Area of a region

$\int_a^b (top)-(bottom)\,dx$

Center of Mass

$M_y = \int \tilde{x}\,dm = \int_a^b x\,\delta(f(x)-g(x))dx$

$M_x = \int \tilde{y}\,dm = \int_a^b \frac{\delta}{2}(f^2(x)-g^2(x))dx$

$M = \int dm = \int_a^b \delta(f(x)-g(x))\,dx$

$\bar{x} = \frac{M_y}{m}$ $\bar{y} = \frac{M_x}{m}$

Shell meathod

$\int_a^b Area(x)\,dx = \int_a^b \pi[R(x)^2 - r(x)^2]\,dx$

cylidrical shells

$\int_a^b Area(x)\,dx = \int_a^b 2\pi x\,(f(x))dx$

Arc length

$\int_a^b \sqrt{1+(f'(x))^2}\,dx$

Surface Area

$\int_a^b 2\pi(f(x))\sqrt{1+(f'(x))^2}\,dx$

Work

$\int F(x)dx$

trigonometric substitutions

$\sqrt{a^2+x^2}$ $x = a\tan\theta$

$\sqrt{a^2-x^2}$ $x = a\sin\theta$

$\sqrt{x^2-a^2}$ $x = a\sec\theta$

Integration by Parts

$\int u\,dv = uv - \int v\,du$

ILATE

Trig

derivatives

$\sin'x = \cos x$ $\cot'x = -\csc^2 x$

$\cos'x = -\sin x$ $\csc'x = -\csc x\cot x$

$\tan'x = \sec^2 x$

$\sec'x = \sec x\tan x$

$\sin x = \frac{1}{\csc x}$ $\cos x = \frac{1}{\sec x}$ $\tan x = \frac{1}{\cot x}$

$\sin^2 x + \cos^2 x = 1$

$1 + \tan^2 x = \sec^2 x$

$1 + \cot^2 x = \csc^2 x$

$\tan x = \frac{\sin x}{\cos x}$ $\cot x = \frac{\cos x}{\sin x}$

$\sin^2 x = \frac{1-\cos(2x)}{2}$

$\cos^2 x = \frac{1+\cos(2x)}{2}$

Integration Formulas

$\int \frac{1}{x}dx = \ln|x| + C$

$\int b^{ax}dx = \frac{1}{a\ln b}b^{ax} + C$

$\int \ln(x)dx = x\ln x - x + C$

$\int \tan x\,dx = -\ln|\cos x| + C$

$\int \csc x\,dx = \ln|\csc x\cot x| + C$

$\int \sec x\,dx = \ln|\sec x + \tan x| + C$