

$$4.11. M(-1, 0, 3)$$

$$g: \frac{x+1}{2} = \frac{y-3}{4} = \frac{z-3}{-1}$$

$$d: a(x-(-1)) + b(y-0) + c(z-3) = 0$$

$$a(x+1) + by + c(z-3) = 0$$

$$d \perp g \Rightarrow \vec{n}_d \text{ и } \vec{u}_g \text{ сонаправлены}$$

$$\rightarrow \text{можно } \alpha \text{ выбрать } \vec{n}_d = \vec{u}_g = (2, 4, -1)$$

$$\Rightarrow d: 2(x+1) + 4y - (z-3) = 0$$

$$2x + 2 + 4y - z + 3 = 0$$

$$d: 2x + 4y - z + 5 = 0$$

$$4.14. P(-1, -2, 1)$$

$$l: \frac{x}{-2} = \frac{y-3}{4} = \frac{z-4}{1}$$

$P'(x_0, y_0, z_0)$ - проекция P на l , $Q(x_1, y_1, z_1)$ - симметричная P относительно l

$$P' \in l \Rightarrow \frac{x_0}{-2} = \frac{y_0-3}{4} = \frac{z_0-4}{1} = t$$

$$x_0 = -2t$$

$$y_0 = 3 + 4t$$

$$z_0 = 4 + t$$

$$\vec{PP}' \perp l \Rightarrow \langle \vec{PP}', \vec{u}_l \rangle = 0$$

$$\vec{PP}' = (x_0 - (-1), y_0 - (-2), z_0 - 1) = (-2t + 1, 3 + 4t + 2, 4 + t - 1) = (1 - 2t, 5 + 4t, 3 + t)$$

$$\langle \vec{PP}', \vec{u}_l \rangle = \langle (1 - 2t, 5 + 4t, 3 + t), (-2, 4, 1) \rangle = (-2)(1 - 2t) + 4(5 + 4t) + 3 + t = 0$$

$$-2 + 4t + 20 + 16t + 3 + t = 0$$

$$21t = -21$$

$$t = -1$$


$$P'(2, -1, 3)$$

P' - середина PQ

$$2 = \frac{-1 + x_1}{2} \quad -1 = \frac{-2 + y_1}{2} \quad 3 = \frac{1 + z_1}{2}$$

$$x_1 = 5 \quad y_1 = 0 \quad z_1 = 5$$

$$Q(5, 0, 5)$$



4.19. $T(-3, 1, 2)$

$$d: 4x - y + 2z - 5 = 0$$

$$p: \frac{x+3}{0} = \frac{y-2}{2} = \frac{z+1}{-1} \quad P(-3, 2, -1), \vec{u}_p = (0, 2, -1)$$

$$l: \frac{x+3}{a} = \frac{y-1}{b} = \frac{z-2}{c} \quad T \in l$$

$$l \parallel \alpha \Rightarrow \vec{u}_l \perp \vec{n}_\alpha \Rightarrow \langle \vec{u}_l, \vec{n}_\alpha \rangle = 0$$

$$\langle \vec{u}_l, \vec{n}_\alpha \rangle = \langle (a, b, c), (4, -1, 2) \rangle = 4a - b + 2c = 0$$

$$l \text{ wrt } p \Rightarrow [\vec{TP}, \vec{u}_l, \vec{u}_p] = 0$$

$$\vec{TP} = (\cancel{-3} - \cancel{-3}, 2 - 1, -1 - 2) = (0, 1, -3)$$

$$\begin{vmatrix} 0 & 1 & -3 \\ a & b & c \\ 0 & 2 & -1 \end{vmatrix} = 0$$

$$-a \cdot \begin{vmatrix} 1 & -3 \\ 2 & -1 \end{vmatrix} = 0$$

$$-a \cdot (-1 + 6) = 0$$

$$a = 0$$

$$-b + 2c = 0$$

$$b = 2c$$

Može se uzeti y=1 $\Rightarrow \vec{u}_l = (0, 2, 1)$

$$l: \frac{x+3}{0} = \frac{y-1}{2} = \frac{z-2}{1}$$