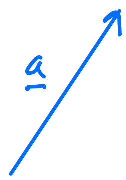
Vectors

A vector quantity has both magnitude and direction

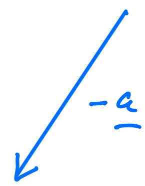
A scalar quantity has only magnitude

Vectors	Force, velocity, acceleration displacement
Scalars	Mass, speed, distance

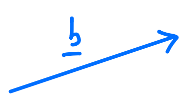
Vectors do have position except that we often have position vectors relative to an orgin



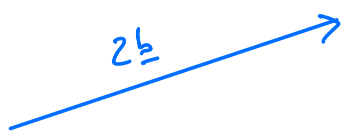
$\underline{a} \begin{pmatrix} 2 \\ 3 \end{pmatrix}$



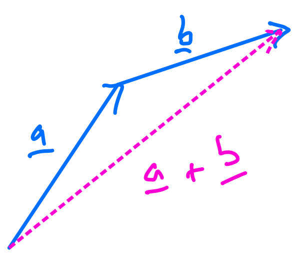
$-\underline{a} = \begin{pmatrix} -2 \\ -3 \end{pmatrix}$



$= \begin{pmatrix} 1 \\ 3 \end{pmatrix}$

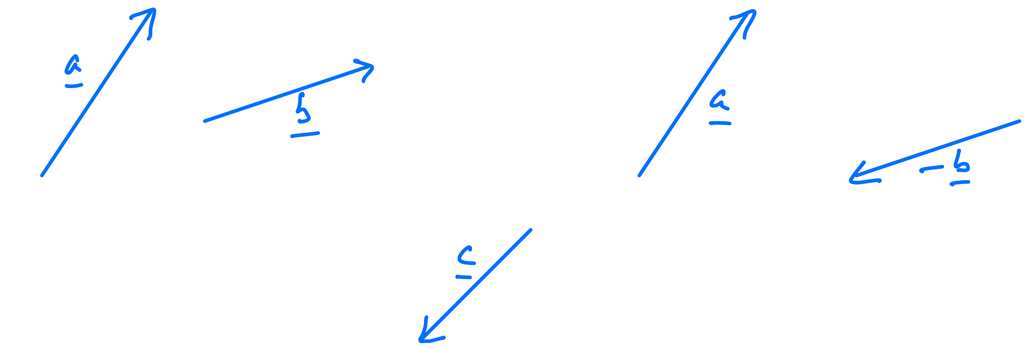


$= 2\begin{pmatrix} 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$



$\underline{a} + \underline{b} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$

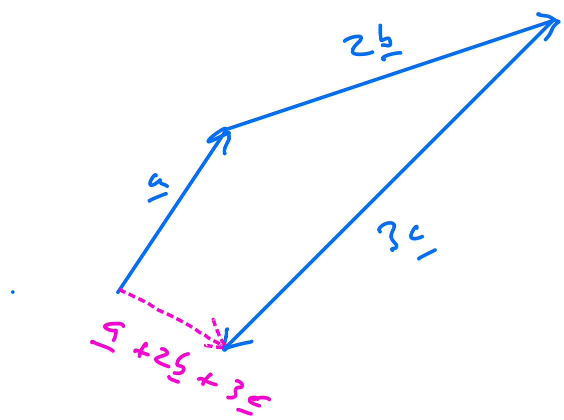
triangle rule, parallelogram rule, nose to tail rule

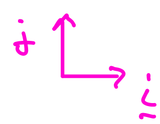


Find $\underline{a} + 2\underline{b} + 3\underline{c}$

$$\begin{pmatrix} 2 \\ 3 \end{pmatrix} + 2\begin{pmatrix} 3 \\ 1 \end{pmatrix} + 3\begin{pmatrix} -2 \\ -2 \end{pmatrix}$$

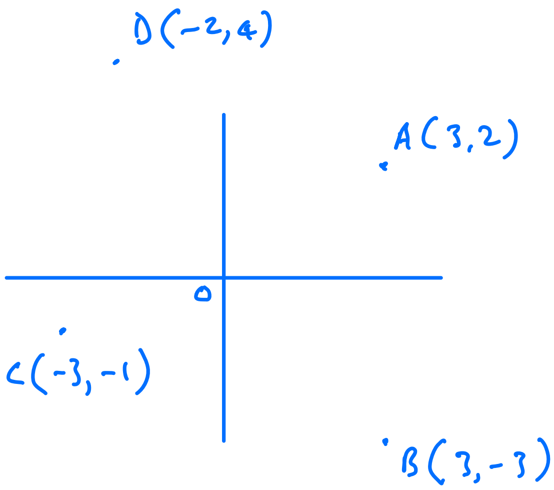
$$= \begin{pmatrix} 2 + 6 - 6 \\ 3 + 2 - 6 \end{pmatrix} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$





A unit vector in the x-direction is normally called $\underline{i}$

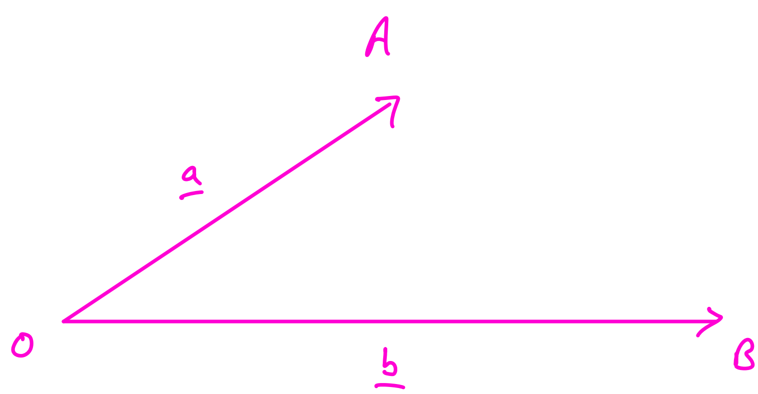
A unit vector in the y-direction is normally called $\underline{j}$



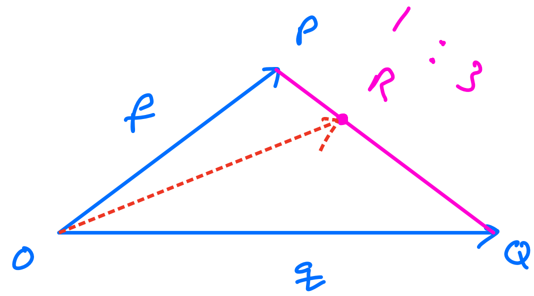
$\overrightarrow{OA} = \begin{pmatrix}3\\2\end{pmatrix}$ $\overrightarrow{OB} = \begin{pmatrix}3\\-3\end{pmatrix}$ $\overrightarrow{OC} = \begin{pmatrix}-3\\-1\end{pmatrix}$ $\overrightarrow{OD} = \begin{pmatrix}-2\\4\end{pmatrix}$

We say A has position vector $\begin{pmatrix}3\\2\end{pmatrix}$

We say the point (x, y) has position vector $\begin{pmatrix}x\\y\end{pmatrix}$



$$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$$
$$= -a + \underline{b} \qquad \text{or} \qquad \underline{b} - \underline{a}$$



Suppose R splits PQ in ratio 1 : 3

Find $\overrightarrow{OR}$

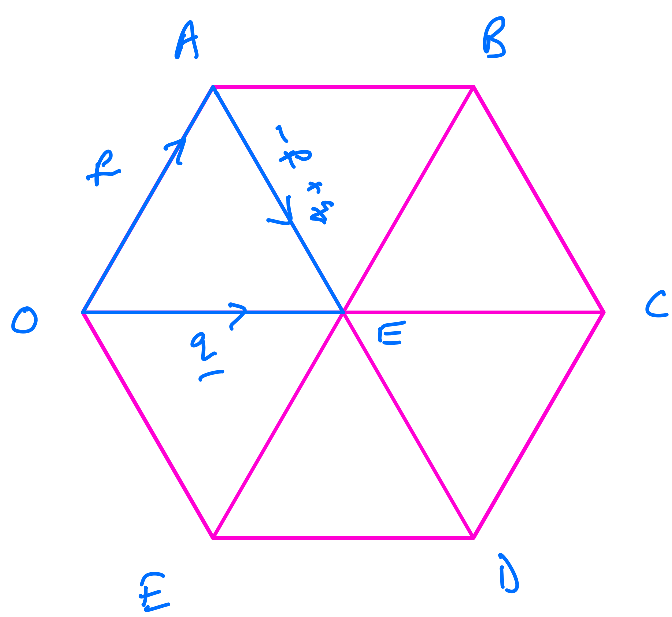
$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$

$= -\underline{p} + \underline{q}$

$\overrightarrow{PR} = \frac{1}{4}\overrightarrow{PQ} = \frac{1}{4}(-\underline{p} + \underline{q}) = -\frac{1}{4}\underline{p} + \frac{1}{4}\underline{q}$

$\overrightarrow{OR} = \overrightarrow{OP} + \overrightarrow{PR}$

$= \underline{p} - \frac{1}{4}\underline{p} + \frac{1}{4}\underline{q} \qquad = \underline{\frac{3}{4}\underline{p} + \frac{1}{4}\underline{q}}$



$\overrightarrow{AE} = \overrightarrow{AO} + \overrightarrow{OE}$

$= -\underline{p} + \underline{q}$

$\overrightarrow{OD} = \overrightarrow{OA} + \overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD}$

$= \underline{p} + \underline{q} - \underline{p} + \underline{q} - \underline{p} = 2\underline{q} - \underline{p}$

$$\overrightarrow{OD} = \overrightarrow{OE} + \overrightarrow{ED}$$

$$= -\underset{\sim}{p} + \underset{\sim}{q} + \underset{\sim}{q} = 2\underset{\sim}{q} - \underset{\sim}{p}$$

$\overrightarrow{OD}$ is independent of the actual route taken from O to D

Homework Read Chapter 11 Pages 230 – 240

without actually doing any exercises
