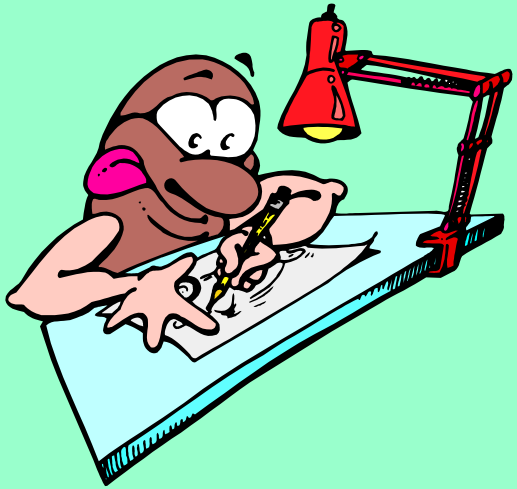
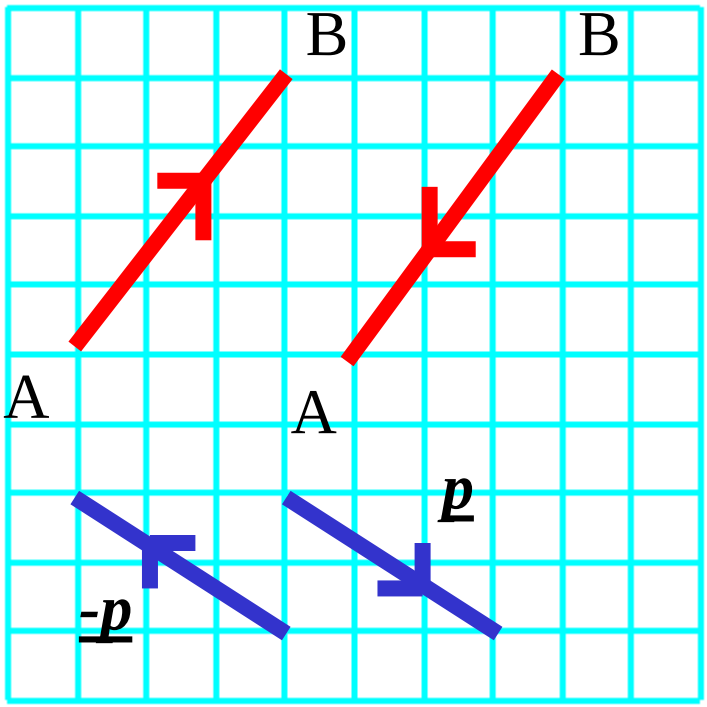


2. Subtraction of vectors

The negative of a vector



In component form:

$$\overrightarrow{AB} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

What happens if we change the direction of the line segment, so that it goes from B to A?

$$\overrightarrow{BA} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

so $\overrightarrow{BA} = -\overrightarrow{AB}$

What will the components of $-\underline{p}$ be?

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

Change the sign of each component

Heinemann, p.236, EX 13D, Q2

The zero vector

Look at what happens if we add a vector and its negative:

$$\overrightarrow{AB} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \qquad \overrightarrow{BA} = -\overrightarrow{AB} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

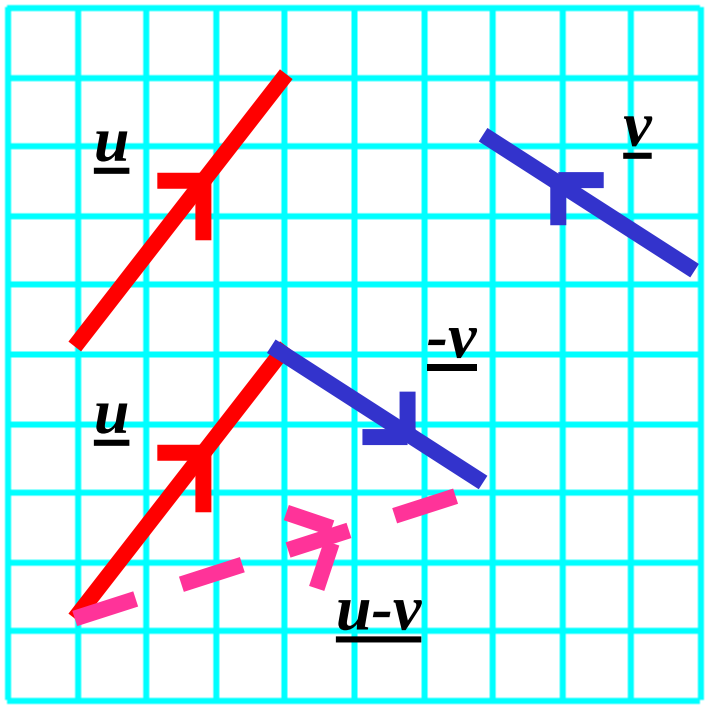
$$\Rightarrow \overrightarrow{AB} + (-\overrightarrow{AB}) = \begin{pmatrix} 3+(-3) \\ 4+(-4) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

The ZERO VECTOR

$$\underline{p} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} \quad \Rightarrow -\underline{p} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

$$\Rightarrow \underline{p} + (-\underline{p}) = \begin{pmatrix} 3+(-3) \\ -2+2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

Subtracting vectors



To find $\underline{u - v}$:

We must "add the negative" as finding the results of vector additions requires them to be "nose to tail".

$$\underline{u} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \quad \underline{v} = \begin{pmatrix} -3 \\ 2 \end{pmatrix} \Rightarrow -\underline{v} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

Subtract corresponding components

$$\underline{u} - \underline{v} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} = \begin{pmatrix} 3-(-3) \\ 4-2 \end{pmatrix}$$

$$(\underline{u} + (-\underline{v})) = \begin{pmatrix} 3+3 \\ 4+(-2) \end{pmatrix}$$

Heinemann, p.236, EX 13D, Q3 & 4