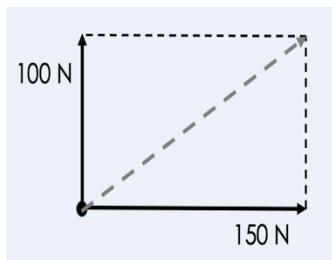
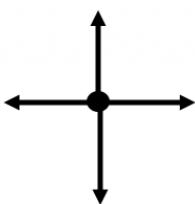


## Scalars and Vectors

- Scalars** are quantities which only have **size** (magnitude), such as distance, speed, mass and energy.
- Vectors** are quantities with **size** and **direction**, such as displacement, velocity, acceleration, force and weight.
- Resultant force** is a **vector** quantity
- Forces acting in the same direction can be added together
- Forces acting in opposite directions can be subtracted
- Resultant forces can be **resolved** into their horizontal and vertical **components**



## Newton's Laws

- Newton's **Third Law** states that **every action has an equal and opposite reaction**
- Newton's **First Law** states than an **object's motion will not change unless acted upon by an unbalanced force**
- If the resultant force is 0 N a stationary object will remain stationary
- If the resultant force is 0 N an object in motion will continue moving at the same velocity
- If the resultant force is not 0 N a stationary object will accelerate in the direction of the resultant force
- If the resultant force is not 0 N an object in motion will accelerate in the direction of the resultant force

## Acceleration

- Acceleration is the **rate of change of velocity**
- Change in velocity is calculated using final velocity minus initial velocity

- Acceleration happens when there is change in velocity (**speeding up, slowing down or a change in direction**)
- Negative acceleration (slowing down) can be called **deceleration**
- The SI unit for acceleration is **m/s<sup>2</sup>**
- An object moving in a circle is accelerating because it is constantly changing direction
- Objects near Earth's surface experience gravitational acceleration of 9.8 m/s<sup>2</sup>
- Air resistance/drag increases with speed**

$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time}}$$

## Velocity-Time Graphs

- Velocity-time graphs can be used to describe motion
- A **horizontal line** shows a **constant velocity**
- A straight line with a **positive gradient** (slope) shows that an object has a **positive acceleration** (speeding up)
- A straight line with a **negative gradient** (slope) shows that an object has a **negative acceleration/deceleration** (slowing down)
- Acceleration** can be calculated by calculating the **gradient**
- Distance** can be calculated from the **area under the graph**
- A **curved** line shows that **acceleration** is **changing**

