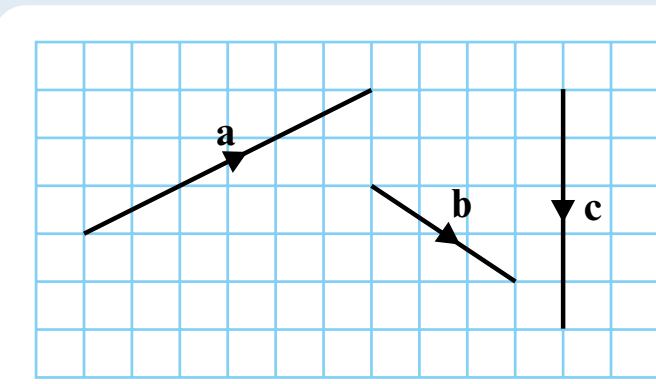


Chapter 11 – Vectors

Example 1 – Adding vectors

The diagram shows vectors \mathbf{a} , \mathbf{b} and \mathbf{c} .

Draw a diagram to illustrate the vector addition $\mathbf{a} + \mathbf{b} + \mathbf{c}$.

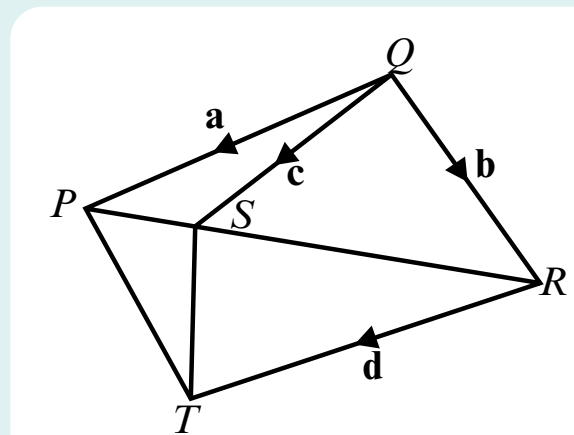


Example 2 – Adding vectors

In the diagram, $\vec{QP} = \mathbf{a}$, $\vec{QR} = \mathbf{b}$, $\vec{QS} = \mathbf{c}$ and $\vec{RT} = \mathbf{d}$

Find in terms of \mathbf{a} , \mathbf{b} , \mathbf{c} and \mathbf{d} :

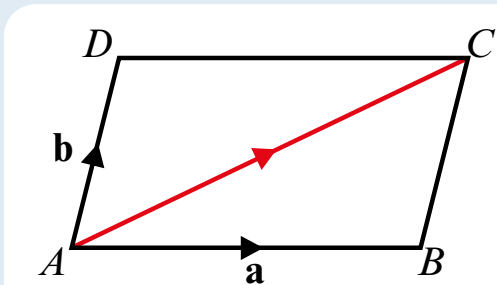
- \vec{PS}
- \vec{RP}
- \vec{PT}
- \vec{TS}



Example 3 – Parallelograms and vectors

$ABCD$ is a parallelogram.

$\vec{AB} = \mathbf{a}$, $\vec{AD} = \mathbf{b}$. Find \vec{AC} .



Example 4 – proving vectors are parallel

Show that the vectors $6\mathbf{a} + 8\mathbf{b}$ and $9\mathbf{a} + 12\mathbf{b}$ are parallel.

Example 5 – Midpoints and vectors

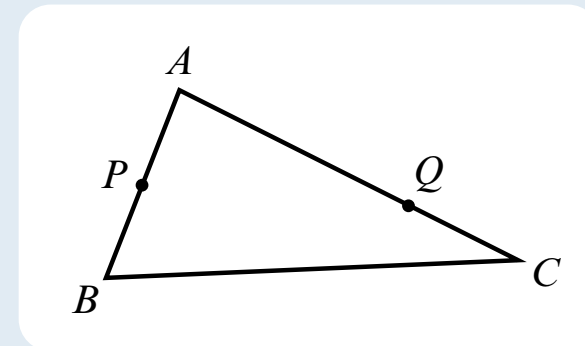
In triangle ABC , $\vec{AB} = \mathbf{a}$ and $\vec{AC} = \mathbf{b}$.

P is the midpoint of AB .

Q divides AC in the ratio 3 : 2.

Write in terms of \mathbf{a} and \mathbf{b} :

- \vec{BC}
- \vec{AP}
- \vec{AQ}
- \vec{PQ}



Example 6 – Adding and subtracting vectors in column form

$\mathbf{a} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

Find **a.** $\frac{1}{3}\mathbf{a}$ **b.** $\mathbf{a} + \mathbf{b}$ **c.** $2\mathbf{a} - 3\mathbf{b}$

Example 7 – Adding and subtracting vectors in component form

$\mathbf{a} = 3\mathbf{i} - 4\mathbf{j}$, $\mathbf{b} = 2\mathbf{i} + 7\mathbf{j}$

Find **a.** $\frac{1}{2}\mathbf{a}$ **b.** $\mathbf{a} + \mathbf{b}$ **c.** $3\mathbf{a} - 2\mathbf{b}$

Example 8 – Representing vectors

- Draw a diagram to represent the vector $-3\mathbf{i} + \mathbf{j}$
- Write this as a column vector.

Example 9 – Adding vectors in column form

Given that $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j}$, $\mathbf{b} = 12\mathbf{i} - 10\mathbf{j}$ and $\mathbf{c} = -3\mathbf{i} + 9\mathbf{j}$, find $\mathbf{a} + \mathbf{b} + \mathbf{c}$, using column vector notation in your working.

Example 10 – Adding vectors in component form

Given $\mathbf{a} = 5\mathbf{i} + 2\mathbf{j}$ and $\mathbf{b} = 3\mathbf{i} - 4\mathbf{j}$, find $2\mathbf{a} - \mathbf{b}$ in terms of \mathbf{i} and \mathbf{j} .

Example 11 – Vector magnitude

Given that $\mathbf{a} = 3\mathbf{i} + 4\mathbf{j}$ and $\mathbf{b} = -2\mathbf{i} - 4\mathbf{j}$:

- find $|\mathbf{a}|$
- find a unit vector in the direction of \mathbf{a}
- find the exact value of $|2\mathbf{a} + \mathbf{b}|$

Example 12 – Vector direction

Find the angle between the vector $4\mathbf{i} + 5\mathbf{j}$ and the positive x -axis.

Example 13 – Vector direction

Vector \mathbf{a} has magnitude 10 and makes an angle of 30° with \mathbf{j} .

Find \mathbf{a} in \mathbf{i} , \mathbf{j} and column vector format.

