

Math 20E

September 4, 2013

Question 1 Suppose \mathbf{F} is a C^1 vector field on \mathbb{R}^3 . Let H be the unit hemisphere given by $x^2 + y^2 + z^2 = 1$ with $z \geq 0$, let D be the unit disk given by $z = 0$ with $x^2 + y^2 \leq 1$, and let $S = H \cup D$. Then,

A. $\partial H = \partial D$, including orientation when H and D are both oriented with the upward-pointing unit normal vector.

B.
$$\iint_H (\nabla \times \mathbf{F}) \cdot d\mathbf{S} = \iint_D (\nabla \times \mathbf{F}) \cdot d\mathbf{S}.$$

C.
$$\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S} = \iint_H (\nabla \times \mathbf{F}) \cdot d\mathbf{S} + \iint_D (\nabla \times \mathbf{F}) \cdot d\mathbf{S}.$$

D.
$$\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S} = 0.$$

***E. A, B and D**

Question 2 Suppose \mathbf{F} is a C^2 vector field on \mathbb{R}^3 , and let S be the unit sphere given by $x^2 + y^2 + z^2 = 1$. Then, $\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S}$

A. by Stokes' Theorem is equal to $\int_{\partial S} \mathbf{F} \cdot d\mathbf{s}$.

B. by Gauss's Theorem is equal to $\iiint_B \nabla \cdot (\nabla \times \mathbf{F}) dV$, where B is the unit ball given by $x^2 + y^2 + z^2 \leq 1$.

C. is 0.

D. **A** and **B**

***E.** **A**, **B**, and **C**