No.

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Nama : Hana Lia

NPM : 2013022027

M/K : Kelistrikan dan Kemagnetan

Problem 1.11 (halaman 15)

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

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

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

Solution

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

$\vec{\nabla} f = 2x\,i + 3y^3 j + 4z^3 k$

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

$\vec{\nabla} f = 2xy^3 z^4 j + 3x^2 y^2 z^4 j + 4x^2 y^3 z^4 k$

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

$\vec{\nabla} f = e^x \sin(y) \ln(z) + e^x \cos(y) \ln(z) j$

$+ e^x \sin(y) (1/z) k$

Problem 1.12

- The height of a certain hull (in feer) is given by...

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

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where is distance (in milles) north x the distance east of sounth hadly.

a. Where is the top of the hill located ?

$\Rightarrow$ Menentukan fungsi gradien

$\vec{\nabla} b = 10\,(2y - 6x - 18)\,i + (2x - 8y + 28)\,j$

untuk menentukan puncak bukit menggunakan

$\vec{\nabla} b = 10\,(2y - 6x - 18)\,i + (2x - 8y + 28)\,j = 0$

$= 2y - 6x - 18 = 0$] Solusi dari sistem persamaan

$= 2x - 8y + 28 = 0$] $(n = (x, y)\ (-2, 3)$

b. How hight is the hill ?

$\Rightarrow$ subsitusi $(x, y) = (-2, 3)$ pada (x, y)

$b(-2, 3) = 10\,(-12 - 12 - 36 + 36 + 84 + 12)$

$= 720$ m

Jadi, ketinggiannya adalah 720 m.

c. How steep is the slope (in feet permilie) at a point (mile. with and one mile east of sounth hadley ? in what direction is the slope steepest, at that point ?

$\Rightarrow$ subsitusikan $(x, y) = (1, 1)$ pada $\vec{\nabla b}$

$\vec{\nabla} b\,(1, b) = 10\,(2 - 6 - 18)\,i + (2 - 8 + 28)\,j = 220\,(-i + j)$

$|\vec{\nabla} b| = 220\sqrt{2} \approx 311$ m/km, arahnya kebarat laut (135° dari sumbu x positif)

No. Date.

Problem 1.13

letibe the separation vektor from a fixed point (x', y', z') to the point (x, y, z) and let be it's length show that.

a. $\nabla(i) = 2 n$

b. $\nabla(1/\pi) = -2/2^2$

c. What is the general formula for $\nabla(z^n)$?

Solution

$$(x, y, z)\ z = (x - x_0)i + (y - y_0)j + (z - z_0)k$$

$$z = \sqrt{(x - x_0)^2 + (y - y_0)^2 + (z - z_0)}$$

$$(x_0, y_0, z_0) = (x - x_0)^2 + (y - y_0)^2 + (z - z_0)$$

a. $$\vec{\nabla} z^2 = \frac{2}{2x}\left[(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2\right]i + \frac{2}{2y}\left[(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2\right]j + \frac{2}{2z}\left[(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2\right]k$$

$$= 2(x - x_0)i + 2(y - y_0)j + 2(z - z_0)k$$

$$= 2z \text{ (terbukti)}$$

c. $\frac{2}{2x}(z^n) = n_z^{n-1}\frac{2n}{2x} = n_z^{n-1}(1/z\ 1/2\ 2x) = n_z^{n-1}2x, (z = x - x_0)$

$\frac{2}{2y}(z^n) = n_z^{n-1}2y, \frac{2}{2z}(z^n) = n_z^{n-1}2z$, sehingga

$\vec{\nabla}(z^n) = n_z^{n-1}\bar{z}$

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