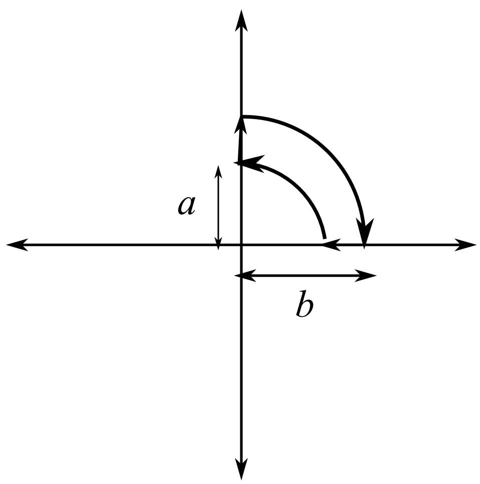
1. **Calculate the laplacian of the following:**
   (i) $F = x^2 + 2xy + 3z + 4$ **(ii)** $F = \sin(\hat{\mathbf{k}} \cdot \vec{\mathbf{r}})$ **(iii)** $F = \frac{1}{r}$

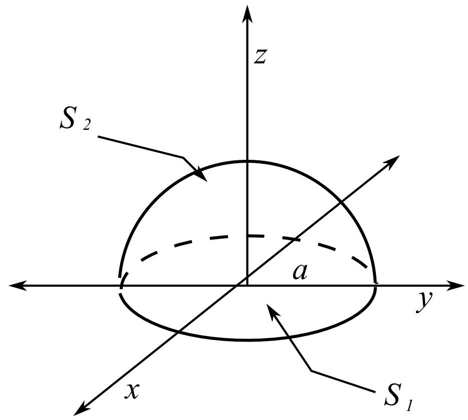
2. **Verify divergence theorem for the vector function $\vec{A} = \vec{r}$. The region is a spherical surface of radius a with the center at the origin.**

3. **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.**



4. **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**

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



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