Three kind of coordinate system.

$$dV = dxdydz = rdrd\theta dz = \rho^2 \sin\psi d\rho d\psi d\theta$$

Taylor series

$$f(a+u, b+v) = f(a,b) + \sum_{k=1}^{\infty} \frac{1}{k!} (u\frac{\partial}{\partial x} + v\frac{\partial}{\partial y})^k f(a,b)$$

Taylor Series

$$f(a+u) = f(a) + \sum_{k=1}^{\infty} \frac{f^{(k)}(a)}{k!} \cdot (x-a)^k$$

Normally used ones

$$\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n \quad \forall|x| < 1$$

$$(1+x)^\alpha = \sum_{n=0}^{\alpha} C_n^\alpha \cdot x^n \quad \forall|x| < 1 \text{从}\alpha\text{个中取}n\text{个}$$

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$$

$$\ln(1+x) = \sum_{n=1}^{\infty} \frac{(-1)^n + 1}{n} \cdot x^n \quad \forall x \in (-1, 1]$$

Statistics

Expectation

$$E(X) = E[(X - E(X))^2] = E(X^2) - (E(X))^2$$

Law of Total Expectation

$$EX = E[E(X|Y)]$$

$$E(Y * f(X)|X) = f(X)E(Y|X)$$

Variance

$$Var(aX + Y + b) = a^2 Var(X) + Var(Y)$$

Covariance

$$var(X \pm Y) = D(X) + D(Y) \pm 2cov(X,Y)$$
$$cov(X,Y) = E(XY) - E(X)E(Y)$$
$$cov(X,Y) = cov(Y,X)$$
$$cov(aX, bY) = ab \cdot cov(X,Y)$$
$$cov(X_1 + X_2, Y) = cov(X_1, Y) + cov(X_2, Y)$$

Chebyshev's Inequality

$$Pr[|X - EX| \geq t] \leq \frac{var(X)}{t^2}$$

Markov's Inequality

$$P(X \geq a) \leq \frac{E(X)}{a}$$