Tuesday, September 18, 2012 (Day 10)

Yesterday: Learned our first three Differentiation Rules

Power Rule: $\frac{d}{dx} x^n = n \cdot x^{n-1}$

Sum + Constant Multiple Rules:

$$\frac{d}{dx}\left(a \cdot f(x) + b \cdot g(x)\right) = a\frac{d}{dx}f(x) + b\frac{d}{dx}g(x)$$

a, b constants; f, g functions

Our last example was $f(x) = x^2 - 2x - 3$

We found $f'(x) = 2x - 2$. This agreed with what we found last week, using graphical techniques and the "definition of the derivative".

Continue this example $f(x) = x^2 - 2x - 3$

(A) Yesterday's example: $f'(x) = 2x - 2$

(B) Find $f'(3)$ and $f'(2.5)$ and $f'(0)$ and interpret these results graphically.

Solution

$f'(3)$ means to substitute $x = 3$ into the function $f'(x) = 2x - 2$

- $f'(3) = 2(3) - 2 = 6 - 2 = 4 = f'(3)$

$f'(2.5)$ means to substitute $x = 2.5$ into f'

- $f'(2.5) = 2(2.5) - 2 = 5 - 2 = 3 = f'(2.5)$
- $f'(0) = 2(0) - 2 = 0 - 2 = -2 = f'(0)$

Graphical interpretation:

The line tangent to graph of f at $x=3$ has slope $m=f'(3)=4$

" " " " " " " " at $x=2.5$ " " $m=f'(2.5)=3$

" " " " " " " " at $x=0$ " " $m=f'(0)=-2$

(C) Find all x-values where the tangent line is horizontal.

Solution

Reword the question

Find all x-values where the tangent line has slope $m=0$.

that is

Find all x-values where $f'(x)=0$,

$$2x-2=0 \quad \text{Solve for } x.$$

$$2x=2$$

$$x=1$$

This agrees with graph.