Questions from Homework

Find the derivative of each function.

Remember!

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

1. $f(x) = 8x^2 - 10$

   $F'(x) = 16x$

2. $f(x) = 2x^2 + 14x - 7$

   $F'(x)\ \ 4x + 14$

3. $f(x) = x^3$

   $F'(x) = 3x^2$

4. $f(x) = \dfrac{x+4}{2x+3}$

   $F'(x) = \dfrac{-5}{(2x+3)^2}$

Remember!

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$f(x) = x^3$ | $f(x+h) = (x+h)^3$

$f(x+h) = x^3 + 3x^2h + 3xh^2 + h^3$

$$f'(x) = \lim_{h \to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}$$

$$= \lim_{h \to 0} \frac{3x^2h + 3xh^2 + h^3}{h}$$

← factor out an "h"

$$= \lim_{h \to 0} \frac{h(3x^2 + 3xh + h^2)}{h} = 3x^2$$

Slope of the tangent

Remember!

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$f(x) = \dfrac{x+4}{2x+3}$

$f(x+h) = \dfrac{(x+h)+4}{2(x+h)+4} = \dfrac{x+h+4}{2x+2h+4}$

$$f'(x) = \lim_{h \to 0} \frac{\frac{x+h+4}{2x+2h+4} - \frac{x+4}{2x+3}}{h}$$

* Multiply each term by $(2x+3)(2x+2h+3)$

$$= \lim_{h \to 0} \frac{(2x+3)(x+h+4) - (x+4)(2x+2h+3)}{h(2x+3)(2x+2h+3)}$$

$$= \lim_{h \to 0} \frac{2x^2+2xh+8x+3x+3h+12 - (2x^2+2xh+3x+8x+8h+12)}{h(2x+3)(2x+2h+3)}$$

$$= \lim_{h \to 0} \frac{2x^2+2xh+8x+3x+3h+12 - 2x^2-2xh-3x-8x-8h-12}{h(2x+3)(2x+2h+3)}$$

$$= \lim_{h \to 0} \frac{-5h}{h(2x+3)(2x+2h+3)} = \frac{-5}{(2x+3)^2}$$

Slope of the tangent

Remember!

Try this one!

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Differentiate the following function using the *Limit Definition of the Derivative*

$f(x) = \sqrt{x+3}$

$f(x+h) = \sqrt{(x+h)+3}$

$= \sqrt{x+h+3}$

$$f'(x) = \lim_{h \to 0} \frac{(\sqrt{x+h+3} - \sqrt{x+3})(\sqrt{x+h+3} + \sqrt{x+3})}{h(\sqrt{x+h+3} + \sqrt{x+3})}$$

$$= \lim_{h \to 0} \frac{x+h+3 - (x+3)}{h(\sqrt{x+h+3} + \sqrt{x+3})}$$

$$= \lim_{h \to 0} \frac{x+h+3-x-3}{h(\sqrt{x+h+3} + \sqrt{x+3})}$$

$$= \lim_{h \to 0} \frac{h}{h(\sqrt{x+h+3} + \sqrt{x+3})} = \frac{1}{\sqrt{x+3} + \sqrt{x+3}}$$

$$= \frac{1}{2\sqrt{x+3}}$$

Slope of the tangent

Homework