

# EE5609 Assignment 2

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**Abstract**—This document contains the solution to find the the values of  $p$  for which given two lines are perpendicular.

Download all python codes from

<https://github.com/ArcticSoup/EE5609–Matrix–Theory/tree/master/Assignment2/Codes>

and latex-tikz codes from

<https://github.com/ArcticSoup/EE5609–Matrix–Theory/tree/master/Assignment2>

## 1 PROBLEM

Find the values of  $p$  such that the pair of lines

$$L_1 : \frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$$

$$L_2 : \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$$

are perpendicular.

## 2 SOLUTION

Rewriting the given lines as follows,

$$L_1 : \frac{x-1}{-3} = \frac{y-2}{\frac{2}{7}p} = \frac{z-3}{2}$$

$$L_2 : \frac{x-1}{\frac{-3}{7}p} = \frac{y-5}{1} = \frac{z-6}{-5}$$

Using the definition of a line in co-ordinate geometry, we see from the above two equations, the direction vectors  $\mathbf{a}$  and  $\mathbf{b}$  of the two lines are

$$\mathbf{a} = \begin{pmatrix} -3 \\ \frac{2}{7}p \\ 2 \end{pmatrix} \quad (2.0.1)$$

$$\mathbf{b} = \begin{pmatrix} \frac{-3}{7}p \\ 1 \\ -5 \end{pmatrix} \quad (2.0.2)$$

respectively.

In order for the two lines to be perpendicular, their dot product should be equal to 0 which gives,

$$\frac{\mathbf{a}^T \mathbf{b}}{\|\mathbf{a}\| \|\mathbf{b}\|} = 0 \quad (2.0.3)$$

Which in turn gives us,

$$\mathbf{a}^T \mathbf{b} = \frac{11}{7}p - 10 \quad (2.0.4)$$

$$\Rightarrow \frac{11}{7}p - 10 = 0 \quad (2.0.5)$$

$$\Rightarrow p = \frac{70}{11} \quad (2.0.6)$$

$$\Rightarrow p \approx 6.364 \quad (2.0.7)$$

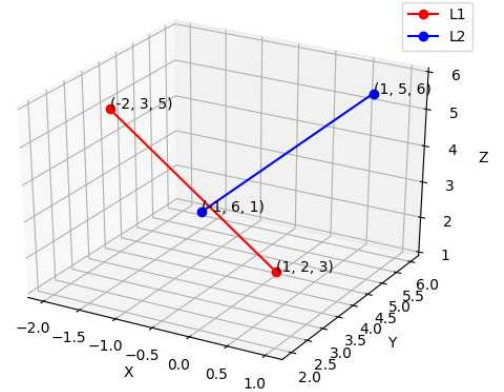


Fig. 0: The two lines plotted by substituting the value of  $p$  found