

Assignment-5

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Abstract—This document contains the procedure to find unknown constant value such that the equation represents pair of straight lines.

Download the python code from

<https://github.com/ankuraditya13/EE5609–Assignment5>

and latex-file codes from

<https://github.com/ankuraditya13/EE5609–Assignment5>

$$\mathbf{u} = \begin{pmatrix} -4 \\ \frac{9}{2} \end{pmatrix} \quad (2.0.6)$$

Now equation (1.0.1) represents pair of straight lines if,

$$\begin{vmatrix} \mathbf{V} & \mathbf{u} \\ \mathbf{u}^T & f \end{vmatrix} = 0 \quad (2.0.7)$$

$$\begin{vmatrix} 0 & \frac{k}{2} & -4 \\ \frac{k}{2} & 0 & \frac{9}{2} \\ -4 & \frac{9}{2} & -12 \end{vmatrix} = 0 \quad (2.0.8)$$

$$\implies k = 0, k = 6 \quad (2.0.9)$$

1 PROBLEM

Find the value of k so that following equation may represent pairs of straight lines,

$$kxy - 8x + 9y - 12 = 0 \quad (1.0.1)$$

2 SOLUTION

The general equation of second degree is given by,

$$ax^2 + 2bxy + cy^2 + 2dx + 2ey + f = 0 \quad (2.0.1)$$

In vector form the equation (2.0.1) can be expressed as,

$$\mathbf{x}^T \mathbf{V} \mathbf{x} + 2\mathbf{u}^T \mathbf{x} + f = 0 \quad (2.0.2)$$

where,

$$\mathbf{V} = \mathbf{V}^T = \begin{pmatrix} a & b \\ b & c \end{pmatrix} \quad (2.0.3)$$

$$\mathbf{u} = \begin{pmatrix} d \\ e \end{pmatrix} \quad (2.0.4)$$

Now, comparing equation (2.0.1) to (1.0.1) we get, $a = c = 0$, $b = \left(\frac{k}{2}\right)$, $d = -4$, $e = \left(\frac{9}{2}\right)$, $f = -12$. Hence, substituting these values in equation (2.0.3) and (2.0.4) we get,

$$\mathbf{V} = \mathbf{V}^T = \begin{pmatrix} 0 & \frac{k}{2} \\ \frac{k}{2} & 0 \end{pmatrix} \quad (2.0.5)$$