

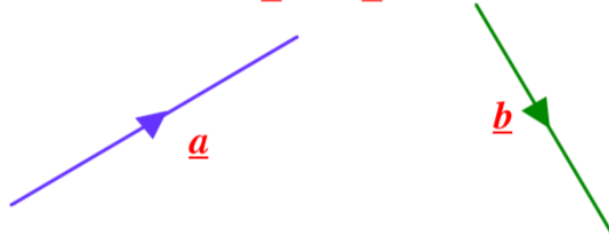
Now Revise

Routine – Non Calculator

Vectors

Applications 1.2

1 Sketch the vectors \underline{a} and \underline{b} .



- (a) Sketch the vector $\underline{a} + \underline{b}$.
- (b) Now sketch and label vector $\underline{a} - \underline{b}$.
- (c) Sketch the vector $\underline{b} - \underline{a}$.
- (d) Sketch the vector $-\underline{2a}$.
- (e) Sketch $\underline{3b} - \underline{2a}$.

2 Given $\underline{p} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$ and $\underline{q} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$, find :-

- (a) $\underline{p} + \underline{q}$
- (b) $\underline{q} - \underline{p}$
- (c) $\underline{3p}$
- (d) $-\underline{2q}$
- (e) $\underline{2p} + \underline{3q}$
- (f) $\underline{4q} - \underline{2p}$.

3 Solve these **vector equations** for vector \underline{x} :-

- (a) $\underline{x} + \begin{pmatrix} 3 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$
- (b) $\underline{x} - \begin{pmatrix} 1 \\ 6 \end{pmatrix} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$
- (c) $\underline{2x} = \begin{pmatrix} 12 \\ -4 \end{pmatrix}$
- (d) $\underline{7x} = \begin{pmatrix} -14 \\ 35 \end{pmatrix}$
- (e) $\underline{4x} - \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 6 \\ 11 \end{pmatrix}$
- (f) $\underline{5x} - \begin{pmatrix} 1 \\ 4 \end{pmatrix} = \underline{2x} + \begin{pmatrix} -7 \\ -1 \end{pmatrix}$

4

The coordinates of 4 points are :-

A(2, -3), B(8, 1), C(12, 1) and D(0, -7).

- Write the vectors \overrightarrow{AB} and \overrightarrow{CD} in component form.
- What does this tell you about the two lines AB and CD ?

5

M is the point (-2, 7) and N is (3, -5).

Calculate $|\overrightarrow{MN}|$, the magnitude of MN.

6

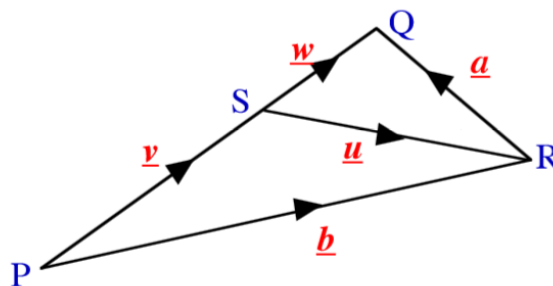
Given that $\underline{v} = \begin{pmatrix} 2 \\ -4 \\ 4 \end{pmatrix}$ and $\underline{w} = \begin{pmatrix} -4 \\ 3 \\ 12 \end{pmatrix}$, find :-

- $\underline{v} + \underline{w}$
- $\underline{v} - \underline{w}$
- $-2\underline{v}$
- $|\underline{v}|$
- $|\underline{w}|$
- Does $|\underline{v}| + |\underline{w}| = |\underline{v} + \underline{w}|$? Explain.

7

In the figure below, the directed line segments represent vectors as shown. For example

the line segment \overrightarrow{PR} is represented by vector \underline{b} .



What line segment is represented by :-

- vector $\underline{b} - \underline{u}$
- vector $\underline{w} - \underline{a}$
- vector $\underline{v} + \underline{u} - \underline{b}$
- vector $\underline{b} + \underline{a} - \underline{v} - \underline{w}$?

8Solve these **vector equations** for vector \underline{x} :-

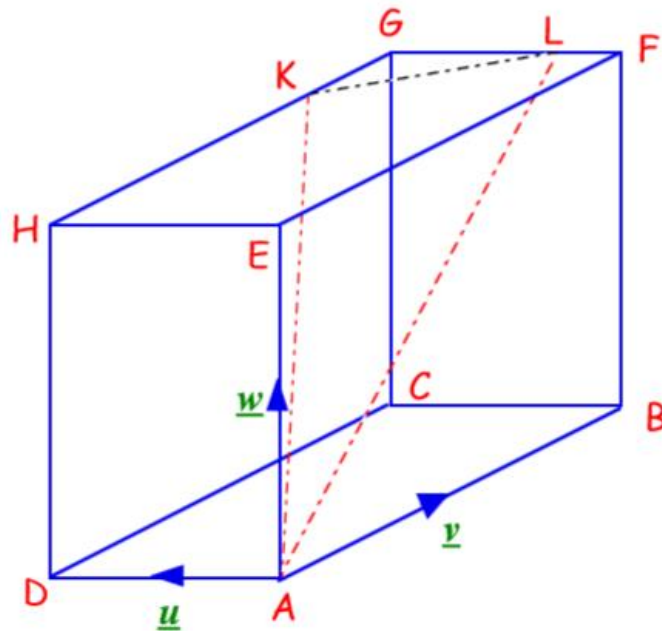
$$(a) \underline{x} + \begin{pmatrix} 1 \\ -2 \\ -1 \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \\ -1 \end{pmatrix} \quad (b) \quad 2\underline{x} - \begin{pmatrix} -3 \\ 7 \\ -5 \end{pmatrix} = \begin{pmatrix} 11 \\ -9 \\ 17 \end{pmatrix}.$$

9

ABCDHEFG is a cuboid.

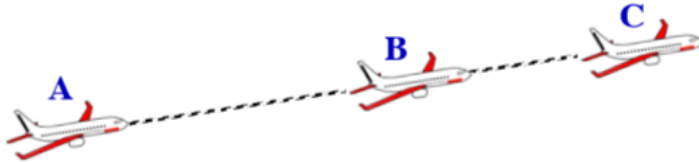
K lies **two thirds** of the way along HG.L lies **one quarter** of the way along FG.

$$\overrightarrow{AD} = \underline{u}, \quad \overrightarrow{AB} = \underline{v} \quad \text{and} \quad \overrightarrow{AE} = \underline{w}.$$

Find, in terms of \underline{u} , \underline{v} and \underline{w} , the vector :-

- (a) \overrightarrow{FG} (b) \overrightarrow{HG} (c) \overrightarrow{LG}
 (d) \overrightarrow{GK} (e) \overrightarrow{AL} (f) \overrightarrow{AK} .

10



An aircraft flying at a constant speed on a straight flight path takes 2 minutes to fly from A to B and one minute from B to C. Relative to a suitable set of axes, A is the point $(-1, 3, 4)$ and B is $(3, 1, -2)$. Find the coordinates of point C.

11

Shown is the cuboid **ABCDEFGH**. Sketch it.



$$\overline{DA} = \underline{u}, \quad \overline{DC} = \underline{v} \quad \text{and} \quad \overline{DE} = \underline{w}.$$

Find, in terms of \underline{u} , \underline{v} and \underline{w} , the vector :-

(a) \overline{EF} (b) \overline{AB} (c) \overline{DF}

(d) \overline{DH} (e) \overline{AG} (f) \overline{DG}

On your sketch, show the point **R**, the mid-point of **AB**, the point **S**, the middle of face **ABGF** and **X** at the very centre of the cuboid.

(g) \overline{AR} (h) \overline{DR} (i) \overline{AS}

(j) \overline{DS} (k) \overline{DX} (l) \overline{HX} .