**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?

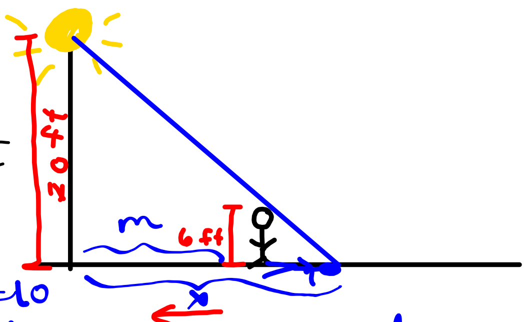
**HW #9 (due Test Day)**
3.4 #11-25 odd - Inflection Points and Concavity
3.5 #15-31 odd - Limits at Infinity

**Test #3 - Wed, 21 Jan?**

$$(x+h)^3 = (x+h)(x+h)(x+h)$$
$$= x^3 + 3x^2h + 3xh^2 + h^3$$
$$(x+h)^2 = x^2 + 2xh + h^2$$

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? $\frac{dx}{dt} = ?$ when $m = 10$




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

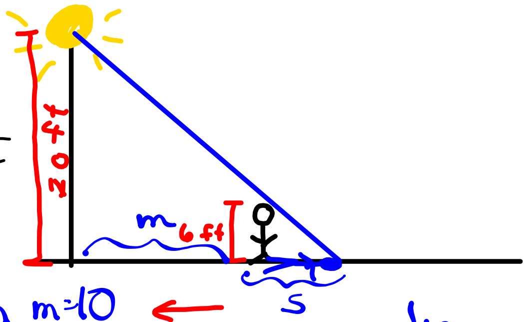
Let $x$ = the distance from the light to the tip of the shadow

Let $m$ = distance from man to light

$$\frac{20}{x} = \frac{6}{x-m}$$
$$20(x-m) = 6x$$
$$20x - 20m = 6x$$
$$14x = 20m$$

$$x = \frac{20m}{14} = \frac{10m}{7}$$
$$\frac{dx}{dt} = \frac{10}{7}\frac{dm}{dt}$$
$$\frac{dx}{dt} = \frac{10}{7}(5\text{ ft/s}) = \boxed{\frac{50}{7}\ \frac{\text{ft}}{\text{s}}}$$

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,




(b) at what rate is the length of his shadow changing? $\frac{ds}{dt} = ?$ when $m = 10$

$\leftarrow -5\text{ ft/s} = \frac{dm}{dt}$

m = dist. from light to man

s = length of shadow

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

$$20s = 6(m+s)$$

$$20s = 6m + 6s$$

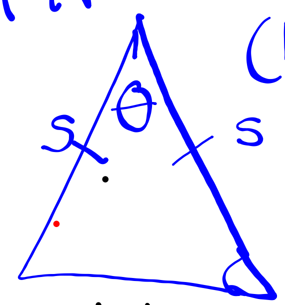
$$14s = 6m$$

$$s = \frac{6m}{14} = \frac{3m}{7}$$

$$\frac{ds}{dt} = \frac{3}{7}\left(\frac{dm}{dt}\right)$$

$$= \frac{3}{7}(-5) = \boxed{-\frac{15}{7}\text{ ft/s}}$$

2.6 #17




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

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

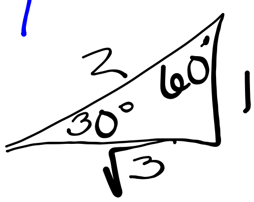

(b) $\frac{d\theta}{dt} = \frac{1}{2}$ rad/min ; $\frac{dA}{dt} = ?$ when $\theta = \frac{\pi}{6}$

~~need formula relating s & θ~~

s is constant!

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

$$= \frac{1}{2}s^2 \cdot \frac{\sqrt{3}}{2}\cdot\frac{1}{2}$$




$\frac{\pi}{6} = 30°$

$\frac{\pi}{3} = 60°$

1. Find the average rate of change of the volume of a sphere with respect to radius, as the radius of the sphere changes from 1 cm to 2 cm.

$$\frac{\Delta V}{\Delta r} = \frac{\frac{4}{3}\pi(2)^3 - \frac{4}{3}\pi(1)^3}{2-1}$$

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

$cm^2$

2. Find the instantaneous rate of change of the volume of a sphere with respect to radius when the radius is 2 cm.

$$\frac{dV}{dr} = V' = 4\pi r^2 = 4\pi(2)^2$$

$cm^2$

3. If the radius of a sphere changes at a rate of 3cm per second, find the rate of change of the volume of the sphere with respect to time when the radius is 2 cm.

$$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt} = 4\pi(2)^2(3)$$

$cm^3/s$

$$xy = 5$$

$$\frac{d}{dx}[xy] = \frac{d}{dx}[5]$$

$$\frac{d}{dx}(x)\cdot y + x\cdot\frac{d}{dx}y = 0$$

$$1\cdot y + x\cdot\frac{dy}{dx} = 0$$

$$y + xy' = 0$$

$$(x \sin y)' = (5)'$$

$$x' \sin y + x(\sin y)' = 0$$

$$\sin y + x(\cos y)(y') = 0$$

$$(3y)' = (2)'$$

$$3y' = 0$$

$$(y^5)' = (3)'$$

$$5y^4 \cdot y' = 0$$

$$[\sin(xy)]' = [5]'$$

$$\cos(xy) \cdot (xy)' = 0$$

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