Exercise 1

Use matrix multiplication to find:

(i) the image of the vector \((2, 3)\) under rotation through the angle \(-\frac{\pi}{4}\) about the origin.
(ii) the image of the vector \((1, 2, -1)\) under rotation through the angle \(\frac{\pi}{3}\) about z-axis.
(iii) the image of the vector \((1, 2, -1)\) under rotation through the angle \(-\frac{\pi}{3}\) about y-axis.

Exercise 2

Determine which of the following are subspaces of \(\mathbb{R}^3\):

(i) the set of all vectors of the form \((-a, 2a, b)\);
(ii) the set of all vectors of the form \((1, 0, -a)\);
(iii) the set of all vectors of the form \((b, a, -a + b)\).

Exercise 3

(i) Find parametric equations for the line spanned by the vector:

\[ \mathbf{u} = (-1, -2, 1); \]

(ii) Give a system of linear equations that determines the line in (i).