## Assignment 2

## T.Guru Balaji

Download all python codes from

https://github.com/TGURUBALAJI/INTERNSHIP -IITH/Assignment2/code

and latex-tikz codes from

https://github.com/TGURUBALAJI/INTERNSHIP -IITH/Assignment2/gbalaji.tex

1 Linear forms Q:2.106

Find the values of k for which the line

$$(k-3 -(4-k^2))\mathbf{x} + k^2 - 7k + 6 = 0$$
 (1)

is

- a) Parallel to the x-axis
- b) Parallel to the y-axis
- c) Passing through the origin

Solution Given equation of the line,

$$(k-3 -(4-k^2))\mathbf{x} + k^2 - 7k + 6 = 0$$
 (2)

of a general line equation  $\mathbf{n}\mathbf{x} = c$ here  $\mathbf{n} = \begin{pmatrix} k-3 & -(4-k^2) \end{pmatrix}$ and  $c = -k^2 + 7k - 6$ 

a) Parallel to x-axis  $\mathbf{n} = \begin{pmatrix} 0 & 1 \end{pmatrix}$  if the line is parallel to x-axis Equation of x-axis is  $\begin{pmatrix} 1 & 0 \end{pmatrix} \mathbf{x} = 0$ 

$$(1 \quad 0) \begin{pmatrix} k-3 \\ -\{4-k^2\} \end{pmatrix} = 0$$

$$k-3 = 0$$

$$\Rightarrow k = 3$$

$$(3)$$

Substituting k = 3 in (2) Equation of line is,

$$\begin{pmatrix} 0 & 5 \end{pmatrix} \mathbf{x} = 6 \tag{4}$$

b) Parallel to y-axis  $\mathbf{n} = \begin{pmatrix} 1 & 0 \end{pmatrix}$  if the line is parallel to y-axis Equation of y-axis is  $\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0$ 

$$(0 \quad 1) {k-3 \choose -(4-k^2)} = 0$$

$$4 - k^2 = 0$$

$$\implies k = \pm 2$$
(5)

Substituting k = 2 in (2). Equation of line is,

$$\begin{pmatrix} -1 & 0 \end{pmatrix} \mathbf{x} = 4 \tag{6}$$

Substituting k = -2 in (2). Equation of line is,

$$\begin{pmatrix} -5 & 0 \end{pmatrix} \mathbf{x} = -24 \tag{7}$$

c) Passing through origin
 c = 0 if the line passes through origin
 Equation of line when passing through origin
 is

$$\mathbf{n}^{\mathsf{T}}\mathbf{x} = 0 \tag{8}$$

Hence

$$-k^{2} + 7k - 6 = 0$$

$$= -k^{2} + k + 6k - 6$$

$$= (k - 1)(k - 6)$$

$$\implies k = 1, k = 6$$
(9)

Substituting k = 1 in (2). The equation of line is,

$$(-2 -3)\mathbf{x} = 0 \tag{10}$$

Substituting k = 6 in (2). The equation of line is

$$\begin{pmatrix} 3 & 32 \end{pmatrix} \mathbf{x} = 0 \tag{11}$$

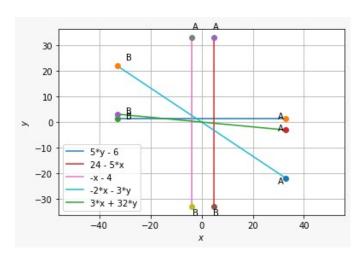


Fig. 3: Plot of line equations