Answer on Question #56126 – Math – Vector Calculus

Let
A=x^2yi−2xzj+2yzk
, find Curl curl A.

3j+4k

2x+2)k

(2x+2)j

3j−4k

Solution

$$\boldsymbol{curl\ A} = \begin{vmatrix} \boldsymbol{i} & \boldsymbol{j} & \boldsymbol{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2y & -2xz & 2yz \end{vmatrix} = \boldsymbol{i}\left(\frac{\partial}{\partial y}(2yz) - \frac{\partial}{\partial z}(-2xz)\right) - \boldsymbol{j}\left(\frac{\partial}{\partial x}(2yz) - \frac{\partial}{\partial z}(x^2y)\right) + \boldsymbol{k}\left(\frac{\partial}{\partial x}(-2xz) - \frac{\partial}{\partial y}(x^2y)\right) = (2z+2x)\boldsymbol{i} - (0-0)\boldsymbol{j} + +(-2z-x^2)\boldsymbol{k} =< 2z+2x, 0, -2z-x^2 >$$

$$curl\ curl\ A = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ 2z+2x & 0 & -2z-x^2 \end{vmatrix}$$

$$= i\left(\frac{\partial}{\partial y}(-2z-x^2) - \frac{\partial}{\partial z}(0)\right)$$

$$- j\left(\frac{\partial}{\partial x}(-2z-x^2) - \frac{\partial}{\partial z}(2z+2x)\right)$$

$$+ k\left(\frac{\partial}{\partial x}(0) - \frac{\partial}{\partial y}(2z+2x)\right) = 0 \cdot i - (-2x-2)j + 0 \cdot k =$$

$$= (2x+2)j = < 0, 2x+2, 0 >$$