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DEPARTMENT OF MATHEMATICS

Unit Normal:

A unit normal to the given surface q at

the point is $\nabla \varphi$

Directional Derivative:

The directional derivative of q in the direction

a is given by,

 $\nabla \varphi \cdot \overrightarrow{a}$ (or) $\nabla \varphi \cdot \overrightarrow{h}$ where $\overrightarrow{h} = \overrightarrow{a}$

The directional derivative is maximum in the direction of the normal to the given surface. Its maximum Value is 1 Vpl.

Angle between two surfaces:

$$Coso = \nabla \varphi_1 \cdot \nabla \varphi_2$$

$$|\nabla \varphi_1| |\nabla \varphi_2|$$

Note:

If the surfaces cut orthogonally then,

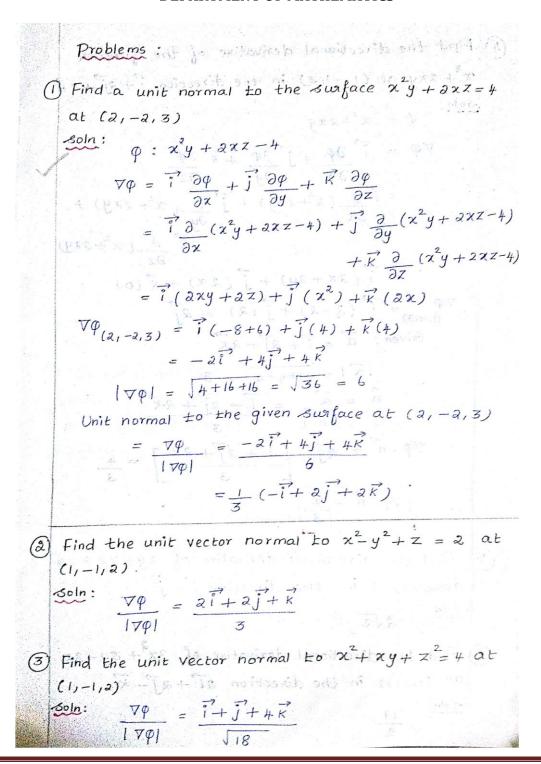
$$\nabla \varphi_1 \cdot \nabla \varphi_2 = 0$$





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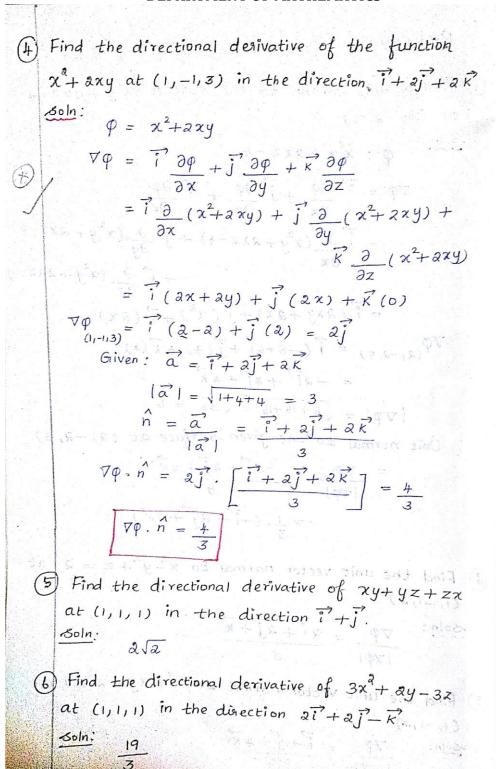






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What is the greatest rate of increase of
$$\varphi = 2yz^2$$
 at $(1,0,3)$?

Soln:

Let $\varphi = xyz^2$
 $= i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial z}$
 $= i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial z}$
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Maximum (or) Greatest rate of increase = $|\nabla\varphi|$
 $= \sqrt{9}$

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 $= \sqrt{9}$

What is the magnitude of $\varphi = x^2y^2z^3$ a maximum?

What is the magnitude of this maximum?

Soln:

 $\varphi = x^2y^2z^2$
 $= i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial y}$
 $= i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial y}$
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