* Tutorial Number - 1

Trigonometry formulas

① $\sin(A \pm B) = \sin A . \cos B \pm \cos A . \sin B$

② $\cos(A \pm B) = \cos A . \cos B \mp \sin A . \sin B$

③ $\sin 2A = 2 \sin A . \cos A = \frac{2 \tan A}{1 + \tan^2 A}$

④ $\cos 2A = \cos^2 A - \sin^2 A = 1 - 2\sin^2 A = 2\cos^2 A - 1 = \frac{2 \tan A}{1 - \tan^2 A}$

⑤ $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A . \tan B}$

⑥ $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$

⑦ $\sin A . \cos B = \frac{1}{2} [\sin(A+B) + \sin(A-B)]$

⑧ $\cos A . \sin B = \frac{1}{2} [\sin(A+B) - \sin(A-B)]$

⑨ $\cos A . \cos B = \frac{1}{2} [\cos(A+B) + \cos(A-B)]$

⑩ $\sin A . \sin B = \frac{1}{2} [\cos(A-B) - \cos(A+B)]$

Diff. Basic Formulae:-

① $\frac{d}{dx}(x^n) = n x^{n-1}$

② $\frac{d}{dx}(\log x) = \frac{1}{x}$

③ $\frac{d}{dx}(a^x) = a^x \cdot \log a$

④ $\frac{d}{dx}(\sin ax) = a \cdot \cos ax$

⑤ $\frac{d}{dx}(\cos ax) = -a \cdot \sin ax$

⑥ $\frac{d}{dx}(\tan x) = \sec^2 x$

⑦ $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$

⑧ $\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cdot \cot x$

⑨ $\frac{d}{dx}(\sec x) = \sec x \cdot \tan x$

⑩ $\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx} f(x) + \frac{d}{dx} g(x)$

⑪ $\frac{d}{dx}[f(x) \cdot g(x)] = \left(\frac{d}{dx} f(x)\right) \cdot g(x) - f(x)\left(\frac{d}{dx} \cdot g(x)\right)$

⑫ $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{\left[\frac{d}{dx} f(x)\right] \cdot g(x) - f(x)\left[\frac{d}{dx} \cdot g(x)\right]}{[g(x)]^2}$

⑬ $\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot \frac{d}{dx}(g(x))$

Coordinate System Formulae

① Coordinate Transformtion -

Polar - $x = r\cos\theta$, $y = r\sin\theta$.

Cylindrical - $x = p\cos\phi$
$y = p\sin\phi$
$z = z$.

Spherical Polar - $x = r\sin\theta.\cos\phi$
$y = r\sin\theta.\sin\phi$
$z = r\cos\theta$.

② Jacobian -

Polar - $\frac{\partial(x,y)}{\partial(r,\theta)} = r$, Cylindrical - $\frac{\partial(x,y,z)}{\partial(p,\phi,z)} = p$

Spherical Polar - $\frac{\partial(x,y,z)}{\partial(r,\theta,\phi)} = r^2\sin\theta$

③ Arc - element / Area element

Polar - $(ds)^2 = (dr)^2 + r^2(d\theta)^2$
$dx.dy = r.dr.d\theta$.

Cylindrical - $(ds)^2 = (dp)^2 + p^2(d\phi)^2 + (dz)^2$

Spherical Polar - $(ds)^2 = (dr)^2 + r^2(d\theta)^2 + r(\sin^2\theta)(d\phi)^2$.

④ Volume Element :

Cylindrical — $dV = \rho d\rho . \rho d\phi . dz$

Spherical Polar — $dV = r^2 \sin\theta . dr . d\theta . d\phi .$