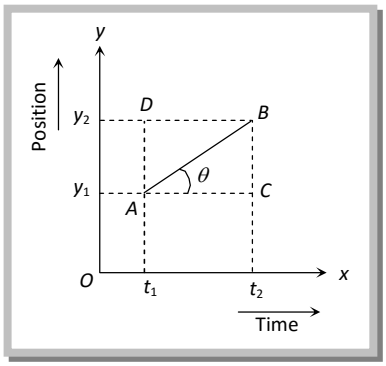
Position Time Graph.

During motion of the particle its parameters of kinematical analysis (u, v, a, r) changes with time. This can be represented on the graph.

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

Let AB is a position-time graph for any moving particle



As Velocity = $\frac{\text{Change in position}}{\text{Time taken}} = \frac{y_2 - y_1}{t_2 - t_1}$ ...(i)

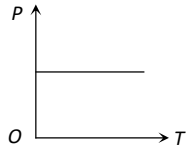
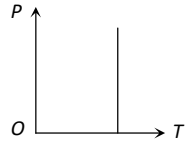
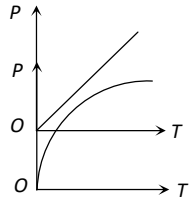
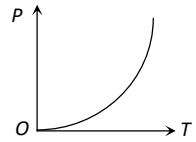
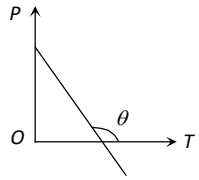
From triangle ABC $\tan\theta = \frac{BC}{AC} = \frac{AD}{AC} = \frac{y_2 - y_1}{t_2 - t_1}$ ....(ii)

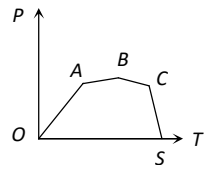
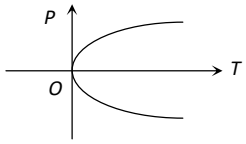
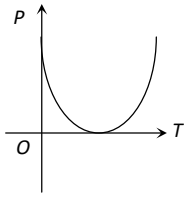
By comparing (i) and (ii) Velocity = tanθ

v = tanθ

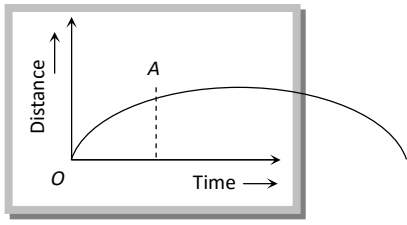
It is clear that slope of position-time graph represents the velocity of the particle.

Various position – time graphs and their interpretation

	$\theta = 0^o$ so v = 0 i.e., line parallel to time axis represents that the particle is at rest.
	$\theta = 90^o$ so v = ∞ i.e., line perpendicular to time axis represents that particle is changing its position but time does not changes it means the particle possesses infinite velocity. Practically this is not possible.
	θ = constant so v = constant, a = 0 i.e., line with constant slope represents uniform velocity of the particle.
	$\theta$is increasing so v is increasing, a is positive. i.e., line bending towards position axis represents increasing velocity of particle. It means the particle possesses acceleration.
	θ is decreasing so v is decreasing, a is negative i.e., line bending towards time axis represents decreasing velocity of the particle. It means the particle possesses retardation.
	θ constant but > 90^o so v will be constant but negative i.e., line with negative slope represent that particle returns towards the point of reference. (Negative displacement).

	Straight line segments of different slopes represent that velocity of the body changes after certain interval of time.
	This graph shows that at one instant the particle has two positions. Which is not possible.
	The graph shows that particle coming towards origin initially and after that it is moving away from origin.

Note: If the graph is plotted between distance and time then it is always an increasing curve and it never comes back towards origin because distance never decrease with time. Hence such type of distance time graph is valid up to point A only, after point A it is not valid as shown in the figure.



For two particles having displacement time graph with slopes θ_1 and $\theta_2$possesses velocities v1 and v_2 respectively then $\frac{\upsilon_1}{\upsilon_2}=\frac{\tan\theta_1}{\tan\theta_2}$