

SECTION 2.5  
NUMBER 11c

2.5.11c Find parametric equations in  $\mathbb{R}^3$  for the line through the points  $(2, 0, 4)$  and  $(-1, 5, -8)$ .

Solution

We need a direction vector  $\vec{d}$  and a translation vector  $\vec{a}$ . For  $\vec{d}$  let's take the vector from  $(2, 0, 4)$  to  $(-1, 5, -8)$ , so  $\vec{d} = [-1-2, 5-0, -8-4] = [-3, 5, -12]$ .

For  $\vec{a}$  let's take the vector from  $(0, 0, 0)$  to  $(2, 0, 4)$ , so  $\vec{a} = [2-0, 0-0, 4-0] = [2, 0, 4]$ .

Hence, the line is

$$\vec{x} = t \vec{d} + \vec{a} = t \begin{bmatrix} -3 \\ 5 \\ -12 \end{bmatrix} + \begin{bmatrix} 2 \\ 0 \\ 4 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} :$$

OR, in terms of components

$$\begin{array}{l} x_1 = -3t + 2 \\ x_2 = 5t \\ x_3 = -12t + 4 \end{array} \quad \text{where } t \in \mathbb{R}.$$

□