Mathematical Formulae:

Spherical Polar Coordinates:

$$x = r\sin\theta\cos\phi, \quad y = r\sin\theta\sin\phi, \quad z = r\cos\theta,$$

$$dV = r^2\sin\theta dr d\theta d\phi \quad \text{(Element of volume)}$$

In the following $\mathbf{F} = F_1\hat{\mathbf{r}} + F_2\hat{\boldsymbol{\theta}} + F_3\hat{\boldsymbol{\phi}}$ (note that $\hat{\mathbf{r}}$, $\hat{\boldsymbol{\theta}}$ and $\hat{\boldsymbol{\phi}}$ are unit vectors):

$$\nabla\cdot\mathbf{F} = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2F_1\right) + \frac{1}{r\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta F_2\right) + \frac{1}{r\sin\theta}\frac{\partial F_3}{\partial\phi}$$

and

$$\nabla\times\mathbf{F} = \frac{1}{r^2\sin\theta}\begin{vmatrix} \hat{\mathbf{r}} & r\hat{\boldsymbol{\theta}} & r\sin\theta\hat{\boldsymbol{\phi}} \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial\theta} & \frac{\partial}{\partial\phi} \\ F_1 & rF_2 & r\sin\theta F_3 \end{vmatrix}.$$

Let f be a scalar function, then the gradient is given by

$$\text{grad} f = \nabla f = \frac{\partial f}{\partial r}\hat{\mathbf{r}} + \frac{1}{r}\frac{\partial f}{\partial\theta}\hat{\boldsymbol{\theta}} + \frac{1}{r\sin\theta}\frac{\partial f}{\partial\phi}\hat{\boldsymbol{\phi}}.$$

Plane Polar Coordinates:

$$x = r\cos\theta, \qquad y = r\sin\theta, \qquad dA = dxdy = rdrd\theta$$

Vector Calculus:

$$\begin{aligned}
\nabla\phi &= \frac{\partial\phi}{\partial x}\mathbf{i} + \frac{\partial\phi}{\partial y}\mathbf{j} + \frac{\partial\phi}{\partial z}\mathbf{k} \\
\nabla\cdot\mathbf{A} &= \frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z} \\
\nabla\times\mathbf{A} &= \left(\frac{\partial A_z}{\partial y} - \frac{\partial A_y}{\partial z}\right)\mathbf{i} - \left(\frac{\partial A_z}{\partial x} - \frac{\partial A_x}{\partial z}\right)\mathbf{j} + \left(\frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y}\right)\mathbf{k} \\
\nabla^2\phi &= \nabla\cdot(\nabla\phi) = \frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} + \frac{\partial^2\phi}{\partial z^2} \\
\nabla\times(\nabla\phi) &= 0 \\
\nabla\cdot(\nabla\times\mathbf{A}) &= 0 \\
\nabla\times(\nabla\times\mathbf{A}) &= \nabla(\nabla\cdot\mathbf{A}) - \nabla^2\mathbf{A}
\end{aligned}$$

Vectors:

$$
\begin{aligned}
\mathbf{A}\cdot\mathbf{B} &= A_xB_x + A_yB_y + A_zB_z \\
\mathbf{A}\times\mathbf{B} &= (A_yB_z - A_zB_y)\mathbf{i} - (A_xB_z - A_zB_x)\mathbf{j} + (A_xB_y - A_yB_x)\mathbf{k} \\
\mathbf{A}\times(\mathbf{B}\times\mathbf{C}) &= (\mathbf{A}\cdot\mathbf{C})\mathbf{B} - (\mathbf{A}\cdot\mathbf{B})\mathbf{C} \\
\mathbf{A}\cdot(\mathbf{B}\times\mathbf{C}) &= \mathbf{B}\cdot(\mathbf{C}\times\mathbf{A}) = \mathbf{C}\cdot(\mathbf{A}\times\mathbf{B})
\end{aligned}
$$

Trigonometry:

$$
\begin{aligned}
\sin(\phi \pm \theta) &= \sin\phi\cos\theta \pm \cos\phi\sin\theta \\
\cos(\phi \pm \theta) &= \cos\phi\cos\theta \mp \sin\phi\sin\theta \\
\tan(\theta \pm \phi) &= \frac{\tan\phi \pm \tan\theta}{1 \mp \tan\phi\tan\theta} \\
\sin(2\phi) &= 2\sin\phi\cos\phi \\
\cos(2\phi) &= 2\cos^2\phi - 1 = 1 - 2\sin^2\phi \\
\sin\phi + \sin\theta &= 2\sin\left(\frac{\phi+\theta}{2}\right)\cos\left(\frac{\phi-\theta}{2}\right) \\
\sin\phi - \sin\theta &= 2\cos\left(\frac{\phi+\theta}{2}\right)\sin\left(\frac{\phi-\theta}{2}\right) \\
\cos\phi + \cos\theta &= 2\cos\left(\frac{\phi+\theta}{2}\right)\cos\left(\frac{\phi-\theta}{2}\right) \\
\cos\phi - \cos\theta &= 2\sin\left(\frac{\phi+\theta}{2}\right)\sin\left(\frac{\phi-\theta}{2}\right)
\end{aligned}
$$