Example 6

Find the values of the scalars p and q if:

$$p\mathbf{i} + q\mathbf{j} = 3(2\mathbf{i} - \mathbf{j}) + 4\mathbf{i} + \mathbf{j}$$
$$p\mathbf{i} + q\mathbf{j} = 6\mathbf{i} - 3\mathbf{j} + 4\mathbf{i} + \mathbf{j}$$
$$= 10\mathbf{i} - 2\mathbf{j}$$

Equating the **i** and **j** components:

$$p = 10$$
$$q = -2$$

2.7 Parallel vectors

Vectors **a** and **b** are parallel if:

$k\mathbf{a} = \mathbf{b}$ where k is a constant.

In other words, if you can multiply one vector by a constant to get the other vector, then those vectors are parallel.

Example 7

Vectors

$$\mathbf{a} = 2\mathbf{i} + \mathbf{j}$$
$$\mathbf{b} = 4\mathbf{i} + 2\mathbf{j}$$
$$\mathbf{c} = 6\mathbf{i} + 3\mathbf{j} \qquad \text{are all parallel.}$$

2.8 Finding a unit vector parallel to a given vector

Example 8

Find the unit vector which is parallel to the vector $5\mathbf{i} + 12\mathbf{j}$.

The vector $5\mathbf{i} + 12\mathbf{j}$ has magnitude $\sqrt{5^2 + 12^2} = 13$ units.

So the vector $\dfrac{5\mathbf{j} + 12\mathbf{j}}{13}$ will be parallel to $5\mathbf{i} + 12\mathbf{j}$ and will be of unit length.

(A 'unit vector' is a vector of length 1 unit.)

2.9 Obtaining a vector given its magnitude and direction

Example 9

The vector **v** has magnitude 20 and is in the direction of the vector $3\mathbf{i} + 4\mathbf{j}$. Find **v** in the form $p\mathbf{i} + q\mathbf{j}$.

The vector $3\mathbf{i} + 4\mathbf{j}$ has magnitude $\sqrt{3^2 + 4^2} = 5$ units.

So the vector $\dfrac{3\mathbf{i} + 4\mathbf{j}}{5}$ is a *unit* vector parallel to $3\mathbf{i} + 4\mathbf{j}$.