

Assignment 7 Part 1

1. Compute $\text{Curl}F$ at $(-1, 1, 6)$ for $F = x^2yi - xyj + z^2k$

$$\begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2y & -xy & z^2 \end{vmatrix}$$
$$= \left(\frac{\partial z^2}{\partial y} - \frac{\partial(-xy)}{\partial z} \right) i + \left(\frac{\partial(x^2y)}{\partial z} - \frac{\partial z^2}{\partial x} \right) j + \left(\frac{\partial}{\partial x}(-xy) - \frac{\partial}{\partial y}(x^2y) \right) k$$
$$= -(y + x^2)k$$

2. Show that the vector field $F = y^2z^3i + 2xyz^3j + 3xy^2z^2k$ is conservative and find a function f so that $F = \nabla f$

3. Use the divergence theorem to evaluate $\iint_S F \cdot NdS$
if $F = 2xi - yj + 6zk$ and S is the sphere $x^2 + y^2 + z^2 = 16$

4. Use the Stoke's Theorem to find $\int_C F \cdot NdS$
where $F(x, y, z) = 3zi + 5xj - 2yk$
and C is the intersection of $z = y + 3$ and $x^2 + y^2 = 1$
oriented counterclockwise.