Examples

(1) A *piecewise linear* function $f(x)$ is characterized by
erty that its rates of change are locally constant, namely, its
$f'(x)$ is a step function.

(2) If $f(x) = x^n$, then $f'(x) = nx^{n-1}$.

(3) If $f(x) = \sin x$, then $f'(x) = \cos x$. We shall c
computation of the derivative, $f'(x)$, from a given function,
operation among functions and call such an operation *diff*
It is not difficult to verify the following simple but use
differentiation:

(i) $[f_1(x) + f_2(x)]' = f_1'(x) + f_2'(x)$.

(ii) $[c \cdot f(x)]' = c \cdot f'(x)$.

(iii) $[f(x) \cdot g(x)]' = f'(x) \cdot g(x) + f(x) \cdot g'(x)$.

(iv) $\left[\frac{1}{f(x)}\right]' = \frac{-f'(x)}{[f(x)]^2}$.

(v) $f[g(x)]' = f'[g(x)] \cdot g'(x)$
(chain rule for differentiation of composite funct

In general, differentiation is technically a rather straight
eration.

§ 2. Fundamental Theory of Calculus

2.1. The relationship between integration and diff