# 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

$$\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$$
$$\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$$

## 2 Solution

Rewriting the given lines as follows,

$$\frac{x-1}{-3} = \frac{y-2}{\frac{2}{7}p} = \frac{z-3}{2}$$
$$\frac{x-1}{\frac{-3}{7}p} = \frac{y-5}{1} = \frac{z-6}{-5}$$

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

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

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

respectively.

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

$$\frac{\mathbf{a}^T\mathbf{b}}{\|\mathbf{a}\|\,\|\mathbf{b}\|} = 0 \tag{2.0.3}$$

Which gives us,

$$\mathbf{a}^T\mathbf{b} = \frac{11}{7}p - 10 \tag{2.0.4}$$
$$\implies \frac{11}{7}p - 10 = 0 \tag{2.0.5}$$
$$\implies p = \frac{70}{11} \tag{2.0.6}$$
$$\implies p \approx 6.364 \tag{2.0.7}$$