4.7.11

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Question:
Find the distance of the plane 2x - 3y + 4z - 6 = 0 from the origin.

Solution:
We want to find the distance of the plane

$$2x - 3y + 4z - 6 = 0 \tag{1}$$

from the origin using the vector approach.

Step 1: Identify the normal vector.
The general equation of a plane is

$$\left(n\right) \cdot \left(r\right) = D, \tag{2}$$

where

$$\left(n\right) = \begin{pmatrix} A \\ B \\ C \end{pmatrix} \tag{3}$$

is the normal vector of the plane and D is a constant.
From the given plane, we have

$$\left(n\right) = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix} \quad D = 6. \tag{4}$$

Step 2: Distance formula.
The distance of a point r_0 from the plane is given by

$$\text{Distance} = \frac{|n \cdot r_0 - D|}{\|n\|}. \tag{5}$$

For the origin, $r_0 = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$, so

$$\text{Distance} = \frac{|n \cdot r_0 - 6|}{\sqrt{2^2 + (-3)^2 + 4^2}} = \frac{6}{\sqrt{29}}. \tag{6}$$

Answer:

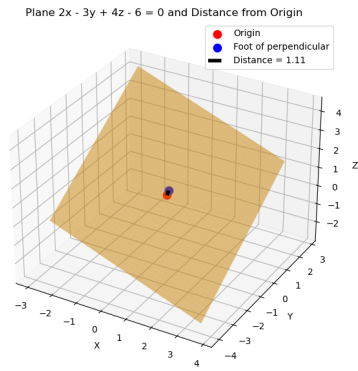$$\boxed{\frac{6}{\sqrt{29}}} \tag{7}$$

Graph presentation:

Fig. 1