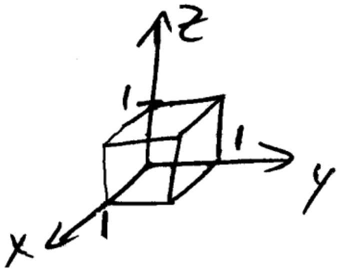
Verify Divergence Theorem, $\oiint_S \bar{A}\bullet d\bar{s} = \iiint_v \bar{\nabla}\bullet\bar{A}\,dv$, for $\bar{A} = x^2 y\,\hat{a}_x$ for surface S surrounding the volume $0 < x < 1$, $0 < y < 1$, and $0 < z < 1$.



$$\bar{\nabla}\bullet\bar{A} = \frac{\partial x^2 y}{\partial x} = \underline{\underline{2xy}}$$

$$\iiint_V \bar{\nabla}\bullet\bar{A}\,dv = \int_{z=0}^{1}\int_{y=0}^{1}\int_{x=0}^{1} 2xy\,dx\,dy\,dz$$

$$= 2\int_{z=0}^{1} dz \int_{y=0}^{1} y\,dy \int_{x=0}^{1} x\,dx$$

$$= 2(1-0)\left(\frac{y^2}{2}\right)\Big|_0^1\left(\frac{x^2}{2}\right)\Big|_0^1 = 2(1/2)(1/2)$$

$$= \underline{\underline{1/2}}$$

$\hat{a}_x\bullet\pm\hat{a}_z = 0$

$\hat{a}_x\bullet\pm\hat{a}_y = 0$

0

$$\oiint_S \bar{A}\bullet d\bar{s} = \left[\iint_{Top}\bar{A}\bullet d\bar{s}_z + \iint_{Bott}\bar{A}\bullet -d\bar{s}_z + \iint_{Right}\bar{A}\bullet d\bar{s}_y + \iint_{Left}\bar{A}\bullet -d\bar{s}_y\right]$$

$$+\iint_{front}\bar{A}\bullet d\bar{s}_x + \iint_{Back}\bar{A}\bullet -d\bar{s}_x \qquad d\bar{s}_x = \hat{a}_x\,dy\,dz$$

$$= \int_{\substack{z=0\\ X=1}}^{1}\int_{y=0}^{1} \underset{\to 1}{\cancel{x}^2}\, y\,dy\,dz + \int_{\substack{z=0\\ x=0}}^{1}\int_{y=0}^{1} \underset{\to 0}{\cancel{x}^2}\, y\,dy\,dz = \underline{\underline{1/2}}$$