

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

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

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

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

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

$$-k^2 + 7k - 6 = 0 \\ = -k^2 + k + 6k - 6 \quad (9) \\ = (k-1)(k-6) \\ \Rightarrow k = 1, k = 6$$

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,

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

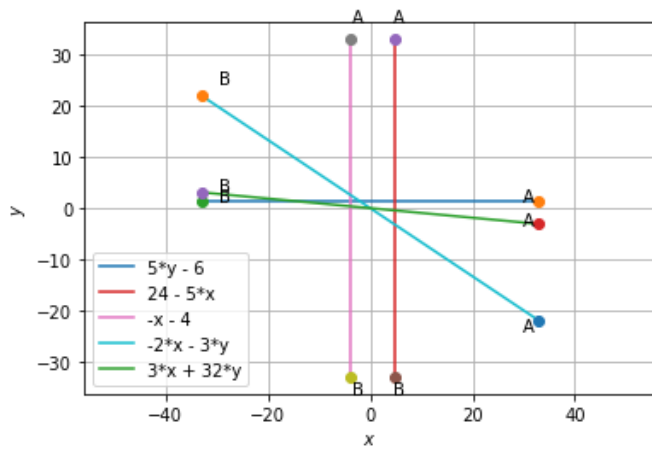


Fig. 3: Plot of line equations