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$\underline{1}$ $P_1 = (1,-2,0)$

em s: $\frac{1-2}{3} = \frac{-2+5}{1} = \frac{0-2}{2} \Rightarrow \frac{-1}{3} \neq \frac{3}{1} \neq -1$ — P_1 não pertence a s

$P_2 = (1,0,-2)$

em α: $2.1+0+2+2=0$ — P_2 não pertence a α

$6 \neq 0$

2,0

$\underline{2}$ eq. paramét. de uma reta r, $O=(0,0,0)$ e $r \perp \pi$

$\pi: \begin{cases} x = 2p-q \\ y = -3p+q \\ z = p-q \end{cases}$

$P = (0,0,0) \in \pi$

$\vec{v} = (2,-3,1) \in \pi$

$\vec{u} = (-1,1,-1) \in \pi$

$A = (x,y,z) \in \pi$

$\vec{AP} = (x,y,z)$

Logo $\Rightarrow \pi$: $[\vec{AP}, \vec{v}, \vec{u}] = 0$

$\begin{vmatrix} x & y & z \\ 2 & -3 & 1 \\ -1 & 1 & -1 \end{vmatrix} \begin{matrix} x & y \\ 2 & -3 \\ -1 & 1 \end{matrix} = 0$

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

$\pi \Rightarrow 2x + y - z = 0$

$n_\pi = (2,1,-1)$

reta $\begin{cases} x = 0 + 2t \\ y = 0 + 1t \\ z = 0 - 1t \end{cases} \Rightarrow \begin{cases} x = 2t \\ y = t \\ z = -t \end{cases}$

2,0

$\underline{3}$ eq paramétrica da reta inter. de π e β

$\begin{cases} 2x + y - z = 0 \rightsquigarrow n_\pi = (2,1,-1) \\ x - y + z + 3 = 0 \rightsquigarrow n_\beta = (1,-1,1) \end{cases}$

$\mapsto$ diretor da reta int.

$\vec{v} = n_\pi \times n_\beta = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{vmatrix} = (1-1)\vec{i} - (2+1)\vec{j} + (-2-1)\vec{k}$

$\vec{v} = (0,-3,-3)$.

$P_0 \Rightarrow$ com $y = 0$

$(-1, 0, -2)$

$\begin{cases} 2x - z = 0 \rightsquigarrow 2(-3-z) - z = 0 \rightsquigarrow -6 - 2z - z = 0 \rightsquigarrow -3z = 6 \\ x + z = -3 \rightsquigarrow x = -3 - z \rightsquigarrow x = -3 + 2 = -1 \end{cases}$

$z = -2$

reta int $\begin{cases} x = -1 \\ y = -3t \\ z = -2 - 3t \end{cases}$

2,0

④ Posição relativa / distância entre r e s

$v_r = (1,-3,2)$; $v_s = (3,1,2)$

$v_r \times v_s = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & -3 & 2 \\ 3 & 1 & 2 \end{vmatrix} = (-6-2)\vec{i} - (2-6)\vec{j} + (1+9)\vec{k}$

$\neq 0$

$\mapsto$ concorrentes ou reversas

$\rightarrow$

$$[\overrightarrow{P_1P_2}, \vec{v_r}, \vec{v_s}] = \begin{vmatrix} 2 & -6 & 4 \\ 1 & -3 & 2 \\ 3 & 1 & 2 \end{vmatrix}\begin{matrix} 2 & -6 \\ 1 & -3 \\ 3 & 1 \end{matrix}$$

$$\begin{matrix} - & - & - & + & + & + \end{matrix}$$

$= +\cancel{36} - \cancel{4} + \cancel{12} - \cancel{12} - \cancel{36} + \cancel{4}$

$= 0$

$\hookrightarrow$ coplanares

$\Rightarrow$ concorrentes

2,0

$d(r, s) = 0$

5. eq. cartesiana do plano que cont. r e s.

$\vec{v_r} \parallel \gamma$; $\vec{v_s} \parallel \gamma$; $P = (0, 1, -2) \in r$ e $\in \gamma$

$A = (x, y, z) \in \gamma$

$$[\vec{v_r}, \vec{v_s}, \overrightarrow{PA}] = 0 \Rightarrow \begin{vmatrix} x & y-1 & z+2 \\ 1 & -3 & 2 \\ 3 & 1 & 2 \end{vmatrix}\begin{matrix} x & y-1 \\ 1 & -3 \\ 3 & 1 \end{matrix} = 0$$

$$\begin{matrix} - & - & - & + & + & + \end{matrix}$$

$-6x + 6y - 6 + z + 2 + 9z + 18 - 2x - 2y + 2 = 0$

$\gamma: -8x + 4y + 10z + 16 = 0$

ou

$\gamma: 4x - 2y - 5z - 8 = 0$

2,0