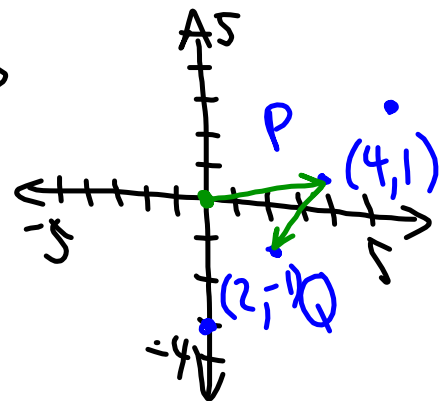


① Plot points in \mathbb{R}^2 corresponding to $\vec{x} = \begin{bmatrix} 4 \\ 1 \end{bmatrix} + t \begin{bmatrix} -2 \\ -2 \end{bmatrix}$. What do they represent, geometrically?

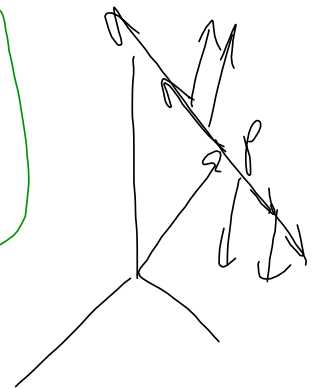
$(4, 1)$



② Give the equation of the line in \mathbb{R}^3 through $P(1, -5, 2)$ and $Q(4, 3, -1)$.

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \vec{X} = \begin{bmatrix} 1 \\ -5 \\ 2 \end{bmatrix} + t \begin{bmatrix} 3 \\ 8 \\ -3 \end{bmatrix} + s \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$$

\vec{OP} \vec{PQ}



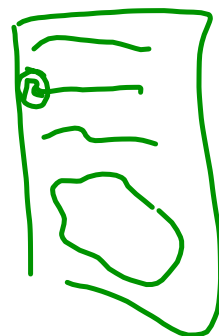
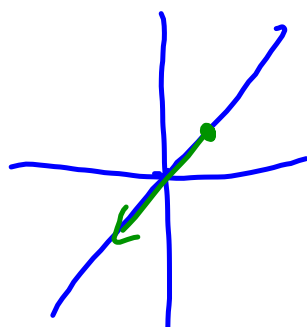
③ Repeat ① for $\vec{x} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} + t \begin{bmatrix} -2 \\ -2 \end{bmatrix}$

$$t = \frac{1}{2} \rightarrow (0, 0)$$

$$t = 0 \rightarrow (1, 1)$$

$$t = 1 \rightarrow (-1, -1)$$

$$t = 2 \rightarrow (-3, -3)$$



$$\begin{array}{cccccc|c}
 x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & \\
 \hline
 1 & 6 & -1 & 0 & 2 & -4 & 1 \\
 0 & 0 & 0 & 1 & -4 & 1 & 3 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0
 \end{array}$$

$$\begin{aligned}
 x_4 - 4x_5 + x_6 &= 3 \\
 x_4 &= 3 + 4s - t
 \end{aligned}$$

$$\begin{aligned}
 x_1 &= 1 - 6r + r - 2s + 4t \\
 x_2 &= 9 \\
 x_3 &= 7 \\
 x_4 &= 3 + 4s - t \\
 x_5 &= s \\
 x_6 &= t
 \end{aligned}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} \xrightarrow{X} = \begin{bmatrix} 1 \\ 0 \\ 3 \\ 0 \\ 0 \\ 0 \end{bmatrix} + 9 \begin{bmatrix} -6 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + r \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + s \begin{bmatrix} -2 \\ 0 \\ 4 \\ 0 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} 4 \\ 0 \\ 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$