Important Theorems

Continuity The function f is continuous at $x = c$ if $\lim_{x \to c} f(x) = f(c)$.

Absolute Extrema If f is continuous on the closed interval $[a,b]$ then f has an abolute maximum and an absolute minimum value. Furthermore, the absolute extrema will occur at either the critical points or the endpoints.

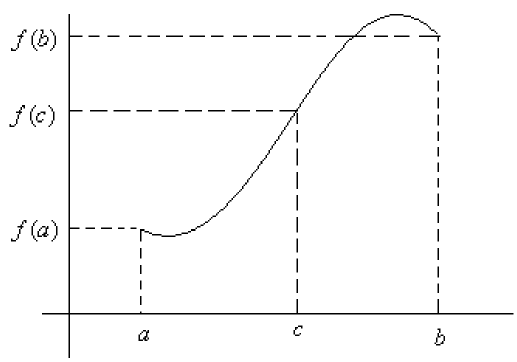
First Fundamental Theorem If f is continous on $[a,b]$ and if F is any antiderivative for f, then $\int_a^b f(x)dx = F(b) - F(a)$.

Second Fundamental Theorem

a) If f is continuous on $[a,b]$ and if $F(x) = \int_a^x f(t)dt$, then $F'(x) = f(x)$.

b) If f is continuous on $[a,b]$ and if $F(x) = \int_a^{g(x)} f(t)dt$, then $F'(x) = f(g(x))g'(x)$.

Intermediate Value Theorem If f is a continuous function on the closed interval $[a,b]$, then f takes on every value between $f(a)$ and $f(b)$. In other words, if $f(a) \le y_0 \le f(b)$ then there exists a value c, $a \le c \le b$, such that $f(c) = y_0$.



Mean Value Theorem If f is continuous at every point in the closed interval $[a,b]$ and differentiable at every point of its interior (a,b), then there is at least one point c in (a,b) at which $f'(c)=\dfrac{f(b)-f(a)}{b-a}$.

Derivative of an Inverse Function Let f be a function that is differentiale on an interal I. If f possesses an inverse function g, then g is differentiable at any x for which $f'\left(g(x)\right)\neq 0$.

$g'(x)=\dfrac{1}{f'(g(x))}$. If we use the terminology f^{-1} instead of g we get:

$\left(f^{-1}\right)'(x)=\dfrac{1}{f'(f^{-1}(x))}$.

L'Hopital's Rule If $\lim\limits_{x\to c}\dfrac{f(x)}{g(x)}=\dfrac{0}{0}$ or $\dfrac{\infty}{\infty}$, then $\lim\limits_{x\to c}\dfrac{f(x)}{g(x)}=\lim\limits_{x\to c}\dfrac{f'(x)}{g'(x)}$.

Trapezoid Rule $\int_a^b f(x)dx \approx \dfrac{b-a}{2n}\left[y_0+2y_1+2y_2+...2y_{n-1}+y_n\right]$

Simpson's Rule $\int_a^b f(x)dx \approx \dfrac{b-a}{3n}\left[y_0+4y_1+2y_2+4y_3...4y_{n-1}+y_n\right]$