Trig Integrals

$\int \sin x\,dx$	$= -\cos x\,dx + C$
$\int \cos x\,dx$	$= \sin x\,dx + C$
$\int \sec^2 x\,dx$	$= \tan x\,dx + C$
$\int \tan x\,dx$	$= \ln\lvert\sec x\rvert + C$
$\int \sec x \tan x\,dx$	$= \sec x + C$
$\int \csc^2 x\,dx$	$= -\cot x + C$
$\int \csc x \cot x\,dx$	$= -\csc x + C$
$\int \cot x\,dx$	$= \ln\lvert\sin x\rvert + C$

Trig Identities

$\int (1/x^2 + a^2)\,dx$	$= 1/a \tan^{-1}(x/a) + C$
$\int (1/\mathrm{Sqrt}(a^2 - x^2)\,dx$	$= \sin^{-1}(x/a) + C$

(While a > 0)

Area Between Curves

```
Area = ∫[Height] Width
A = ∫(f(x) - g(x)] dx
1. Graph Equasions
2. Label
3. Determine how to slice
4. Set up dA
5. dA = height*dx
6. Get range a & b from inters ections
7. Plug in and find area
```

There is never (-) area.

Volume by Disk

```
dV = A(x) dx
V = ∫A(x)dx
Volume = ∫Radius^2 * Thickness
V = ∫(pi(r)^2) dx
```

Volume by Washer

```
dV = A(x) dx
V = ∫A(x) dx
Volume = ∫[(pi r out^2)-(pi r in^2)] dx
```

Slice Perpendicular to Axis of Rotation

Volume by Shell

```
dVolume = Circumference * dArea
dV = (2 pi r) dArea
V = ∫(2 pi r)(Area)dx
1. Write: dV = 2 pi r dA
2. Find dA(height dx)
3. Find Radius(x or y)
4. Plug in
5. Take integral
```

Slice Parallel to Axis of Rotation

Average Value of a Function

```
Average Value = 1/b-a * ∫f(x) dx
Symmetry:
If f(x) is EVEN, then ∫f(x)dx from -a to a =
2∫f(x) from 0 to a
If f(x) is ODD, then ∫f(x)dx from -a to a = 0
```

Important Integrals

$\int c\,f(x)\,dx$	$= c \int f(x)\,dx$
$\int [f(x) + g(x)]\,dx$	$= \int f(x)\,dx + \int g(x)\,dx$
$\int 1/x\,dx$	$= \ln\lvert x\rvert + C$
$\int e^x\,dx$	$= e^x + C$
$\int b^x\,dx$	$= (b^x / \ln b) + C$

Methods of Integration

Method	When to Use	Example
U-Substitution	When a Polynomial is raised to a power > 1	$\int (3x + 5)^5$
Integration by Parts	When U-Sub will not work	$\int xe^x$
Trigonometric Integration	Only Trig raised to powers	$\int \sin^6 x \cos^3 x dx$
Trigonometric Substitution	3/2 powers or $\mathrm{Sqrt}(a^2-x^2)$ etc.	$dx/(x^2\mathrm{Sqrt}(25-x^2))$

U-Substitution

Integration by Parts

Logarithmic
Inverse trig
Algebraic
Trigon ometric
Expone ntial
$\int u\,dv = u\,v - \int v\,du$
1. Write $u\,v - \int v\,du$
2. Use LIATE to find u; the other term becomes dV
3. Setup u= dV= du= V=
4. Solve

Cyclical Functions will need to be split and substituted.

Trigonometric Integration

Identities
$\sin^2 t + \cos^2 t = 1$
$\sin^2 t = 1/2\,[1-\cos(2t)]$
$\cos^2 t = 1/2\,[1+\cos(2t)]$
Can use with U-Subs tit ution

Don't change all of the trig to the same form.

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Trigonometric Substitution

Pythag. Identities
$\sin^2 + \cos^2 = 1$
$1 + \tan^2 = \sec^2$
$1 + \cot^2 = \csc^2$
1. Identify a and u
2. Sub in the trig
3. Manipulate to simplify
4. Get rid of trig with a triangle