

1. Consider the plane $\mathcal{P} : 3x - y + 2z = 7$.

a. Give an example of a nonzero vector \mathbf{n} normal to the plane \mathcal{P} . No explanation is required.

$$\mathbf{n} = \boxed{3} \mathbf{i} + \boxed{-1} \mathbf{j} + \boxed{2} \mathbf{k}$$

b. Give an example of a point P_0 in the plane \mathcal{P} . No explanation is required.

$$P_0 \left(\boxed{1}, \boxed{0}, \boxed{2} \right)$$

c. Give an example of a nonzero vector \mathbf{v} parallel to the plane \mathcal{P} . No explanation is required.

$$\mathbf{v} = \boxed{1} \mathbf{i} + \boxed{3} \mathbf{j} + \boxed{0} \mathbf{k}$$

d. Write inside the box parametric equations of one of the lines lying in the plane \mathcal{P} . No explanation is required. [The box should contain nothing else.]

$$L: \left. \begin{array}{l} x = 1 + t \\ y = 3t \\ z = 2 \end{array} \right\} \\ -\infty < t < \infty$$

e. Find an equation of the plane that passes through the point $(1, 1, 1)$ and contains the line L in Part d. Show all your work.

Let $Ax + By + Cz = D$ be the equation of the plane.

$$(1, 1, 1) \text{ is in the plane} \Rightarrow A + B + C = D \quad (1)$$

$$L \text{ lies in the plane} \Rightarrow A \cdot (1+t) + B \cdot 3t + C \cdot 2 = D \text{ for all } t$$

$$\Rightarrow (2) \quad A + 3B = 0 \quad \text{and} \quad A + 2C = D \quad (3)$$

$$\left. \begin{array}{l} (2) \Rightarrow A = -3B \\ (1) \text{ and } (3) \Rightarrow C = B \end{array} \right\} \text{ and } (1) \Rightarrow D = -B$$

Taking $B = -1$ gives the equation: $3x - y - z = 1$