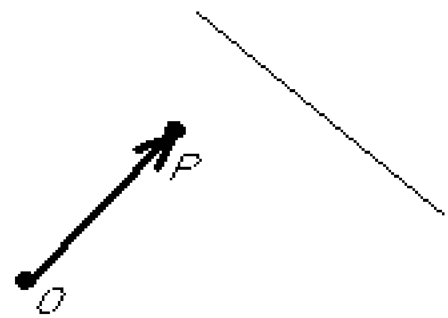
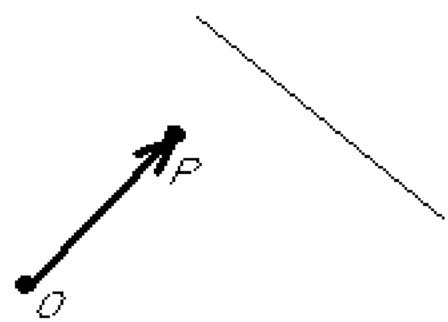
Page 477, #36(b)

1 p477, #36(b), §1 Asked

Asked: The plane through point P_0, (2,-3,2), and the line $6x{+}4y{+}3z{+}5 = 0$, $2x{+}y{+}z{-}2 = 0$.



2 p477, #36(b), §2 Identification



- I need a vector normal to the plane.
- I can get this by crossing two vectors in the plane.
- One such vector is $\vec{n}_1 \times \vec{n}_2$.
- To find another, find *any* point Q on the line, then $r_Q - r_{P_0}$ is in the plane.

3 p477, #36(b), §3 Solution

$$6x + 4y + 3z + 5 = 0 \qquad \Longrightarrow \qquad \vec{n}_1 = (6, 4, 3)$$

$$2x + y + z - 2 = 0 \qquad \Longrightarrow \qquad \vec{n}_2 = (2, 1, 1)$$

$$\vec{s} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 6 & 4 & 3 \\ 2 & 1 & 1 \end{vmatrix} = \begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix}$$

When $x = 0$ on the line,

$$4y + 3z + 5 = 0, \quad y + z - 2 = 0 \qquad \Longrightarrow \qquad x = 0, \quad y = -11, \quad z = 13$$

$$\vec{n} = \begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix} \times \left[\begin{pmatrix} 0 \\ -11 \\ 13 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \\ 2 \end{pmatrix} \right]$$

$$= \begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix} \times \begin{pmatrix} -2 \\ -8 \\ 11 \end{pmatrix} = \begin{pmatrix} -16 \\ -7 \\ -8 \end{pmatrix}$$

$$\begin{pmatrix} 16 \\ 7 \\ 8 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 16 \\ 7 \\ 8 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ -3 \\ 2 \end{pmatrix}$$

$$16x + 7y + 8z = 27$$