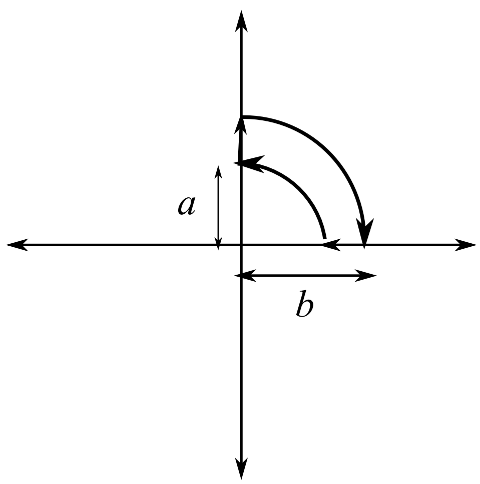
1. **Verify divergence theorem for the vector function $\vec{A} = \vec{r}$. The region is a spherical surface of radius a with the center at the origin.**

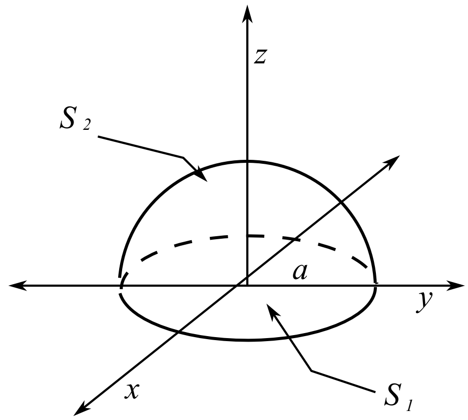
2. **Verify stokes' theorem for the vector field $\vec{A} = (y\hat{i} - x\hat{j})/(x^2 + y^2)$ over the region shown in the figure. The loop consists of a quarter arc of two concentric circles of radii a and b and two straight paths along the y and the x axes.**



3. **Verify Stokes' Theorem for the vector field $\vec{A} = (y\hat{i} - x\hat{j})$ over a region bounded by a circle of radius a on the xy plane in the following two cases as shown in the figure:**
   (a) **The region is S_1 the flat circular disk of radius a on the xy plane.**
   (b) **The region is S_2 the hemisphere over the xy plane with center at the origin**

4. **If $\vec{\nabla} \times \vec{A} = 0$ then show that there is a scalar function $F(\vec{r})$ such that $\vec{\nabla} F = \vec{A}$.**

5. **Use the divergence theorem and the stokes' theorem to show that $\vec{\nabla} \cdot (\vec{\nabla} \times \vec{A}) = 0$ for any vector field $\vec{A}$.**



6. Show that

$$\int_S (\vec{\nabla} \times \vec{A}) f \cdot \hat{n} da = \int_S (\vec{A} \times \vec{\nabla} f) \cdot \hat{n} da + \oint_C f \vec{A} \cdot \vec{dl}$$

where C is a closed curve enclosing a surface S.