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MK : Kelistrikan & Kemagnetan

Problems

1.11 Find the gradients of the following functions :

(a) $f(x, y, z) = x^2 + y^3 + z^4$

$\Rightarrow \nabla f = 2x \hat{x} + 3y^2 \hat{y} + 4z^3 \hat{z}$

(b) $f(x, y, z) = x^2 y^3 z^4$

$\Rightarrow \nabla f = 2xy^3z^4 \hat{x} + 3x^2y^2z^4 \hat{y} + 4x^2y^3z^3 \hat{z}$

(c) $f(x, y, z) = e^x \sin(y) \ln(z)$

$\Rightarrow \nabla f = e^x \sin y \ln z \hat{x} + e^x \cos y \ln z \hat{y} + e^x \sin y \left(\frac{1}{z}\right) \hat{z}$

1.12 The height of a certain hill (in feet) is given by

$$h(x, y) = 10(2xy - 3x^2 - 4y^2 - 18x + 28y + 12)$$

Where y is the distance (in miles) north, x the distance east of South Hadley

(a) Where is the top of the hill located

$\Rightarrow \nabla h = 10[(2y - 6x - 18)\hat{x} + (2x - 8y + 28)\hat{y}] \quad \nabla h = 0 \quad \text{maka}$

$$\left. \begin{array}{l} 2y - 6x - 18 = 0 \quad \times 1 \Rightarrow 2y - 6x - 18 = 0 \\ 2x - 8y + 28 = 0 \quad \times 3 \Rightarrow 6y - 24x + 84 = 0 \end{array} \right\} \begin{array}{l} 2y - 18 - 24y + 84 = 0 \end{array}$$

$22y = 66$

$y = 3$

$2x - 24 + 28 = 0$

$2x = -4$

$x = -2$

Top is 3 miles north, 2 miles west, of South Hadley

(b) How high is the hill?

 $\Rightarrow$ Letakkan $y = 3$ dan $x = -2$ pada persamaan h

$h = 10(-12 - 12 - 36 + 36 + 84 + 12)$

$= 10 \cdot 72$

$= 720 \text{ ft}$