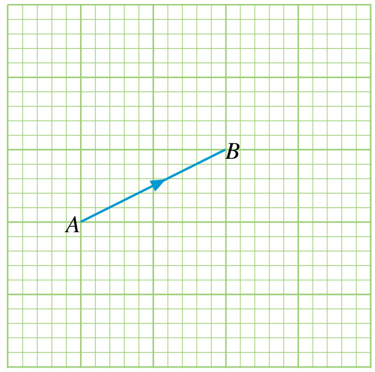
Brainworks

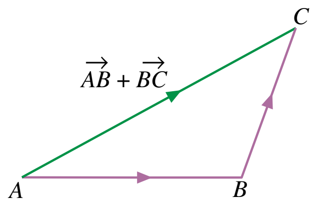
7. The diagram shows a vector $\overrightarrow{AB}$.
   (a) Draw a vector $\overrightarrow{CD}$ which is equal to $\overrightarrow{AB}$.
   (b) Draw a vector $\overrightarrow{EF}$ such that $|\overrightarrow{EF}| = |\overrightarrow{AB}|$, but $\overrightarrow{EF} \neq \overrightarrow{AB}$.
   (c) Draw a vector $\overrightarrow{GH}$ such that $|\overrightarrow{GH}| \neq |\overrightarrow{AB}|$, but $\overrightarrow{GH}$ and $\overrightarrow{AB}$ are in the same direction.



4.2 Operations On Vectors

A. Addition

If an object is translated from A to B, and then from B to C, the combined effect is a translation from A to C. Therefore, we refer to the combined effect as the addition of vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$, and the addition is defined as

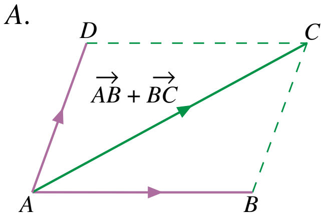


$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}.$$

$\overrightarrow{AC}$ is called the **sum** or the **resultant** of the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$. $\overrightarrow{AC}$ is also the single translation that moves the object directly from A to C. This rule is known as the **triangle law of vector addition**.

Notice that, for the sum $\overrightarrow{AB} + \overrightarrow{BC}$, B is the intermediate point. That means, the terminal point of the vector $\overrightarrow{AB}$ is connected to the initial point of the vector $\overrightarrow{BC}$.

Now, consider the sum of the vectors $\overrightarrow{AB}$ and $\overrightarrow{AD}$ with the common initial point A. We construct a parallelogram $ABCD$ with adjacent sides BC and CD as shown.



Then $\overrightarrow{AD} = \overrightarrow{BC}$ (opposite sides of parallelogram)

$\therefore$ $\overrightarrow{AB} + \overrightarrow{AD} = \overrightarrow{AB} + \overrightarrow{BC}$

$= \overrightarrow{AC}$ (triangle law of vector addition)

i.e. $\overrightarrow{AB} + \overrightarrow{AD} = \overrightarrow{AC}$

where AC is the diagonal of the parallelogram $ABCD$. This is known as the **parallelogram law of vector addition**.