Rules of Derivatives

Rules of Derivatives so far

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- Power Rule

$$\frac{d}{dx} x^n = n\, x^{n-1}$$

- Exponent Rule

$$\frac{d}{dx} b^x = \frac{d}{dx} e^{x \ln(b)} = \ln(b) e^{x \ln(b)} = \ln(b) b^x$$

- Contant Rule

$$\frac{d}{dx}(a\, f(x)) = a\left(\frac{d}{dx} f(x)\right) = a\, f'(x)$$

- Sum/Difference Rule

$$\frac{d}{dx}(f(x) \pm g(x)) = \frac{d}{dx} f(x) \pm \frac{d}{dx} g(x) = f'(x) \pm g'(x)$$

Product Rule

$$\frac{d}{dx}(f(x)g(x))=(\frac{d}{dx}f(x))g(x)+(\frac{d}{dx}g(x))f(x)$$

$$\frac{d}{dx}(f(x)g(x))=f'(x)g(x)+g'(x)f(x)$$

- Take the derivative of the first, keep the second
- Plus the derivative of the second, keep the first

Quotient Rule

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right)=\frac{f'(x)g(x)-g'(x)f(x)}{(g(x))^2}$$

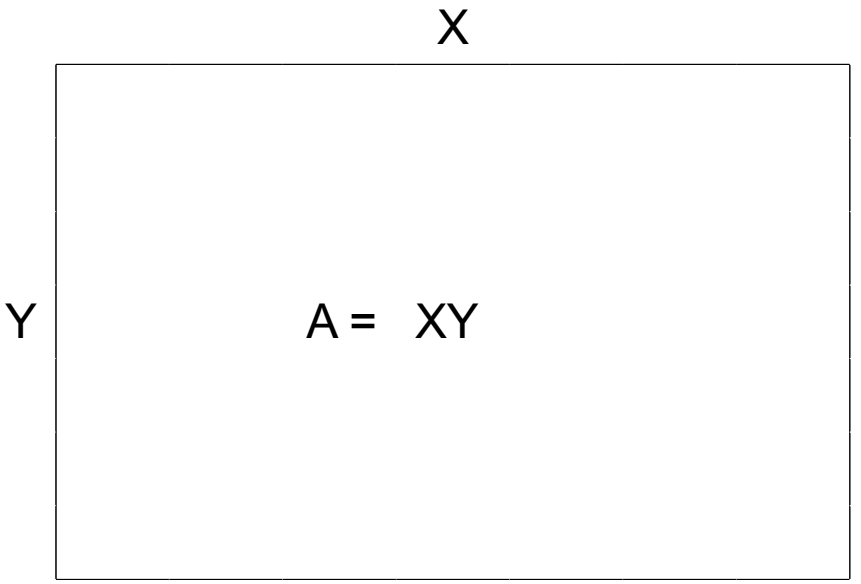
- Take the derivative of the top, keep the bottom
- Minus the derivative of the bottom, keep the top
- All over the bottom squared

Example Problem

- You have 50 meters of fencing and want to use it to make a rectangular pen with the most area
  - How long should each side be?

Pen Problem

- You have 50 meters of fencing and want to use it to make a rectangular pen with the most area
  - How long should each side be?
  - P = 2X + 2Y
  - 25 = X + Y
  - Y = 25 – X
  - A = XY
  - A(X) = X(25 - X)



Pen Problem

- Max Area means that A'(X) = 0
- A(X) = X(25 – X)
- A'(X) = 1*(25 – X) + (-1)X
- A'(X) = 25 – 2 X = 0
- 25 = 2 X
- X = 25/2
- Y = 25 – X
- Y = 25/2

- A(X) = X(25 – X)
- A'(X) = 25 X - X^2
- A'(X) = 25 – 2 X = 0

- A square pen will maximize area

Parabola Maxima

- When is a parabola of the form

  $Ax^2 + Bx + C$

  have its maximum point assuming $A < 0$

Parabola Maxima

- When is a parabola of the form

  $Ax^2 + Bx + C$

  have its maximum point assuming $A > 0$
- $2Ax + B = 0$
- $2Ax = -B$
- $X = -B/(2A)$

Questions?