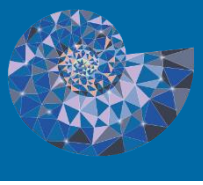
Magnitude and direction



Gold

Two forces F_1 and F_2 are given by the vectors $F_1 = (p\mathbf{i} + 5\mathbf{j})$ N and $F_2 = (3\mathbf{i} + q\mathbf{j})$ N. The resultant force, $R = F_1 + F_2$ acts in a direction which is parallel to the vector $2\mathbf{i} - 5\mathbf{j}$.

a Find the angle, to 2 decimal places, between R and the vector $2\mathbf{i}$.

b Show that $5p + 2q = -25$.

c Given that $p = -3$, find, to 2 decimal places, the magnitude of R.

Silver

For some positive constant p, the vector:

$$\frac{1}{2}\mathbf{i} + p\mathbf{j}$$

is a unit vector in a direction parallel to $-3q\mathbf{i} + 2\mathbf{j}$. Find the values of p and q.

Bronze

The vectors:

$$-3\mathbf{a} + 4k\mathbf{b} \text{ and } 7\mathbf{a} + \mathbf{b}$$

are parallel. Find the value of k.