

1. Let $\vec{F} = -2(x^2 + y^2)(\hat{x} + \hat{y})$.
 - Construct $d\vec{S}$ for the paraboloid $z = 3 - x^2 - y^2$ over the region defined by $x^2 + y^2 \leq 1$.
 - Make a rough sketch of the surface. Is this a closed surface?
 - Evaluate $\vec{F} \cdot d\vec{S}$. How many variables do you (should you?) have?
 - Reckon the value of $\int_S \vec{F} \cdot d\vec{S}$ where S is the surface defined above.
 - Referring to your sketch, should it be positive or negative or zero?
2. Let $\vec{G} = 5\hat{z}$.
 - If S is the portion of the plane $2x - y - z = 3$ where $0 \leq x \leq 1.5$ and $2x - 3 \leq y \leq 0$, construct $d\vec{S}$.
 - Ascertain the value of $\int_S \vec{G} \cdot d\vec{S}$ in this case.
3. Let Ω be the lower hemisphere of the sphere of radius 5 and let $\vec{H} = x\hat{x} + y\hat{y} + z\hat{z}$.
 - Sketch Ω and $\vec{H}$ and decide if $\iint_{\Omega} \vec{H} \cdot d\vec{S}$ is positive, negative or zero.
 - Construct $d\vec{S}$ for Ω . Try using spherical coordinates.
 - Compute the value of $\iint_{\Omega} \vec{H} \cdot d\vec{S}$ explicitly.
 - Does it agree with your decision?