Tutorial-2: PH-102: Department of Physics

1. Convert the following equation written in Cartesian coordinates into an equation in Cylindrical coordinates.

$$x^3 + 2x^2 - 6z = 4 - 2y^2$$

2. Evaluate the following integral, $\iint_S^{\cdot} \vec{F} \cdot d\vec{S}$, where $\vec{F} = 2xz\hat{\imath} + (1 - 4xy^2)\hat{\jmath} + (2z - z^2)\hat{k}$ and S is the surface of the solid bounded by $z = 6 - 2x^2 - 2y^2$ and the plane z = 0. Note that both of the surfaces of this solid included in S.

3. Determine the divergence of F, for $F(x, y, z) = x^2y^3 - 4xz$ in the direction of $\vec{v} = (-1,\ 2, 0)$.

4. Evaluate $\iint_S^{\cdot}(y^2 + 3x)\ dS$, S is the region in the 3rd quadrant between $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$.

5. Use Stokes' Theorem to evaluate $\iint_S^{\cdot} Curl\ \overrightarrow{F} \cdot d\vec{S}$, where $\vec{F} = y\hat{\imath} - x\hat{\jmath} + yx^3\hat{k}$ and S is the portion of the sphere of radius 4 with $z \geq 0$ and the upwards orientation.