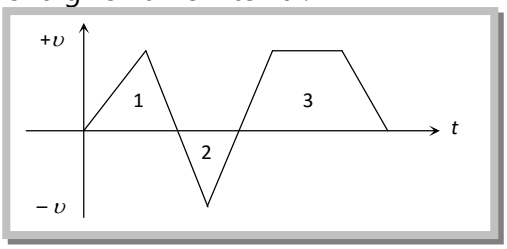
Velocity Time Graph.

The graph is plotted by taking time t along x-axis and velocity of the particle on y-axis.

Distance and displacement: The area covered between the velocity time graph and time axis gives the displacement and distance travelled by the body for a given time interval.



Then Total distance $=|A_1|+|A_2|+|A_3|$

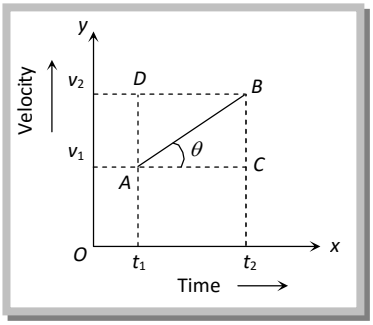
= Addition of modulus of different area. i.e. $s=\int|\upsilon|\,dt$

Total displacement $= A_1 + A_2 + A_3$

= Addition of different area considering their sign. i.e. $r=\int \upsilon\, dt$

Here A_1 and A_2 are area of triangle 1 and 2 respectively and A_3 is the area of trapezium .

Acceleration: Let AB is a velocity-time graph for any moving particle



As Acceleration = $\dfrac{\text{Change in velocity}}{\text{Time taken}} = \dfrac{v_2 - v_1}{t_2 - t_1}$ ...(i)

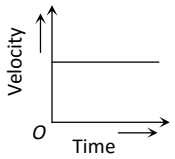
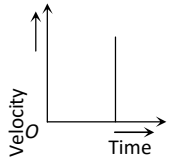
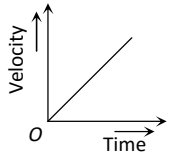
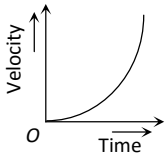
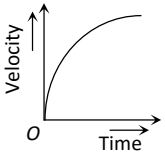
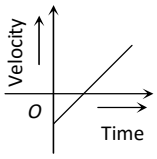
From triangle ABC, $\tan\theta = \dfrac{BC}{AC} = \dfrac{AD}{AC} = \dfrac{v_2 - v_1}{t_2 - t_1}$ ....(ii)

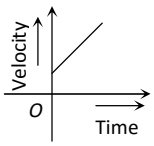
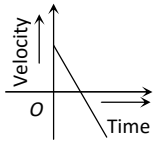
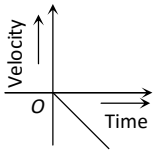
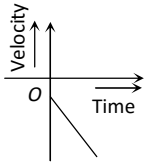
By comparing (i) and (ii)

Acceleration (a) = $\tan\theta$

It is clear that slope of velocity-time graph represents the acceleration of the particle.

Various velocity – time graphs and their interpretation

	$\theta = 0$, $a = 0$, v = constant i.e., line parallel to time axis represents that the particle is moving with constant velocity.
	$\theta = 90^{o}$, $a = \infty$, v = increasing i.e., line perpendicular to time axis represents that the particle is increasing its velocity, but time does not change. It means the particle possesses infinite acceleration. Practically it is not possible.
	θ =constant, so a = constant and v is increasing uniformly with time i.e., line with constant slope represents uniform acceleration of the particle.
	θ increasing so acceleration increasing i.e., line bending towards velocity axis represent the increasing acceleration in the body.
	θ decreasing so acceleration decreasing i.e. line bending towards time axis represents the decreasing acceleration in the body
	Positive constant acceleration because θ is constant and $< 90^{o}$ but initial velocity of the particle is negative.

	Positive constant acceleration because θ is constant and < 90^o but initial velocity of particle is positive.
	Negative constant acceleration because θ is constant and > 90^o but initial velocity of the particle is positive.
	Negative constant acceleration because θ is constant and > 90^o but initial velocity of the particle is zero.
	Negative constant acceleration because θ is constant and > 90^o but initial velocity of the particle is negative.