Important Things to Remember

$\dfrac{f(b)-f(a)}{b-a}$

(1) can be used to compute <u>the slope of a secant line</u> connecting two points $(a,\ f(a))$ and $(b,\ f(b))$ on the curve $y = f(x)$.

(2) can be used to find <u>the average rate of change</u> of the function $y = f(x)$ from $x = a$ to $x = b$.

$\lim\limits_{x \to a} \dfrac{f(x)-f(a)}{x-a}$

(1) can be used to compute <u>the slope of a tangent line</u> to the curve of $y = f(x)$ at $(a,\ f(a))$.

(2) can be used to find <u>the instantaneous rate of change</u> of the function $y = f(x)$ at $x = a$.

(3) can be used to find <u>the derivative</u> of the function $y = f(x)$ at $(a,\ f(a))$.

$$f'(a) = \lim_{x \to a} \frac{f(x)-f(a)}{x-a}$$

The **derivative** of the function $y = f(x)$ is given by

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

Constant Rule : If $f(x) = c$, where c is any constant, then $f'(x) = 0$.

Power Rule : If $f(x) = x^n$, where n is any real number, then $f'(x) = nx^{n-1}$.

Constant Multiple Rule : If $f(x) = c \cdot g(x)$, where c is any real number and g is differentiable, then $f'(x) = c \cdot g'(x)$.

Sum or Difference Rule : If $f(x) = u(x) \pm v(x)$, where u and v are differentiable, then $f'(x) = u'(x) \pm v'(x)$.

Product Rule : If $f(x) = u(x)v(x)$, where u and v are differentiable, then $f'(x) = u(x)v'(x) + u'(x)v(x)$.

Quotient Rule : If $f(x) = \dfrac{u(x)}{v(x)}$, where u and v are differentiable, then

$$f'(x) = \frac{u'(x)v(x) - u(x)v'(x)}{[v(x)]^2}.$$

Chain Rule : If $f(x) = u(v(x))$, where v is differentiable at x and u is differentiable at $v(x)$, then $f'(x) = u'(v(x)) \cdot v'(x)$.