

## Basic Differentiation Rules

- $\frac{d}{dx}[cu] = cu'$
- $\frac{d}{dx}[u \pm v] = u' \pm v'$
- $\frac{d}{dx}[uv] = uv' + vu'$
- $\frac{d}{dx}\left[\frac{1}{u}\right] = \frac{-u'}{u^2}$
- $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$
- $\frac{d}{dx}[c] = 0$
- $\frac{d}{dx}[u^n] = nu^{n-1}u'$
- $\frac{d}{dx}[x] = 1$
- $\frac{d}{dx}[|u|] = \frac{u}{|u|}(u'), u \neq 0$
- $\frac{d}{dx}[\ln u] = \frac{u'}{u}$
- $\frac{d}{dx}[\log_a u] = \frac{u'}{u(\ln a)}$
- $\frac{d}{dx}[e^u] = e^u u'$
- $\frac{d}{dx}[a^u] = a^u \ln a u'$
- $\frac{d}{dx}[\sin u] = (\cos u)u'$
- $\frac{d}{dx}[\cos u] = -(\sin u)u'$
- $\frac{d}{dx}[\tan u] = (\sec^2 u)u'$
- $\frac{d}{dx}[\cot u] = -(\csc^2 u)u'$
- $\frac{d}{dx}[\sec u] = (\sec u \tan u)u'$
- $\frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$
- $\frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$
- $\frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$
- $\frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}}$
- $\frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$

## Basic Integration Rules

1.  $\int kf(u)du = k \int f(u)du$
2.  $\int [f(u) \pm g(u)]du = \int f(u)du \pm \int g(u)du$
3.  $\int du = u + C$
4.  $\int u^n du = \frac{u^{n+1}}{n+1} + C, n \neq -1$
5.  $\int \frac{du}{u} = \ln|u| + C$
6.  $\int e^u du = e^u + C$
7.  $\int a^u du = \frac{a^u}{\ln a} + C$
8.  $\int \sin u du = -\cos u + C$
9.  $\int \cos u du = \sin u + C$
10.  $\int \tan u du = \ln|\sec u| + C$
11.  $\int \cot u du = \ln|\sin u| + C$
12.  $\int \sec u du = \ln|\sec u + \tan u| + C$
13.  $\int \csc u du = \ln|\csc u - \cot u| + C$
14.  $\int \sin^2 u du = \frac{1}{2}u - \frac{1}{4}\sin 2u + C$
15.  $\int \cos^2 u du = \frac{1}{2}u + \frac{1}{4}\sin 2u + C$
16.  $\int \tan^2 u du = \tan u - u + C$
17.  $\int \cot^2 u du = -\cot u - u + C$
18.  $\int \sec^2 u du = \tan u + C$
19.  $\int \csc^2 u du = -\cot u + C$
20.  $\int \sec u \tan u du = \sec u + C$
21.  $\int \csc u \cot u du = -\csc u + C$
22.  $\int \frac{du}{\sqrt{a^2-u^2}} = \arcsin \frac{u}{a} + C$
23.  $\int \frac{du}{a^2+u^2} = \frac{1}{a} \arctan \frac{u}{a} + C$
24.  $\int \frac{du}{u\sqrt{u^2-a^2}} = \frac{1}{a} \operatorname{arcsec} \frac{u}{a} + C$
25.  $\int u \cdot dv = u \cdot v - \int v \cdot du$

## Trigonometry Substitution

Radical	Substitution	Radical Replacement
$\sqrt{a^2 - x^2}$	$x = a \sin \theta$	$a \cos \theta$
$\sqrt{a^2 + x^2}$	$x = a \tan \theta$	$a \sec \theta$
$\sqrt{x^2 - a^2}$	$x = a \sec \theta$	$a \tan \theta$

1.  $\int \frac{du}{\sqrt{a^2-u^2}} = \arcsin \frac{u}{a} + C$
2.  $\int \frac{du}{a^2+u^2} = \frac{1}{a} \arctan \frac{u}{a} + C$
3.  $\int \frac{du}{u\sqrt{u^2-a^2}} = \frac{1}{a} \operatorname{arcsec} \frac{u}{a} + C$