4.3.16

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Question:
Find the equation of the plane through the points

$$(2,1,0), \quad (3,-2,-2), \quad (3,1,7).$$

Solution: Given three points:

$$P_1(2,1,0), \quad P_2(3,-2,-2), \quad P_3(3,1,7)$$

The direction vectors are:

$$\left(v\right)_1 = \left(P_2 - P_1\right) = (3-2,\ -2-1,\ -2-0) = (1,-3,-2) \tag{1}$$

$$\left(v\right)_2 = \left(P_3 - P_1\right) = (3-2,\ 1-1,\ 7-0) = (1,0,7) \tag{2}$$

The normal vector to the plane is given by the cross product:

$$\left(n\right) = \left(v\right)_1 \times \left(v\right)_2 \tag{3}$$

$$\left(n\right) = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & -3 & -2 \\ 1 & 0 & 7 \end{vmatrix} \tag{4}$$

$$\left(n\right) = (-21,\ -9,\ 3) = (-7,\ -3,\ 1) \tag{5}$$

Hence, the equation of the plane is:

$$-7(x-2) - 3(y-1) + (z-0) = 0 \tag{6}$$

Simplifying:

$$-7x + 14 - 3y + 3 + z = 0 \tag{7}$$

$$7x + 3y - z - 17 = 0 \tag{8}$$

Final answer:

$$\boxed{7x + 3y - z - 17 = 0}$$

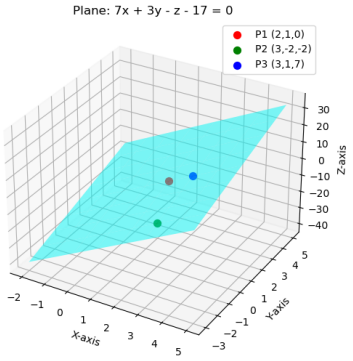

Fig. 1