

Monday, September 17, 2012 (Day 9)

Section 3-5 Basic Differentiation Properties

Symbols for the Derivative of a function f

Symbols without variable: f' or Df

Symbols with variable: $f'(x)$ or $Df(x)$ or $\frac{df(x)}{dx}$

First Rules for Computing Derivatives

The Power Rule

Used for finding derivatives of Power functions

Functions of form

$$f(x) = X^n$$

\leftarrow real number constant exponent
 X variable base

The Power Rule

If $f(x) = x^n$ then $f'(x) = n \cdot x^{n-1}$

Single Equation version: $\frac{d}{dx} x^n = n \cdot x^{n-1}$

Example 1 Let $f(x) = x^3$. Find $f'(x)$

Solution $\frac{d}{dx} x^3 \leftarrow n=3$

$$= 3 \cdot x^{3-1} = 3 \cdot x^2$$

\uparrow power rule \uparrow simplifying

Example 2 Let $f(x) = \frac{1}{x^3}$. Find $f'(x)$.

Solution We must first rewrite $f(x)$ as a power function.

$$f(x) = \frac{1}{x^3} = x^{-3}$$

\uparrow important, necessary skill

Now take derivative

$$f'(x) = \frac{d}{dx} x^{-3} = -3 \cdot x^{-3-1} = -3x^{-4} = -3 \cdot \frac{1}{x^4} = \frac{-3}{x^4}$$

$\leftarrow n = -3$

\leftarrow rewrite answer with positive exponent

Example 3 $f(x) = \sqrt{x}$ find $f'(x)$

Solution

first rewrite $f(x)$ as power function

$$f(x) = \sqrt{x} \equiv x^{\frac{1}{2}}$$

\leftarrow simple yet causes lots of errors

$$x^{-a} = \frac{1}{x^a}$$

Now use Power Rule to find Derivative

$$f'(x) = \frac{d}{dx} x^{\frac{1}{2}} \leftarrow n = \frac{1}{2}$$

$$= \frac{1}{2} \cdot x^{\frac{1}{2}-1} = \frac{1}{2} \cdot x^{-\frac{1}{2}} = \frac{1}{2} \cdot \frac{1}{x^{\frac{1}{2}}} = \frac{1}{2} \cdot \frac{1}{\sqrt{x}} = \frac{1}{2\sqrt{x}}$$

\uparrow Power rule \uparrow Simplify \uparrow Convert to positive exponent \uparrow rewrite \uparrow rewrite

