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Q.1: Show that $\nabla \times [(\mathbf{r} \cdot \mathbf{r})\,\mathbf{a}] = 2\,(\mathbf{r} \times \mathbf{a})$.

Q.2: Find the directional derivative of $f(x,y) = \tan^{-1}\left(\dfrac{y}{x}\right)$ at $(-1, 1)$ in the direction of $3\mathbf{i} - \mathbf{j}$.

Q.3: Find length of the curve traced by $\mathbf{r}(t) = e^{2t} \cos t\, \mathbf{i} + e^{2t} \sin t\, \mathbf{j} + e^{2t}\, \mathbf{k}$ for $0 \leq t \leq 3\pi$.