Closing Tues: HW 9.3

Closing Thurs: HW 9.4

The Math Study Center (Comm B-014) is open from 12:30-4:30pm Mon-Thurs, starting today!

I'll be in there from 2-3:30pm Mondays.

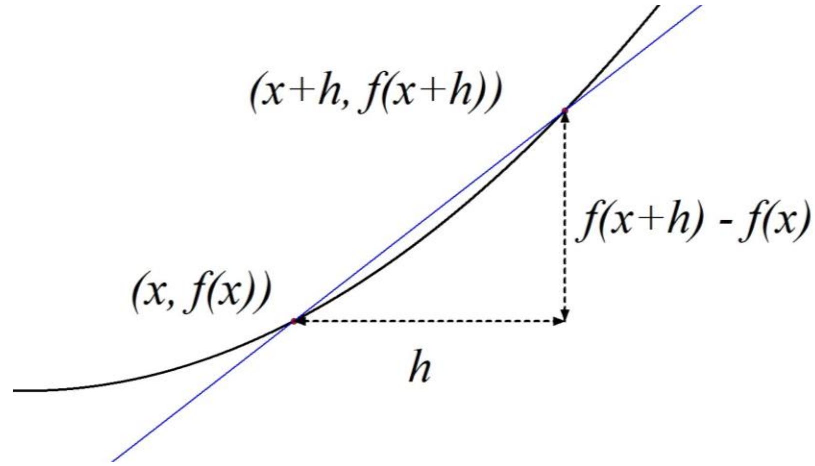
9.3 Summary: To get the formula for ***the slope of the tangent line*** *to f(x) at a point x*.

1. Completely simplify

$$\frac{f(x+h)-f(x)}{(x+h)-x}$$

2. Let *h* go to zero.

The resulting function is called the derivative function: $f'(x)$



9.4: Derivative Patterns

Entry Task: Let $f(x) = x^2$

1. Completely simplify

$$\frac{f(x+h)-f(x)}{(x+h)-x}$$

2. Then let h go to zero.

$$f(x) = x^2$$

$$\frac{f(x+h) - f(x)}{h} =$$

Let's try it again:

$f(x) = x^3$

$$\frac{f(x+h) - f(x)}{h} =$$

POWER RULE: If $f(x) = x^n$, then $f'(x) = n\,x^{n-1}$.

Written briefly, $\frac{d}{dx}(x^n) = n\,x^{n-1}$.

Special Cases:

$$\frac{d}{dx}(x) = 1.$$
$$\frac{d}{dx}(1) = 0.$$

Note: Although we won't prove this.
The power rules works for ALL powers
(including negative and decimal powers)

Exponents Review

$$\frac{1}{x^b} = x^{-b}.$$

$\sqrt[a]{x} = x^{1/a}$ and $\sqrt{x} = x^{1/2}$.

$$x^a x^b = x^{a+b}.$$

$$\frac{x^a}{x^b} = x^{a-b}.$$

$$(x^a)^b = x^{ab}.$$

SUM/DIFFERENCE RULE: $\frac{d}{dx}(f(x)+g(x)) = f'(x)+g'(x)$, and
$\frac{d}{dx}(f(x)-g(x)) = f'(x)-g'(x)$.

$\boxed{\textbf{COEFFICIENT RULE}: \quad \frac{d}{dx}\left(cf(x)\right) = cf'(x).}$

Special Cases:

$$\frac{d}{dx}(c\,x) = c.$$

$$\frac{d}{dx}(c) = 0.$$

Derivative methods so far:

1. **Expand** into sum of terms.

2. **Rewrite** each term as: cx^b.

3. Bring coefficients/sum along for the ride.

4. Use power rule.

5. Simplify.

1. $y = 5x - 3x^2 + 1$

2. $R(q) = -0.4q^3 + \dfrac{q^2}{2} + 4.5q$

3. $y = \sqrt[3]{x} - 3x^4 + \dfrac{5}{\sqrt{x}}$

4. $f(x) = x^3\left(x^5 + \dfrac{2}{x}\right)$

5. $g(x) = 12\sqrt{x} - \dfrac{10}{x^2} + 17$

6. $y = \dfrac{x^{-2} + x^7 - 2}{\sqrt{x}}$

7. $y = \sqrt{x}(x^3 + 4)$

8. $y = \frac{x^3}{3} + \frac{5}{x^2} + 6\sqrt[3]{x^2}$

9. $y = \frac{t^2 - \sqrt{t} + 2}{t^2}$

10. $y = \frac{4\sqrt[3]{x^2}}{5\sqrt{x^3}}$