

Def. The vector form of the equation of a line  $l$  in  $\mathbb{R}^2$  or  $\mathbb{R}^3$  is

$x = p + td$ , where  $p \in l$ ,  
 $d \neq 0$  is a direction vector  
for  $l$ .

ex. Find vector and parametric equations of the line in  $\mathbb{R}^3$  through the point  $P = (1, 2, -1)$  parallel to the vector  $d = \begin{bmatrix} 5 \\ -1 \\ 3 \end{bmatrix}$

Ans. 
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} + t \begin{bmatrix} 5 \\ -1 \\ 3 \end{bmatrix}$$
$$x = 1 + 5t$$
$$y = 2 - t$$