Answer on Question # 68424 -Physics / Other

Check whether the force $\mathbf{F} = yz\mathbf{i} + zx\mathbf{j} + xy\mathbf{k}$, (where $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are unit vectors) is conservative or not.

Solution

For the conservative force the curl of $\mathbf{F}$ is the zero vector. Let's check it out

$$\boldsymbol{\nabla}\times\mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \dfrac{\partial}{\partial x} & \dfrac{\partial}{\partial y} & \dfrac{\partial}{\partial z} \\ F_x & F_y & F_z \end{vmatrix} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \dfrac{\partial}{\partial x} & \dfrac{\partial}{\partial y} & \dfrac{\partial}{\partial z} \\ yz & zx & xy \end{vmatrix} =$$

$$= \mathbf{i}\left(\frac{\partial}{\partial y}xy - \frac{\partial}{\partial z}zx\right) + \mathbf{j}\left(\frac{\partial}{\partial z}yz - \frac{\partial}{\partial x}xy\right) + \mathbf{k}\left(\frac{\partial}{\partial x}zx - \frac{\partial}{\partial y}yz\right) =$$

$$= \mathbf{i}(x - x) + \mathbf{j}(\mathrm{y} - \mathrm{y}) + \mathbf{k}(z - z) = \mathbf{0}.$$

So the force is conservative.

Answer: conservative.