Intersection of 2 lines

line 1: $\vec{r}_1 = \begin{pmatrix} 8 \\ 5 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$

line 2: $\vec{r}_2 = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$

Find the intersection (if it exists)

x-coord: $8 + 3\lambda = 1 + \mu$
y-coord: $5 + 2\lambda = 1 \longrightarrow \underline{\underline{\lambda = -2}}$

$$8 + 3(-2) = 1 + \mu$$

$$2 = 1 + \mu \longrightarrow \underline{\underline{\mu = 1}}$$

$\dfrac{\lambda = -2}{\begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}}$ $\quad$ $\dfrac{\mu = 1}{\begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}}$ $\longleftarrow$ $\boxed{\text{The lines intersect at } (2, 1, 1)}$

- ## The Intersection of a line and a plane

line: $\vec{r} = 2\vec{i} - \vec{j} + 3\vec{k} + \lambda(\vec{i} - \vec{j} + 2\vec{k})$

plane: $2x - y + z = -2$

$$2(\underline{2+\lambda}) - (\underline{-1-\lambda}) + (\underline{3+2\lambda}) = -2$$

$$4 + 2\lambda + 1 + \lambda + 3 + 2\lambda = -2$$

$$5\lambda = -10$$

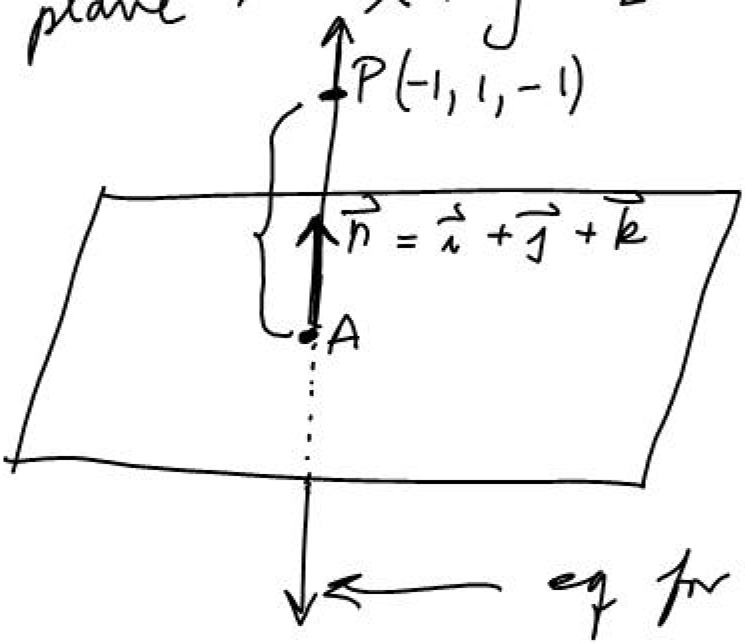
parameter where the intersection occurs $\longrightarrow$ $\lambda = -2$

$\boxed{(0, 1, -1)}$ ← pt. of intersection

- Distance from a point to a plane

point : $(-1, 1, -1)$

plane : $x + y + z = 2$



eq for this line :

$$\vec{r} = (-1+\lambda)\vec{i} + (1+\lambda)\vec{j} + (-1+\lambda)\vec{k}$$

$$x + y + z = 2$$

$$(-1+\lambda) + (1+\lambda) + (-1+\lambda) = 2$$

$$\lambda = 1$$

$$A(0, 2, 0)$$

distance formula

$$AP = \sqrt{(0 - -1)^2 + (2-1)^2 + (0 - -1)^2} = \sqrt{3}$$

Intersection of 2 planes

plane 1: $x+y-2z=4$

plane 2: $2x-y+z=1$

Eliminate z

$$
\begin{array}{r}
x+y-\cancel{2z}=4 \\
4x-2y+\cancel{2z}=2 \\
\hline
5x-y \quad =6
\end{array}
$$

$$x=\frac{6+y}{5}$$

Eliminate y

$$3x-z=5$$

$$x=\frac{z+5}{3}$$

$$x=\frac{6+y}{5}=\frac{z+5}{3}$$

$$\boxed{\frac{x-0}{1}=\frac{y-(-6)}{5}=\frac{z-(-5)}{3}}$$ Line of intersection