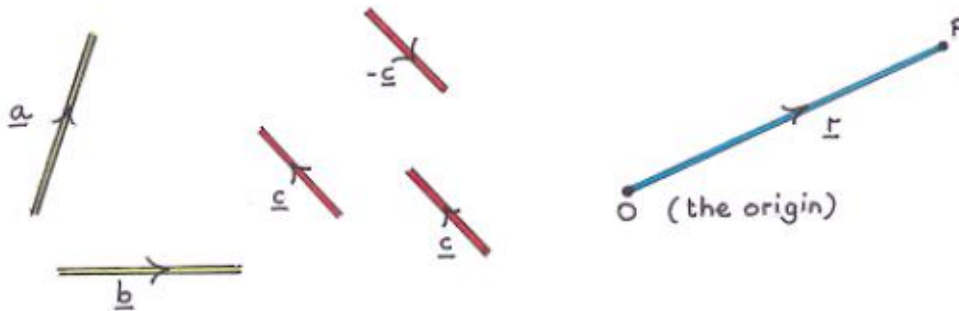


MiLearn

Some general rules to remember - Vectors

Some physical properties, such as temperature or area, are given completely by their magnitude and so one only requires a number (or a **scalar**) to represent them. There are also other physical quantities, such as force, velocity or acceleration, for which we must know direction as well as size or magnitude in order to work with them. It is often helpful to represent such quantities by directed lines called **vectors**. Because vectors carry the physical information of both magnitude and direction, using them gives us a really cool way of handling these quantities.

The drawing below shows 3 rules for working with vectors.



- **Two vectors are equal if and only if they are equal in both magnitude and direction.**
So **a** is not equal to **b** although they are the same length, because they are in different directions. However, the two vectors marked **c** are equal.
- **If **c** is a vector, then **-c** is defined as having the same magnitude but the reverse direction to **c**.** Subtracting **c** is the same as adding **-c**. (*think opposites*)
- **Multiplying a vector by a number or scalar just has the effect of changing its scale.**
So, for example, **2a** would be twice as long as **a** but in the same direction as **a**.

The two vectors labelled **c** are defined to be equal although we need a shift to move them exactly on top of each other. Vectors that can be shifted about are

called **free vectors**. (if you like pro sports...think of a 'free' agent player who can shift teams..)

BUT....

There is one important situation in which we can't shift the vectors around. Displacement from a given fixed point such as the origin is a vector quantity, but the vector is **tied** to the fixed point. The vector \mathbf{r} in the drawing above is called the **position vector** of the point P from the fixed origin O, and describes the displacement of P from O. It *must* run from O to P and can't be shifted around.