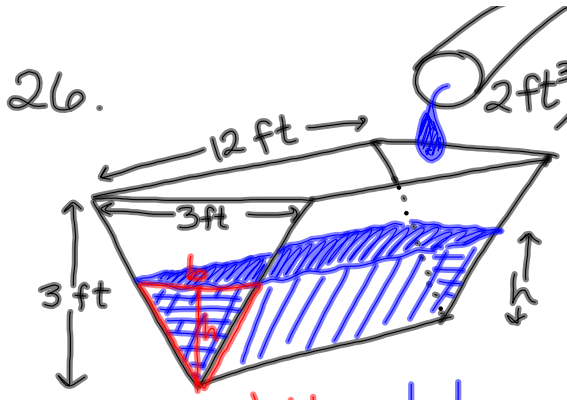
$V = \frac{4}{3}\pi r^3$

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

$\frac{dr}{dt} = \frac{\frac{dV}{dt}}{4\pi r^2}$ $\frac{\text{cm}^3/\text{min}}{\text{cm}^2}$

$\frac{2}{4\pi(900)} = \frac{2}{9\pi}$ cm/min

26.



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

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

area of $\triangle = \frac{1}{2}bh$ $b = h$

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

$V = 6h^2$ a.

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

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{12h} = \frac{2}{12\cdot 1} = \frac{1}{6}$ ft/min

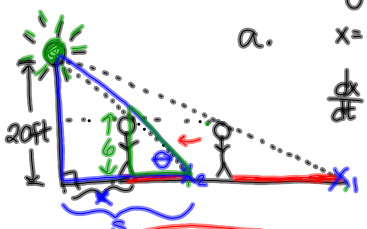
b. $\frac{dh}{dt} = \frac{3}{8}$ in/min when $h = 2$ ft

$\frac{dV}{dt} = 12\cdot h\cdot\frac{dh}{dt} = 12\cdot 2\text{ft}^2\cdot\frac{3}{8}\frac{\text{in}}{\text{min}}\cdot\frac{1\text{ft}}{12\text{in}} = \frac{3}{4}$ ft/

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?

(b) at what rate is the length of his shadow changing?



a. x = distance from man to light

$\frac{dx}{dt} = -5$ ft/s

s = distance from light to tip of shadow

$\frac{ds}{dt} = ?$ when $x = 10$ ft

$\tan\theta = \frac{20}{s} = \frac{6}{s-x}$

$6s = 20s - 20x$

$20x = 14s$

$10x = 7s$

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

$\frac{ds}{dt} = \frac{10}{7}\cdot\frac{dx}{dt} = \frac{10}{7}(-5) = \frac{-50}{7}$ ft/s

HW: #25, 27, 35

b. Let s = length of shadow

$\frac{20}{x+s} = \frac{6}{s}$

$20s = 6x + 6s$

$14s = 6x$

$s = \frac{3}{7}x$

$\frac{ds}{dt} = \frac{3}{7}\frac{dx}{dt} = \frac{-15}{7}$