

# 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>

**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  $\mathbf{n}\mathbf{x} = c$

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

a) Parallel to x-axis

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

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

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

$$k - 3 = 0 \quad (4)$$

$$k = 3 \quad (5)$$

Substituting  $k = 3$  in (2)

Equation of line is,

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

b) Parallel to y-axis

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

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

$$(0 \quad 1)\begin{pmatrix} k - 3 \\ -(4 - k^2) \end{pmatrix} = 0 \quad (7)$$

$$4 - k^2 = 0 \quad (8)$$

$$k = \pm 2 \quad (9)$$

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

$$(-1 \quad 0)\mathbf{x} = 12 \quad (10)$$

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

$$(-5 \quad 0)\mathbf{x} = -24 \quad (11)$$

c) Passing through origin

$c = 0$  if the line passes through origin

Equation of line when passing through origin is

$$\mathbf{n}^T \mathbf{x} = 0 \quad (12)$$

Hence

$$-k^2 + 7k - 6 = 0 \quad (13)$$

$$(k - 1)(k - 6) = 0 \quad (14)$$

$$k = 1, k = 6 \quad (15)$$

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

$$(-2 \quad -3)\mathbf{x} = 0 \quad (16)$$

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

$$(3 \quad 32)\mathbf{x} = 0 \quad (17)$$

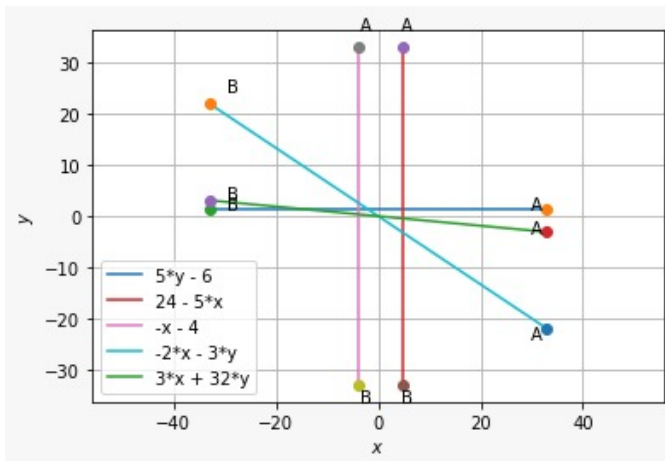


Fig. 3: Plot of line equations