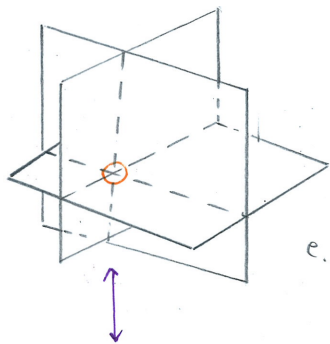


Intersection of 3 Planes / 3 simultaneous eqⁿs w/ 3 unknowns



- Given 3 plane equations

Write in matrix form.

e.g.
$$\begin{aligned} x+y+z &= 3 \\ 2x+y &= 6 \\ 5y+3z &= 0 \end{aligned} \rightarrow \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 0 \\ 0 & 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix}$$

Det of this actually = 0

Solve Using matrix techniques (inverses, or row-reduction) or 'brute-force' algebra. 1 unique solution.

No

Is matrix determinant equal to 0?

Yes

Are there 2 equations in matrix with coefficients all proportional?

Yes

Is the right hand side also proportional?

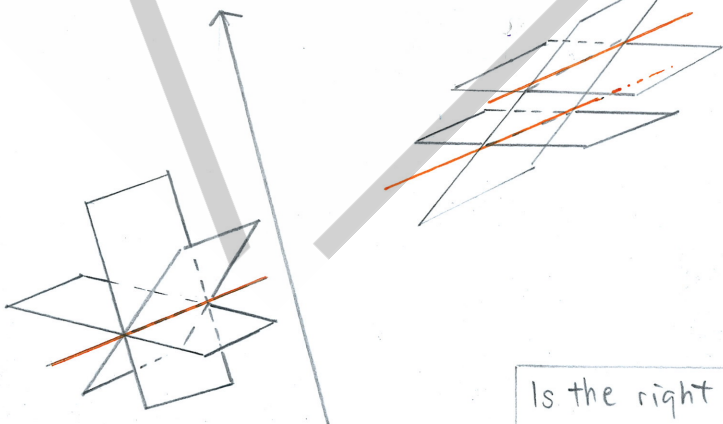
Yes

Identical Planes

Solve as intersection of 2 planes

No

2 Parallel Planes, No solution



3 planes intersecting in one single line.

No

Perform 'row reduction' to get zeroes in the bottom left of matrix (purple squares)

$$\begin{bmatrix} 1 & 1 & 1 & | & 3 \\ 2 & 1 & 0 & | & 6 \\ 0 & 5 & 3 & | & 0 \end{bmatrix}$$

$$\begin{array}{l} \text{2nd row} - 2 \times \text{1st row} \\ \text{3rd row} - 5 \times \text{1st row} \end{array} \rightarrow \begin{bmatrix} 1 & 1 & 1 & | & 3 \\ 0 & -1 & -2 & | & 0 \\ 0 & -2 & -4 & | & -15 \end{bmatrix}$$

$$\text{3rd row} - 2 \times \text{2nd row} \rightarrow \begin{bmatrix} 1 & 1 & 1 & | & 3 \\ 0 & -1 & -2 & | & 0 \\ 0 & 0 & 0 & | & -15 \end{bmatrix}$$

If a matrix has det=0 then the orange entry is guaranteed to be zero.

Is the right hand side also zero?

Yes

No

(this case)

No solution

