Инд. задания, Вар.№9

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2

$$u = xy + 2xz^2 - zy \quad \vec{l} = \{-3, 4, -1\} \quad M(2, 1, 5) \quad |l| = \sqrt{26}$$

$$\frac{\partial u}{\partial l} = \frac{\partial u}{\partial x}\cos\alpha + \frac{\partial u}{\partial y}\cos\beta + \frac{\partial u}{\partial z}\cos\gamma$$

$$\frac{\partial u}{\partial x} = y + 2z^2 \quad \cos\alpha = \frac{l_x}{|l|} = -\frac{3}{\sqrt{26}}$$

$$\frac{\partial u}{\partial y} = x - z \quad \cos\beta = \frac{l_y}{|l|} = \frac{4}{\sqrt{26}}$$

$$\frac{\partial u}{\partial z} = 4xz - y \quad \cos\gamma = \frac{l_z}{|l|} = -\frac{1}{\sqrt{26}}$$

$$\frac{\partial u}{\partial l} = (y + 2z^2)(-\frac{3}{\sqrt{26}}) + (x - z)(\frac{4}{\sqrt{26}}) + (4xz - y)(-\frac{1}{\sqrt{26}})$$

$$\frac{\partial u}{\partial l}(M) = -\frac{204}{\sqrt{26}}$$

$$\overline{grad}(u) = \left(\frac{\partial u}{\partial x}; \frac{\partial u}{\partial y}; \frac{\partial u}{\partial z}\right)$$

$$\overline{grad}(u)(M) = (51; -3; 39)$$

3

$$3x^2 + 2y^2 - z^2 = 4 \quad M(-1, 1, 1)$$

$$F(M_0)'_x(x - x_0) + F(M_0)'_y(y - y_0) + F(M_0)'_z(z - z_0) = 0$$

$$F'_x = (3x^2 + 2y^2 - z^2 - 4)'_x = 6x \quad F(M)'_x = -6$$

$$F'_y = (3x^2 + 2y^2 - z^2 - 4)'_y = 4y \quad F(M)'_y = 4$$

$$F'_z = (3x^2 + 2y^2 - z^2 - 4)'_z = 2z \quad F(M)'_z = 2$$

$$-6(x + 1) + 4(y - 1) + 2(z - 1) = 0$$

$\underline{-6x + 4y + 2z - 12 = 0}$ - уравнение касательной плоскости,
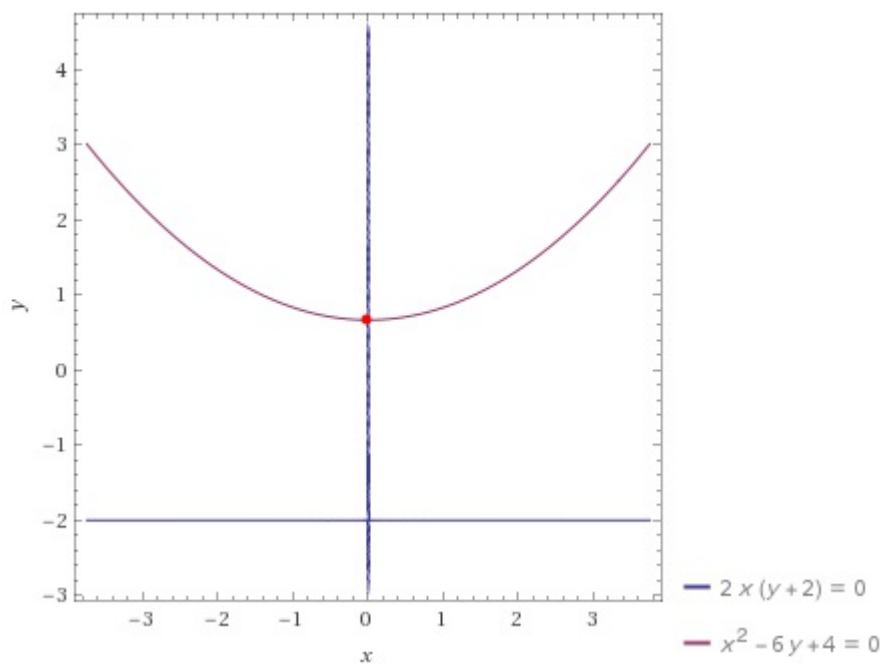
$\underline{\frac{x+1}{-6} = \frac{y-1}{4} = \frac{z-1}{2}}$ - уравнение нормали.

4

$$z = x^2 y + 2x^2 - 3y^2 + 4y$$

$$z'_x = 2xy + 4x \quad z'_y = x^2 - 6y + 4$$

$$\begin{cases} x(2y + 4) = 0 \\ x^2 - 6y + 4 = 0 \end{cases} \Rightarrow \begin{cases} x = 0 \vee y = -2 \\ x^2 - 6y = -4 \end{cases} \Rightarrow \begin{cases} x = 0 \\ y = \frac{4}{6} \end{cases}$$

$$x = 0 \quad y = \frac{4}{6}$$

$M_0\left(0; \frac{4}{6}\right)$ - стационарная точка

$$A = z''_{xx} = 2y + 4 \quad B = z''_{xy} = 2x \quad C = z''_{yy} = -6$$

$$AC - B^2 = -32 < 0;$$

экстремума нет.