Calculus I

Definition 1: Derivative Formulas

$\frac{d}{dx}(c) = 0$

$\frac{d}{dx}(f \pm g) = f' \pm g'$

$\frac{d}{dx}(kx) = k$

$\frac{d}{dx}(x^n) = nx^{n-1}$

$(f\ g)' = f'g + fg'$

$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$

$(f(g(x)))' = f'(g(x)) \cdot g'(x)$

$\frac{d}{dx}(\sin x) = \cos x$

$\frac{d}{dx}(\cos x) = -\sin x$

$\frac{d}{dx}(\tan x) = \sec^2 x$

$\frac{d}{dx}(\sec x) = \sec x\ \tan x$

$\frac{d}{dx}(\csc x) = -\csc x\ \cot x$

$\frac{d}{dx}(\cot x) = -\csc^2 x$

$\frac{d}{dx}([f(x)]^n) = n[f(x)]^{n-1} \cdot f'(x)$

Definition 2: Integral Formulas

$\int x^n\ dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$

$\int \cos x\ dx = \sin x + C$

$\int \cos(bx)\ dx = \frac{1}{b}\sin(bx) + C$

$\int \sin x\ dx = -\cos x + C$

$\int \sin(bx)\ dx = -\frac{1}{b}\cos(bx) + C$

$\int \sec^2 x\ dx = \tan x + C$

$\int \csc^2 x\ dx = -\cot x + C$

$\int \sec x \tan x\ dx = \sec x + C$

$\int \csc x \cot x\ dx = -\csc x + C$

Integration Techniques

1. u **Substitution**

   Given $\int_a^b f(g(x))g'(x)\ dx$,

   (a) Let $u = g(x)$

   (b) Then $du = g'(x)\ dx$

   (c) If there are bounds, you must change them using $u = g(b)$ and $u = g(a)$

$$\int_a^b f(g(x))g'(x)\ dx = \int_{g(a)}^{g(b)} f(u)\ du$$