MATH102: QUIZ VII

Name:
Student Number:
Section: 4
Date: April 8, 2009

Question: Find the directional derivative of the function $f(x, y, z) = x^2 + 2y^2 - 3z^2$ at the point $P(1, 1, 1)$ in the direction of the vector $\mathbf{A} = \mathbf{i} + \mathbf{2j} + \mathbf{2k}$

Solution:

$$(D_{\mathbf{u}} f)_P = \mathbf{u} \cdot (\nabla f)_P$$

where

$$\mathbf{u} = \frac{\mathbf{A}}{||\mathbf{A}||} = \frac{1}{3}(\mathbf{i} + \mathbf{2j} + \mathbf{2k})$$

and

$$\nabla f = 2x\mathbf{i} + 4y\mathbf{j} - 6z\mathbf{k} \rightarrow (\nabla f)_P = 2\mathbf{i} + 4\mathbf{j} - 6\mathbf{k}$$

Hence

$$(D_{\mathbf{u}} f)_P = \frac{1}{3}(\mathbf{i} + \mathbf{2j} + \mathbf{2k}) \cdot (\mathbf{2i} + \mathbf{4j} - \mathbf{6k}) = \frac{\mathbf{1}}{\mathbf{3}}(\mathbf{2} + \mathbf{8} - \mathbf{12}) = -\frac{\mathbf{2}}{\mathbf{3}}$$