Derivative of a Function

p. 148 - 152 (2.7) # 15

1. Analytically, the definition of a derivative of f at x is

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

which is called the difference quotient....(I say - slope generator)

2. Graphically, the derivative of a function at a point p is the slope of a tangent line to the graph of f at p.
3. Numerically, the derivative at a point is the ***limit*** of slopes of the secant lines or the ***limit*** of the difference quotient.
4. The derivative at a point $x = a$ is found by

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h} \text{ or by } \lim_{x \to a} \frac{f(x) - f(a)}{x - a}.$$

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1. Use the definition of derivative to find:

a) $f'(x)$ b) $f'(2)$ for $f(x) = -5x + 4$.

2. Evaluate $\lim_{h \to 0} \frac{6(x+h)^2 - 2(x+h) + 7 - (6x^2 - 2x + 7)}{h}$

**3. If $f(x) = 2x^2 + 1$, then $\lim_{x \to 0} \frac{f(x) - f(0)}{x^2}$ is ____.

Class Notes

1. Evaluate $\lim_{h \longrightarrow 0} \frac{-3(x + h)^2 + 2(x + h) - 1 - (-3x^2 + 2x - 1)}{h}$

2. Using the definition of the derivative, find the slope of the tangent line to the graph of $f(x) = 7 + 2x$ at $x = -4$.

Find the following limits.

3. $\lim_{x \longrightarrow -5} \frac{(\cos(\pi x))}{6}$

4. $\lim_{t \longrightarrow (-5)} (h(t))$ for $h(t) := \begin{cases} e & t = -5 \\ -2t + 1 & t \neq -5 \end{cases}$