Projectiles

- In this topic we study about the motion of objects thrown horizontally or those that are thrown at an angle (other than 90^0) to the horizontal.
- Air resistance will be ignored.
- If there is no air resistance, the particle thrown as mentioned above will follow a parabolic path (the shape of a quadratic graph).
- During the motion, at any instant of time, the direction of velocity is along the tangent.
- Since air resistance is ignored, there is only one force experienced by the object after it is projected. This force is the weight of the object, which acts vertically downwards. This causes an acceleration downwards (the gravitational acceleration). For Mechanics in A Level Maths, we take the magnitude of this acceleration as $9.8 m/s^2$ and for A Level Physics we take it as $9.81 m/s^2$.
- During the journey, the directions of velocity and displacement keep on changing.
- The suvat equations involve vectors (s, u, v and a).
- As the directions of velocity and displacement keep on changing, we cannot simply substitute the magnitudes of velocity and displacement into the suvat equations. We will study two methods to tackle this issue.
- One method is to analyse the horizontal and vertical motions separately. Horizontal components of the vectors do not affect the vertical components of the vectors and vice versa. Since the acceleration's direction is vertically downwards, its horizontal component will be zero. This means, the horizontal component of the velocity remains constant. Hence, we can use the equation, velocity = displacement / time (or displacement = velocity x time often written as s = vt or s = ut) to relate the horizontal components of the vectors. The vertical component of the acceleration is 9.8 m/s^2 downwards for Mechanics in A Level Maths or 9.81 m/s^2 for A Level Physics. This means, we can use the suvat equations to relate the vertical components of the vectors.
- In the second method we will represent all the vectors in terms of **i** and **j** and directly use suvat equations without splitting the motion into horizontal and vertical motions.