Closing *Tues*: 3.6-9
Closing *Thurs*: 3.9
Closing next *Tues*: 3.10
Closing next *Thurs*: 4.1(1), 4.1(2)
Remember: Friday is a Holiday (no class)

3.9 Related Rates:

1. Draw & label ***everything***.
2. What you **know**?
   What you **want**?
3. Equations relating quantities?
4. *Differentiate* with respect to *t*.
5. Substitute in your values and solve.
   Do **NOT** substitute until last step.

Entry Task: (Like HW 3.9/3) A kite at an altitude of 400 ft is being blown horizontally at 10 ft/sec away from the person holding the kite string at ground level. At what rate is the string being let out when 500 ft of string is already out?

Example: (Like HW 3.9/2) One bike is 4 miles east of an intersection, travelling toward the intersection at the rate of 9 mph. At the same time, a 2^{nd} bike is 3 miles south of the intersection and is travelling away from the intersection at a rate of 10 mph.

- At what rate is the distance between them changing?
- Is this distance increasing or decreasing?

Example: (Like 3.6-9/13, 3.9/9)

A 13-foot ladder is leaning against a wall and its base is slipping away from the wall at a rate of 3 ft/sec when it is 5 ft from the wall.

How fast is the top of the ladder dropping at that moment?

Example: (Like 3.9/6)

A lighthouse is located on a small island 2 km away from the nearest point *P* on a straight shoreline and its light makes three revolutions per minute.

How fast is the beam of light moving along the shoreline when it is 1 km from *P*?

Other Questions?

3.10 Linear Approximation (*Preview*)

Idea: "Near" the point (a,f(a)) the graphs of $y = f(x)$ and the tangent line $y = f'(a)(x - a) + f(a)$ are very close together.

We say the tangent line is a **linear approximation** (or **linearization** or **tangent line approximation**) to the function. Sometimes it is written as

$$L(x) = f'(a)(x - a) + f(a)$$

In other words:

If $x \approx a$, then

$$f(x) \approx f'(a)(x - a) + f(a)$$

Example: Find the linear approximation of $f(x) = \sqrt{x}$ at $x = 81$. Then use it to approximate the value of $\sqrt{82}$.

Example: Find the linearization of $g(x) = \sin(x)$ at $x = 0$. Then use it to approximate the value of sin(0.03).

Example:

Using tangent line approximation estimate the value of $\sqrt[3]{8.5}$.