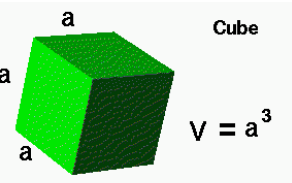**A vector** is a measurement that has both size and direction. For example a force has a size measured in newtons and will be acting up, down, sideways or in some other direction direction. Velocity is another vector you need to be practiced with. Velocity is given in ms^{-2} and a direction east, west, towards Doncaster or some other direction.
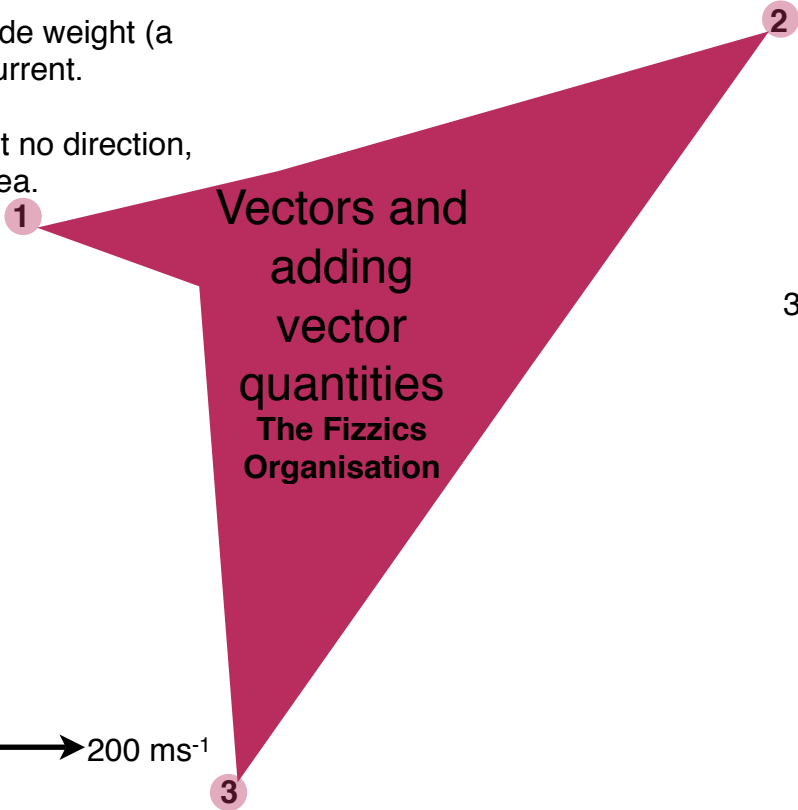**Other examples of vectors** include weight (a force), acceleration and electric current.

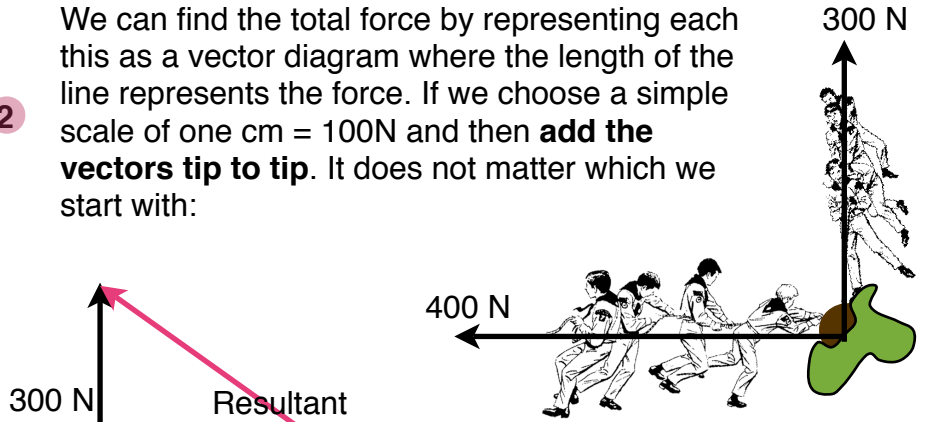**A scalar** is a quantity with size but no direction, for example mass, volume and area.

Velocity has size and direction

Volume has size but no direction

Vectors and adding vector quantities
The Fizzics Organisation

For example two teams of boy scouts work together to pull down a tree. They are not very bright so they don't pull in the same direction, they pull at 90 degrees to one another.

We can find the total force by representing each this as a vector diagram where the length of the line represents the force. If we choose a simple scale of one cm = 100N and then **add the vectors tip to tip**. It does not matter which we start with:

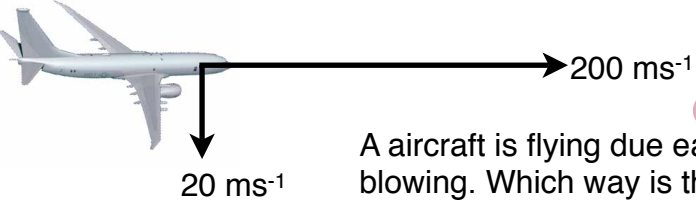300 N

400 N

300 N | Resultant | θ | 400 N

We can find the exact value of the resultant (the combination of the two) by using an accurate scale diagram or by a calculation.

Because we have a right angle we can find the resultant using Pythagoras:
$R^2 = 300^2 + 400^2$
so R = 500

To find the angle we use one of the trig functions, for example:

$\sin\theta = \dfrac{\text{opposite}}{\text{hypotenuse}} = \dfrac{300}{500}$

giving θ as 36.9 degrees

200 ms^{-1}

20 ms^{-1}

A aircraft is flying due east but there is a strong north wind blowing. Which way is the aircraft heading and how fast?

First add the vectors tip to tip. (in black, scale 40 ms^{-1} = 1 cm)

θ

The resultant, in red, is drawn from the start to the finish.

If the resultant velocity is V then $V^2 = 200^2 + 20^2$
Then V = 201 ms^{-1} the angle $\theta = \tan^{-1}\dfrac{20}{200}$ =5.7 degrees