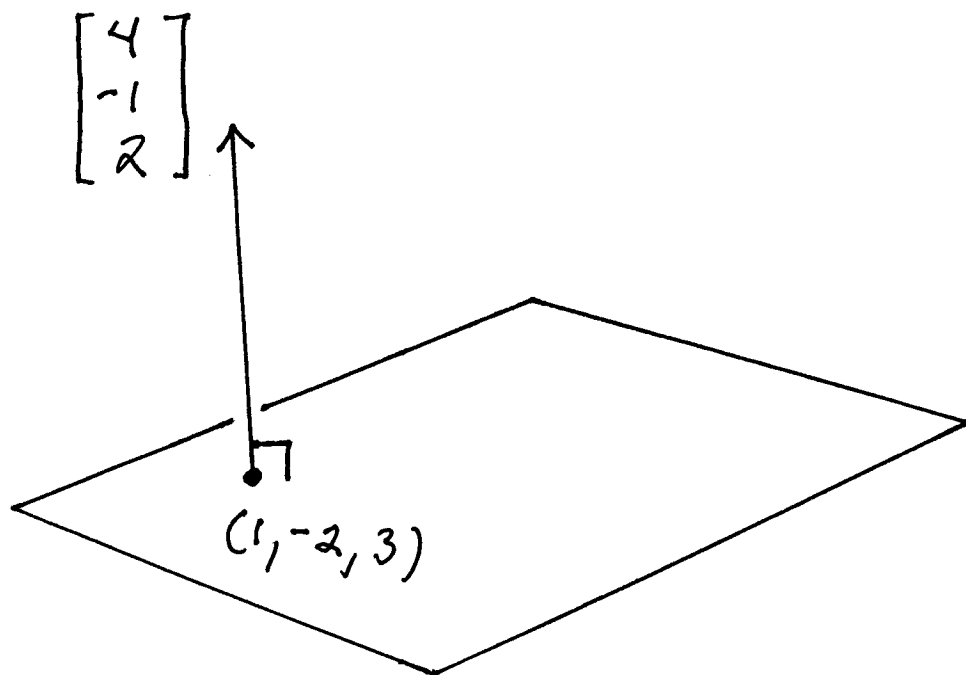


Creating An Equation for a Plane in $\mathbb{R}^3$

Example: Find an equation for the plane passing through the point $(1, -2, 3)$ and having normal ($\perp$) vector

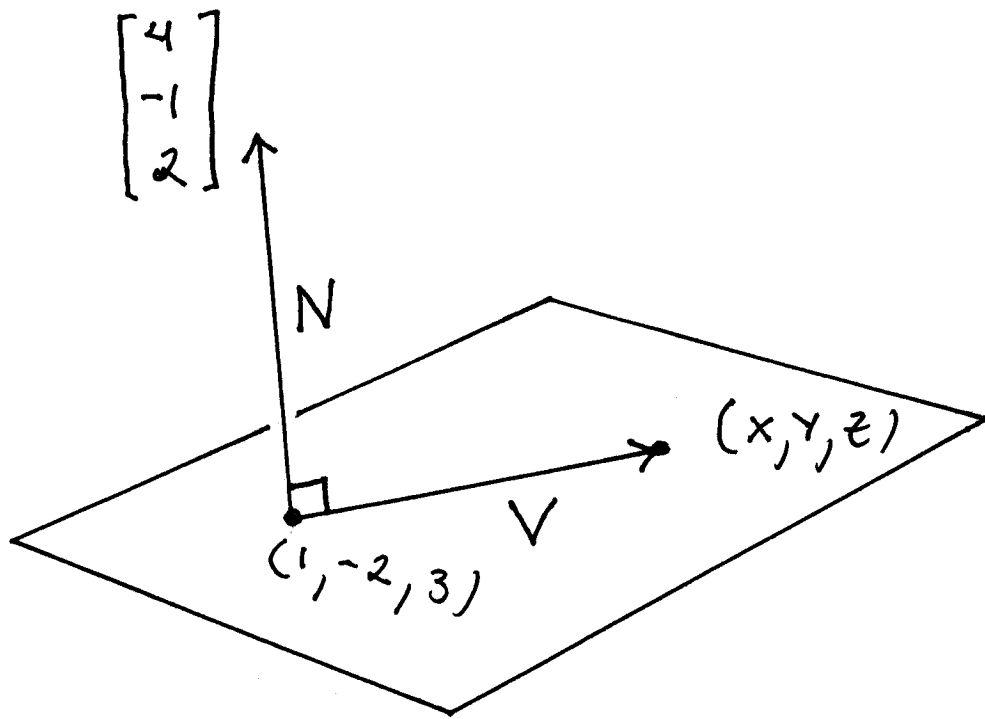
$$N = \begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix} :$$



Start by letting (x, y, z) be a random variable point on the plane. Now form vector V from point $(1, -2, 3)$ to point (x, y, z) :

$$V = \begin{bmatrix} x-1 \\ y-(-2) \\ z-3 \end{bmatrix} = \begin{bmatrix} x-1 \\ y+2 \\ z-3 \end{bmatrix}. \quad \text{Clearly,}$$

$N \perp V$ so $N \cdot V = 0$, i.e.,



$$\begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix} \cdot \begin{bmatrix} x-1 \\ y+2 \\ z-3 \end{bmatrix} = 0 \quad \longrightarrow \quad \text{equation of plane is}$$

$$4(x-1) - (y+2) + 2(z-3) = 0$$