Trigonometric Identities

$$\sin^2(x) + \cos^2(x) = 1$$
$$1 + \tan^2(x) = \sec^2(x)$$
$$1 + \cot^2(x) = \csc^2(x)$$
$$\sin^2(x) = \frac{1}{2}(1 - \cos(2x))$$
$$\cos^2(x) = \frac{1}{2}(1 + \cos(2x))$$
$$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$$
$$\cos(\alpha \pm \beta) = \cos\alpha\, cos\beta \mp \sin\alpha\sin\beta$$
$$\sin(2x) = 2\sin(x)\cos(x)$$
$$\cos(2x) = \cos^2(x) - \sin^2(x)$$

Linearization

$$L(x) = f(a) + f'(a)(x - a)$$

Derivatives

$$\frac{dy}{dx}\sin(x) = \cos(x)$$
$$\frac{dy}{dx}\cos(x) = -\sin(x)$$
$$\frac{dy}{dx}\cot(x) = -\csc^2(x)$$
$$\frac{dy}{dx}\sec(x) = \sec(x)\tan(x)$$
$$\frac{dy}{dx}\csc(x) = -\csc(x)\cot(x)$$
$$\frac{dy}{dx}\tan(x) = \sec^2(x)$$
$$\frac{dy}{dx}\arcsin(x) = \frac{1}{\sqrt{1 - x^2}}$$
$$\frac{dy}{dx}\mathrm{arcsec}(x) = \frac{1}{|x|\sqrt{x^2 - 1}}$$
$$\frac{dy}{dx}\arctan(x) = \frac{1}{1 + x^2}$$

Product Rule

$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$$

Quotient Rule

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

Integrals

$$\int \mathrm{b}^{\mathrm{ax}}\, dx = \frac{1}{a\ln(b)} b^{ax} + C$$
$$\int \ln(x)\ dx = x\ln(x) - x + C$$
$$\int \tan(x)\, dx = -\ln|\cos(x)| + C$$
$$\int \csc(x)\, dx = -\ln|\csc(x) + \cot(x)| + C$$
$$\int \sec(x)\, dx = \ln|\sec(x) + \tan(x)| + C$$
$$\int u\ dv = uv - \int v\, du$$

Area

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

Trigonometric Substitutions

$\sqrt{a^2 + x^2}$	$x = a\tan\emptyset$
$\sqrt{a^2 - x^2}$	$x = a\sin\emptyset$
$\sqrt{x^2 - a^2}$	$x = a\sec\theta$

Volume by Revolution

Disk Method:

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

Shell Method:

$$V = \int_a^b 2\pi(shell\ radius)(shell\ height)\ dx$$

Arc Length

$$L = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\ dx$$

Surface Area

$$SA = \int_a^b 2\pi y\sqrt{1 + \left(\frac{dy}{dx}\right)^2}\ dx$$

Exponential Growth

$$A = A_o e^{kt}$$

Work

$$W = Fd = \int_a^b F(x)\, dx$$

Hooke's Law

$$F = kx$$

Center of Mass

$$M_y = \int \tilde{x}\ dm = \int_a^b x\,\delta\,[f(x) - g(x)]\ dx$$
$$M_x = \int \tilde{y}\ dm = \int_a^b \frac{1}{2}[f(x) + g(x)] \times \delta[f(x) - g(x)]\ dx$$
$$= \int_a^b \frac{\delta}{2}[f^2(x) - g^2(x)]\ dx$$
$$M = \int dm = \int_a^b \delta[f(x) - g(x)]\ dx$$
$$\bar{x} = \frac{M_y}{M}$$
$$\bar{y} = \frac{M_x}{M}$$