

# Assignment 2

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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 QUESTION No. 2.106 - LINEAR FORMS

**2.106** Find the values of  $k$  for which the line

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

is

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

**Solution** Given equation of the line,

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

of a general line equation  $\mathbf{n}\mathbf{x} = c$

here  $\mathbf{n} = (k-3 \quad -(4-k^2))$   
and  $c = -k^2 + 7k - 6$

a) Parallel to x-axis

$\mathbf{n} = (0 \quad 1)$  if the line is parallel to x-axis

Equation of x-axis is  $(1 \quad 0)\mathbf{x} = 0$

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

Substituting  $k = 3$  in (2)

Equation of line is,

$$(0 \quad 5)\mathbf{x} = 6 \quad (4)$$

b) Parallel to y-axis

$\mathbf{n} = (1 \quad 0)$  if the line is parallel to y-axis

Equation of y-axis is  $(0 \quad 1)\mathbf{x} = 0$

$$\begin{aligned} (0 \quad 1) \begin{pmatrix} k-3 \\ -(4-k^2) \end{pmatrix} &= 0 \\ 4-k^2 &= 0 \\ \Rightarrow k &= \pm 2 \end{aligned} \quad (5)$$

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

$$(-1 \quad 0)\mathbf{x} = 4 \quad (6)$$

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

$$(-5 \quad 0)\mathbf{x} = -24 \quad (7)$$

c) Passing through origin

$c = 0$  if the line passes through origin

Equation of line when passing through origin is

$$\mathbf{n}^T \mathbf{x} = 0 \quad (8)$$

Hence

$$\begin{aligned} -k^2 + 7k - 6 &= 0 \\ &= -k^2 + k + 6k - 6 \\ &= (k-1)(k-6) \\ \Rightarrow k &= 1, k = 6 \end{aligned} \quad (9)$$

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

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

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

$$(3 \quad 32)\mathbf{x} = 0 \quad (11)$$

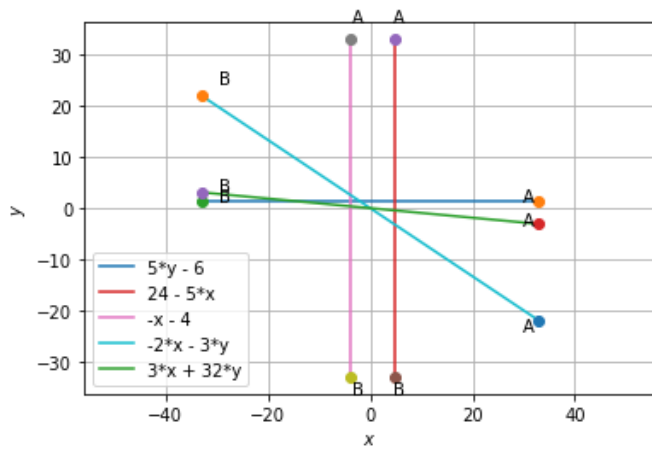


Fig. 3: Plot of line equations