Answer on Question #40475 – Math – Differential Calculus | Equations

Find the directional derivatives of f(x,y,z)=x2+2y2+3z2 at P(1,1,1) in the direction of a=i+j+k

Solution:

$f(x, y, z) = x^2 + 2y^2 + 3z^2.$

Let find partial derivatives of function f(x,y,z) at point P:

$\frac{\partial f}{\partial x}(P) = 2x\big|_P = 2,$

$\frac{\partial f}{\partial y}(P) = 4y\big|_P = 4,$

$\frac{\partial f}{\partial z}(P) = 6z\big|_P = 6.$

Than, we have $\bar{a} = 1\bar{\imath} + 1\bar{\jmath} + 1\bar{k},$

 whence

$|\bar{a}| = \sqrt{1 + 1 + 1} = \sqrt{3}$

and

$\frac{\partial f}{\partial a}\big|_P = 2 \cdot \frac{1}{\sqrt{3}} + 4 \cdot \frac{1}{\sqrt{3}} + 6 \cdot \frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}}(2 + 4 + 6) = \frac{12}{\sqrt{3}} = 4\sqrt{3}.$

Answer: $\frac{\partial f}{\partial a}\big|_P = 4\sqrt{3}.$