THE ANGLE BETWEEN A LINE AND A REAL PLAN

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Let be the line:

$$d: \begin{cases} x = 1 + t \\ y = 2 + 3t \\ z = -2 + 5t \end{cases} ; t \in \mathbb{R}$$

Let be the real plan:

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

Find the angle between d and P.

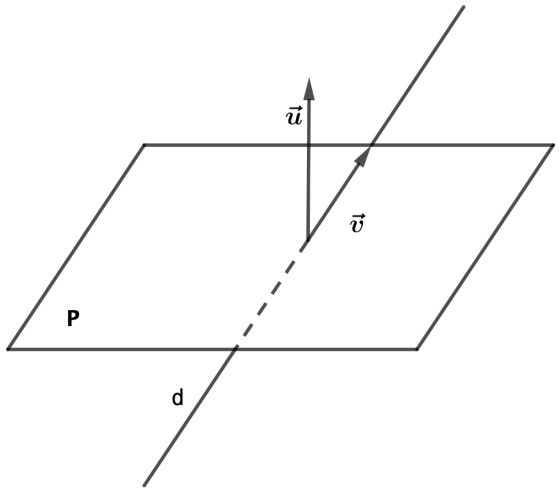
$$d: \begin{cases} x - 1 = t \\ \frac{y-2}{3} = t \\ \frac{z+2}{5} = t \end{cases} ; d: \frac{x-1}{1} = \frac{y-2}{3} = \frac{z+2}{5}$$

The line d has the directory vector:

$$\overrightarrow{v}(1,3,5) = \overrightarrow{i} + 3\overrightarrow{j} + 5\overrightarrow{k}$$

The normal vector of the real plan P is:

$$\overrightarrow{u}(2,3,1) = 2\overrightarrow{i} + 3\overrightarrow{j} + \overrightarrow{k}$$



$$\overrightarrow{u} \cdot \overrightarrow{v} = 1 \cdot 2 + 3 \cdot 3 + 5 \cdot 1 = 16$$

$$|\overrightarrow{u}| = \sqrt{2^2 + 3^2 + 1^2} = \sqrt{14}$$

$$|\overrightarrow{v}| = \sqrt{1^2 + 3^2 + 5^2} = \sqrt{35}$$

$$\cos(\angle(\overrightarrow{u}, \overrightarrow{v})) = \frac{\overrightarrow{u} \cdot \overrightarrow{v}}{|\overrightarrow{u}| \cdot |\overrightarrow{v}|} = \frac{16}{\sqrt{14} \cdot \sqrt{15}} = \frac{16}{\sqrt{210}} = \frac{8\sqrt{210}}{105}$$

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