

Answer on Question #40756 – Math - Differential Calculus | Equations

Obtain the gradient of the following scalar field:

$$U(p,q,z)=p^2z\cos 2q$$

Solution:

The gradient vector of a scalar field $f(p,q,z)$ is denoted ∇f or $\text{grad } f$.

In a rectangular coordinate system, the gradient is the vector field whose components are the

partial derivatives of f : $\nabla f = \frac{\partial f}{\partial p} \mathbf{i} + \frac{\partial f}{\partial q} \mathbf{j} + \frac{\partial f}{\partial z} \mathbf{k} = \left(\frac{\partial f}{\partial p}, \frac{\partial f}{\partial q}, \frac{\partial f}{\partial z} \right)$;

$$U(p,q,z) = p^2 z \cos 2q$$

$$\frac{\partial U}{\partial p} = 2pz \cos 2q;$$

$$\frac{\partial U}{\partial q} = -2p^2 z \sin 2q;$$

$$\frac{\partial U}{\partial z} = p^2 \cos 2q;$$

Answer:

The gradient of the scalar field U : $\text{grad } U = (2pz \cos 2q, -2p^2 z \sin 2q, p^2 \cos 2q)$