Additional Formulas

Summation Formulas:

$$\sum_{i=1}^{n} c = cn$$

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4}$$

Trapezoidal Rule (Area):

$$\int_a^b f(x)dx \approx \frac{(b-a)}{2n}[f(x_0) + 2f(x_1) + 2f(x_2) + ... + 2f(x_{n-1}) + f(x_n)]$$

with

$$\text{Max Error} \leq \frac{(b-a)^3}{12n^2}[max\left|f''(x)\right|]$$

Simpson's Rule (Area):

$$\int_a^b f(x)dx \approx \frac{(b-a)}{3n}[f(x_0) + 4f(x_1) + 2f(x_2) + ... + 4f(x_{n-1}) + f(x_n)]$$

with

$$\text{Max Error} \leq \frac{(b-a)^5}{180n^4}[max\left|f^{(4)}(x)\right|]$$

Additional Formulas

Arc Length:

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

$$s = \int_c^d \sqrt{1 + (g'(y))^2}\ dy$$

Surface of Revolution:

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

$$S = 2\pi \int_c^d r(y)\sqrt{1 + (g'(y))^2}\ dy$$

Work Done by a Variable Force:

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

Force Exerted by a Fluid:

$$F = w \int_c^d h(y)L(y)\ dy$$

Taylor Series Expansion for $f(x)$:

$$p_n(x) = f(c) + \frac{f^{(1)}(c)(x-c)}{1!} + \frac{f^{(2)}(c)(x-c)^2}{2!} + ... + \frac{f^{(n)}(c)(x-c)^n}{n!} + ...$$

Maclaurin Series Expansion for $f(x)$, where $c = 0$:

$$p_n(x) = f(0) + \frac{f^{(1)}(0)x}{1!} + \frac{f^{(2)}(0)x^2}{2!} + ... + \frac{f^{(n)}(0)x^n}{n!} + ...$$

Additional Formulas

Summary of Tests for Series:

Test	Series	Condition(s) of Convergence	Condition(s) of Divergence	Comment
nth-Term	$\sum_{n=1}^{\infty} a_n$		$\lim_{n\to\infty} a_n \neq 0$	This test cannot be used to show convergence
Geometric Series	$\sum_{n=0}^{\infty} ar^n$	$\|r\| < 1$	$\|r\| \geq 1$	Sums: $S = \frac{a}{1-r}$
Telescoping Series	$\sum_{n=1}^{\infty} (b_n - b_{n+1})$	$\lim_{n\to\infty} b_n = L$		Sums: $S = b_1 - L$
p-Series	$\sum_{n=1}^{\infty} \frac{1}{n^p}$	$p > 1$	$p \leq 1$	