

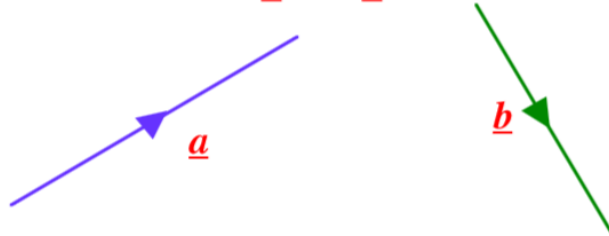
# Now Revise

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**

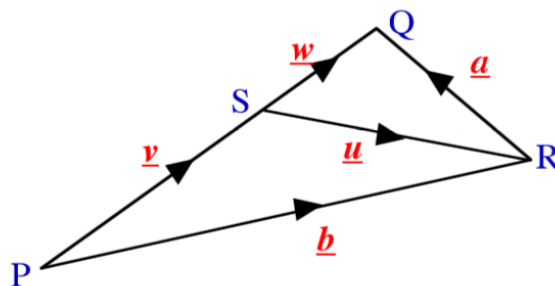
Given that  $\underline{v} = \begin{pmatrix} 2 \\ -4 \\ 4 \end{pmatrix}$  and  $\underline{w} = \begin{pmatrix} -4 \\ 3 \\ 12 \end{pmatrix}$ , find :-

- $\underline{v} + \underline{w}$
- $\underline{v} - \underline{w}$
- $-2\underline{v}$
- $|\underline{v}|$
- $|\underline{w}|$
- 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  $\underline{b} + \underline{a} - \underline{v} - \underline{w}$  ?

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

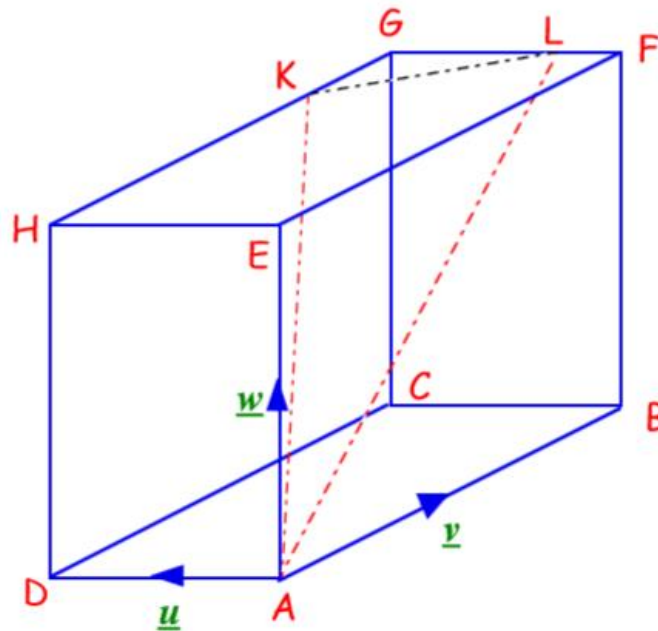
$$(a) \underline{x} + \begin{pmatrix} 1 \\ -2 \\ -1 \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \\ -1 \end{pmatrix} \quad (b) \quad 2\underline{x} - \begin{pmatrix} -3 \\ 7 \\ -5 \end{pmatrix} = \begin{pmatrix} 11 \\ -9 \\ 17 \end{pmatrix}.$$

**9**

ABCDHEFG is a cuboid.

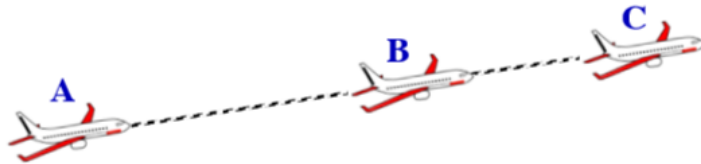
K lies **two thirds** of the way along HG.L lies **one quarter** of the way along FG.

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

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)  $\overline{HX}$ .