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 Question No. 2.106 - LINEAR FORMS

Find the values of k for which the line

$$\begin{pmatrix} k-3 & -\left(4-k^2\right) \end{pmatrix}\mathbf{x} + k^2 - 7k + 6 = 0 \tag{1.0.1}$$

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

2 Solution

Given equation of the line,

$$\begin{pmatrix} k-3 & -\left(4-k^2\right) \end{pmatrix}\mathbf{x} + k^2 - 7k + 6 = 0 \tag{2.0.1}$$

1) Parallel to x-axis
Equation of x-axis is $\begin{pmatrix} 1 & 0 \end{pmatrix}\mathbf{x} = 0$

$$\begin{pmatrix} 1 & 0 \end{pmatrix}\begin{pmatrix} k-3 \\ -(4-k^2) \end{pmatrix} = 0 \tag{2.0.2}$$

$$k - 3 = 0 \tag{2.0.3}$$

$$k = 3 \tag{2.0.4}$$

Substituting $k = 3$ in (2.0.1)
Equation of line is,

$$\begin{pmatrix} 0 & 5 \end{pmatrix}\mathbf{x} = 6 \tag{2.0.5}$$

2) Parallel to y-axis Equation of y-axis is $\begin{pmatrix} 0 & 1 \end{pmatrix}\mathbf{x} = 0$

$$\begin{pmatrix} 0 & 1 \end{pmatrix}\begin{pmatrix} k-3 \\ -(4-k^2) \end{pmatrix} = 0 \tag{2.0.6}$$

$$4 - k^2 = 0 \tag{2.0.7}$$

$$k = \pm 2 \tag{2.0.8}$$

Substituting $k = 2$ in (2.0.1)
Equation of line is,

$$\begin{pmatrix} -1 & 0 \end{pmatrix}\mathbf{x} = 12 \tag{2.0.9}$$

Substituting $k = -2$ in (2.0.1)
Equation of line is,

$$\begin{pmatrix} -5 & 0 \end{pmatrix}\mathbf{x} = -16 \tag{2.0.10}$$

3) passing through origin Equation of line when passing through origin is

$$\mathbf{n}^\top\mathbf{x} = 0 \tag{2.0.11}$$

Hence

$$-k^2 + 7k - 6 = 0 \tag{2.0.12}$$

$$(k-1)(k-6) = 0 \tag{2.0.13}$$

$$k = 1, k = 6 \tag{2.0.14}$$

Substituting $k = 1$ in (2.0.1)

The equation of line is,

$$\begin{pmatrix} -2 & -3 \end{pmatrix}\mathbf{x} = 0 \tag{2.0.15}$$

Substituting $k = 6$ in (2.0.1)

The equation of line is,

$$\begin{pmatrix} 3 & 32 \end{pmatrix}\mathbf{x} = 0 \tag{2.0.16}$$

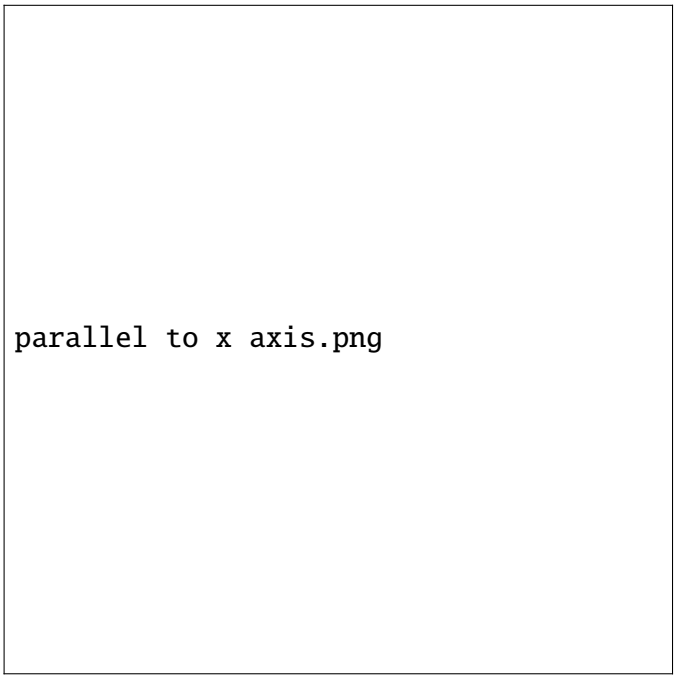

Fig. 3: a) Plot of line parallel to x-axis

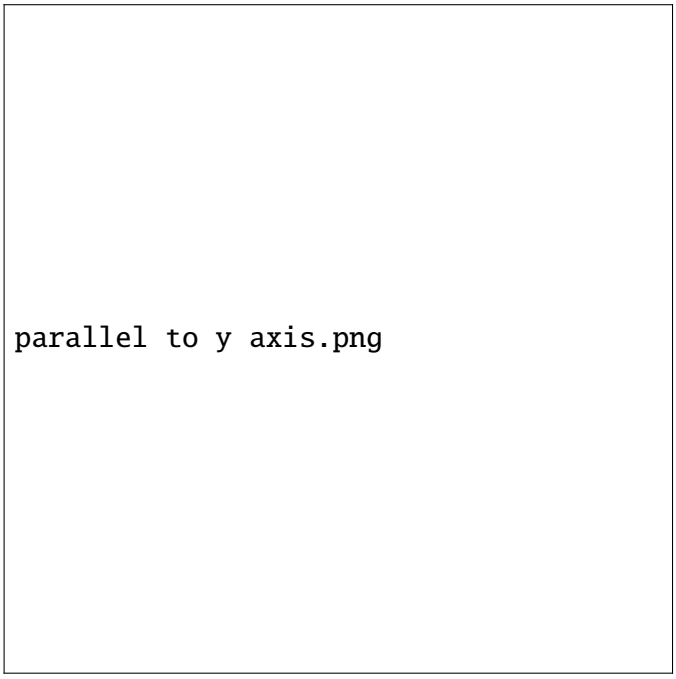

Fig. 3: b) Plot of line parallel to y-axis

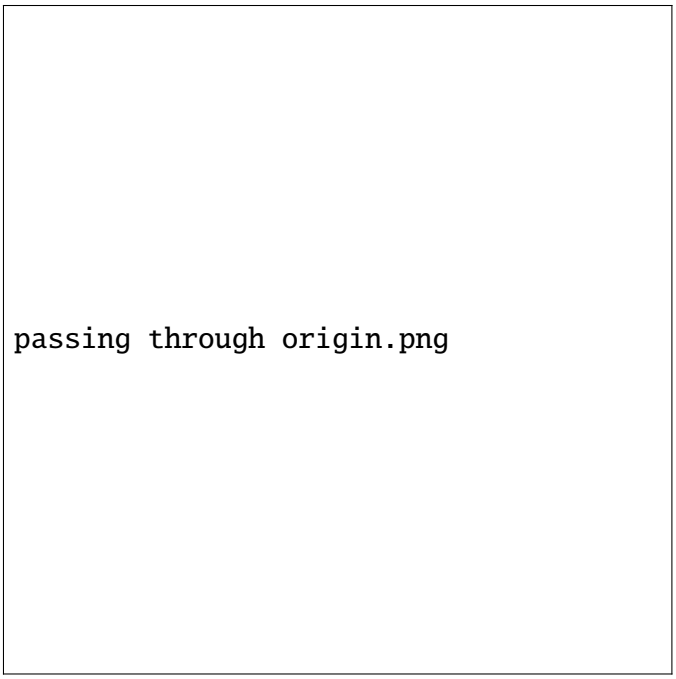

Fig. 3: c) Plot of line passing through origin