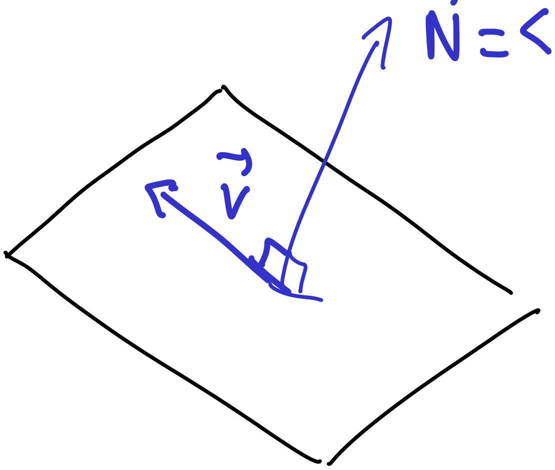
The vector $\vec{v} = \langle 1, 2, -1 \rangle$ and the plane $x + y + 3z = 5$ are

1. parallel
2. ~~perpendicular~~
3. ~~neither~~

$\vec{v}$ not $\parallel \vec{N}$

$\vec{N} = \langle 1, 1, 3 \rangle$

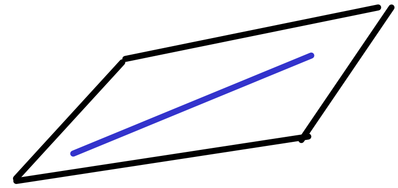


$$\vec{v} \cdot \vec{N} = \langle 1, 2, -1 \rangle \cdot \langle 1, 1, 3 \rangle$$
$$= 1 + 2 - 3 = 0$$

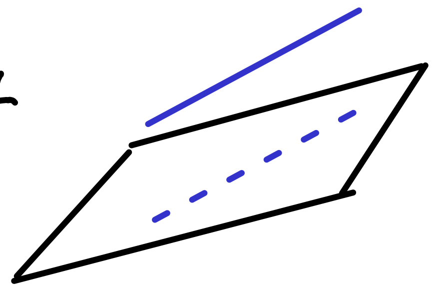
$\vec{v} \perp \vec{N}$

A LINE AND A PLANE:

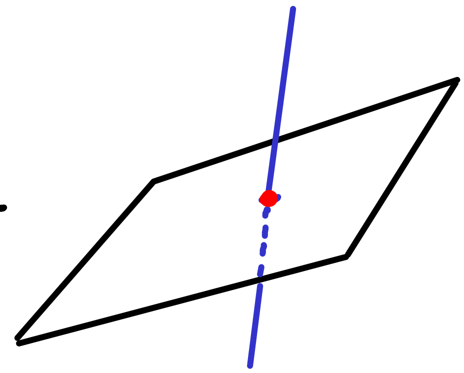
→ The line can be contained in the plane



→ or parallel to it



→ or intersects the plane in a point



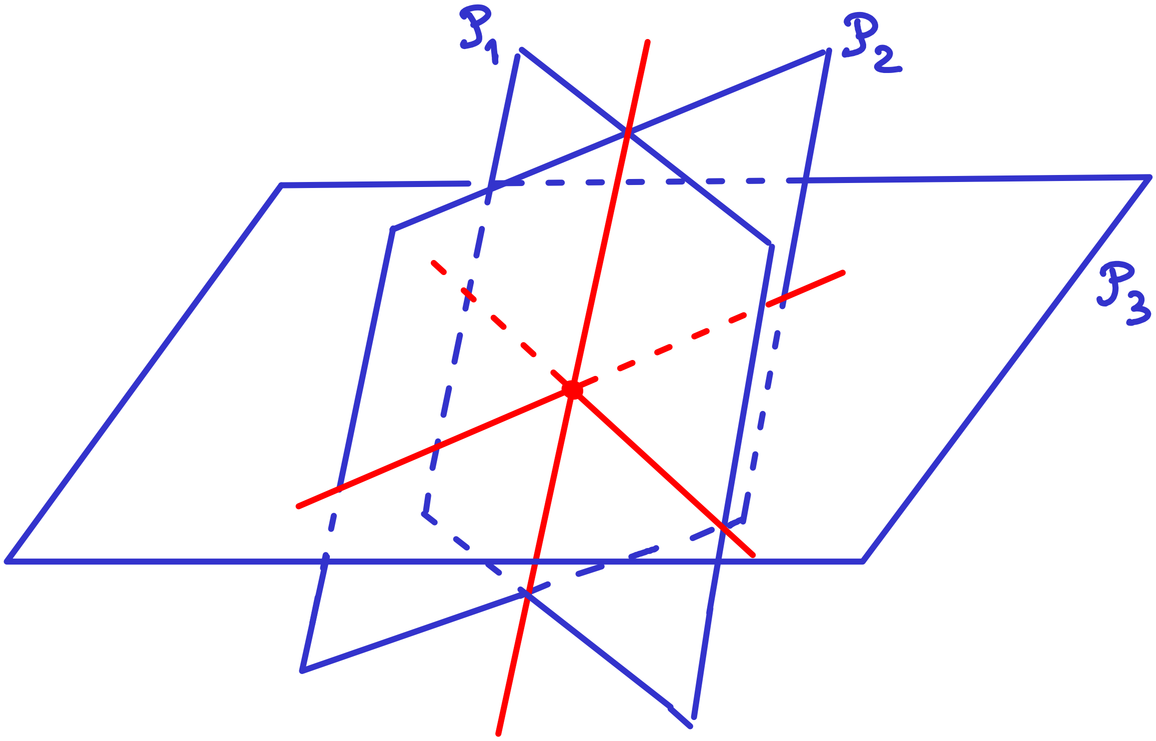
This has to do with: 3×3 linear systems!

$$\begin{cases} x+y+2z=7 & (\mathcal{P}_1) \\ 2x+y-z=4 & (\mathcal{P}_2) \\ x+2y+3z=3 & (\mathcal{P}_3) \end{cases}$$

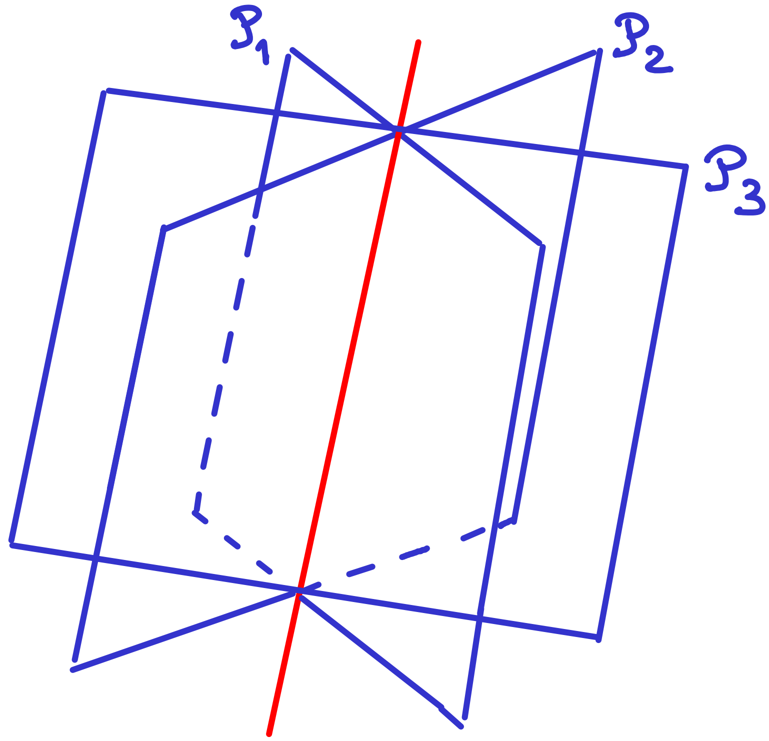
3 planes: where do they intersect?

How many solutions?

If the first 2 planes are not parallel, they intersect in a line.



Line and $\mathcal{P}_3$
intersect in a point
(1 solution)



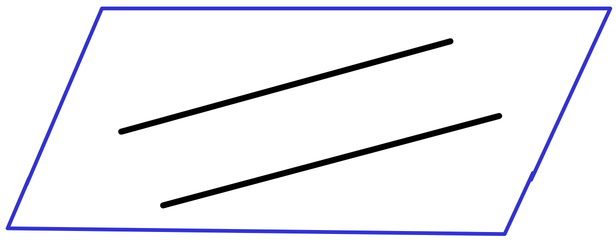
Line // $\mathcal{P}_3$
(no solution)

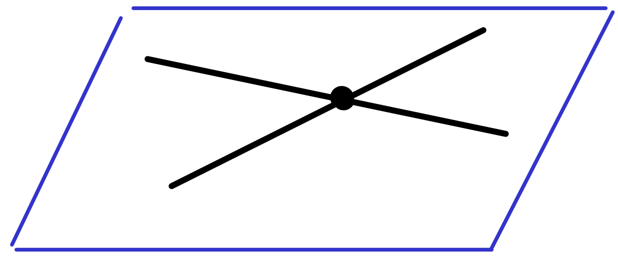
Line contained in $\mathcal{P}_3$
(∞ solutions)

RELATIVE POSITIONS OF 2 LINES:

→ parallel
→ intersecting

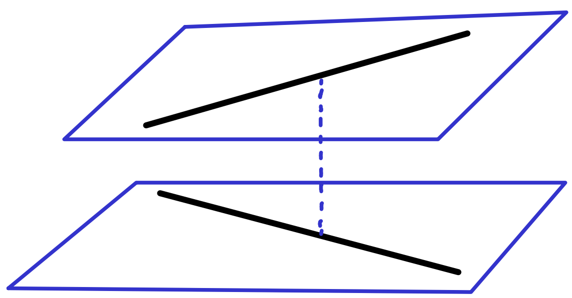
} in both cases, a unique plane containing both lines





→ <u>skew lines</u> = neither parallel nor intersecting

Then they lie on parallel planes



Distance between the 2 planes = shortest distance between points on the skew lines.

CYCLOID

$$\vec{OC} = \langle a\theta, a \rangle$$

$$\vec{CP} = \langle -a \sin\theta, -a \cos\theta \rangle$$

$$\vec{r}(\theta) = \vec{OP} = \vec{OC} + \vec{CP} = \langle a\theta - a\sin\theta, a - a\cos\theta \rangle$$