1. **Find the volume of the tetrahedron whose vertices are** $(0, 0, 0)$, $(a, 0, 0)$, $(0, b, 0)$, $(0, 0, c)$.

2. **Evaluate** $\int_P^Q \vec{\mathbf{A}} \cdot \vec{\mathbf{dl}}$ **for** $\vec{\mathbf{A}} = y\hat{\mathbf{i}} - x\hat{\mathbf{j}}$ **along the following arcs of a circle of radius** a**:** $P \equiv (-a, 0)$; $Q \equiv (a, 0)$.

   (a) $(-a, 0) \to (0, a) \to (a, 0)$

   (b) $(-a, 0) \to (0, -a) \to (a, 0)$

   (c) a loop, forward along (a) and backward along (b)

   (d) Let I **be the value of the loop integral evaluated in (c). Verify that at the origin**

$$\vec{\nabla} \times \vec{A} = \lim_{a \to 0} I/(\pi a^2)$$

3. **Consider** $\vec{\mathbf{A}} = x^2\hat{\mathbf{i}} + y^2\hat{\mathbf{j}} + z^2\hat{\mathbf{k}}$

   (a) Evaluate $\oint_S \vec{\mathbf{A}} \cdot \vec{\mathbf{da}}$ **where** S **is a cubical surface given by the planes** $x = a \pm l$; $y = b \pm l$; $z = c \pm l$.

   (b) Verify that at the point (a, b, c)**,**

$$\vec{\nabla} \cdot \vec{A} = \lim_{l \to 0} \frac{1}{8l^3} \oint_S \vec{\mathbf{A}} \cdot \vec{\mathbf{da}}$$

4. **Let** $\vec{A} = \hat{r}$. **Evaluate** $\int_S \vec{A} \cdot \vec{da}$ **over the surface of a sphere given by the equation** $x^2 + y^2 + z^2 = a^2$.