

# 1.2.11

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Q. Find the slope of the lines

- 1) Passing through the points  $(3, -2)$  and  $(-1, 4)$ .
- 2) Passing through the points  $(3, -2)$  and  $(7, -2)$ .
- 3) Passing through the points  $(3, -2)$  and  $(3, 4)$ .
- 4) Making an inclination of  $60^\circ$  with the positive direction of the  $x$ -axis.

**Solution.**

We will use direction ratios. For two points  $P(x_1, y_1)$  and  $Q(x_2, y_2)$ , a direction vector (column matrix) is

$$\mathbf{d} = \begin{pmatrix} x_2 - x_1 \\ y_2 - y_1 \end{pmatrix} = \begin{pmatrix} l \\ m \end{pmatrix},$$

so the direction ratios are  $(l, m)$  and the slope is

$$\frac{m}{l} \quad (l \neq 0).$$

- 1)  $P(3, -2)$ ,  $Q(-1, 4)$ .

$$\mathbf{d} = \begin{pmatrix} -1 - 3 \\ 4 - (-2) \end{pmatrix} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}.$$

Direction ratios  $(l, m) = (-4, 6)$ . Thus the slope is

$$m = \frac{6}{-4} = -\frac{3}{2}.$$

- 2)  $P(3, -2)$ ,  $Q(7, -2)$ .

$$\mathbf{d} = \begin{pmatrix} 7 - 3 \\ -2 - (-2) \end{pmatrix} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}.$$

Direction ratios  $(l, m) = (4, 0)$ . Slope  $= \frac{0}{4} = 0$ . (horizontal line)

- 3)  $P(3, -2)$ ,  $Q(3, 4)$ .

$$\mathbf{d} = \begin{pmatrix} 3 - 3 \\ 4 - (-2) \end{pmatrix} = \begin{pmatrix} 0 \\ 6 \end{pmatrix}.$$

Direction ratios  $(l, m) = (0, 6)$ . Here  $l = 0$ , so the slope is undefined (vertical line).

- 4) Line making inclination  $\theta = 60^\circ$  with positive  $x$ -axis.

A unit direction vector for angle  $\theta$  is  $\begin{pmatrix} \cos \theta \\ \sin \theta \end{pmatrix}$ . Thus direction ratios may be taken as

$$\begin{pmatrix} l \\ m \end{pmatrix} = \begin{pmatrix} \cos 60^\circ \\ \sin 60^\circ \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \\ \frac{\sqrt{3}}{2} \end{pmatrix},$$

so the slope is

$$m = \frac{\sin 60^\circ}{\cos 60^\circ} = \tan 60^\circ = \sqrt{3}.$$