Question 1. Let $\mathbf{a} = a_1 \mathbf{i} + a_2 \mathbf{j} + a_3 \mathbf{k}$ be a constant vector and $\mathbf{r} = x \mathbf{i} + y \mathbf{j} + z \mathbf{k}$. Show that

a) $(\mathbf{a} \times \nabla) \times \mathbf{r} = -2\mathbf{a}$

b) $\mathbf{a} \times (\nabla \times \mathbf{r}) = 0$

QUESTIONS 2 IS ON THE BACK OF THE PAGE.
Question 2. Find the work \( W = \int_C \mathbf{F} \cdot d\mathbf{r} \) done by the force \( \mathbf{F} = (x^2 - y^2)\mathbf{i} + xy\mathbf{j} \) acting along the curve \( C \) is the path given in the figure.