

Position, Velocity, Speed

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1. **Position function:** the function s that gives the position (relative to the origin) of an object as a function of time t . Written as $s(t)$ or $x(t)$.
2. **Instantaneous velocity** tells how fast something is going at that exact instant and in which direction. ie. how the position is changing.

$$\frac{ds}{dt} = s'(t) = v(t) = \lim_{\Delta t \rightarrow 0} \frac{s(t + \Delta t) - s(t)}{\Delta t}$$

3. **Speed** tells how fast an object is going no matter which direction; measures the rate at which the position changes.

$$\text{speed} = |\text{velocity}|$$

Do the following Free Response problem by hand and then with a calculator.

1983 AB2: A particle moves along the x -axis so that at time t its position is $x(t) = t^3 - 6t^2 + 9t + 11$.

- a) What is the velocity of the particle at $t = 0$?
- b) During what time intervals is the particle moving to the left?
- c) What is the total distance traveled by the particle from $t = 0$ to $t = 2$?

Class Notes on Position, Velocity, and Speed

A dynamite blast propels a heavy rock straight up with a launch velocity of 160 ft/sec. It reaches a height of $s(t) = 160t - 16t^2$ feet after t seconds.

a) How high does the rock go? Must use calculus in your work.

b) What is the velocity and speed of the rock when it is 256 feet above the ground on the way up? on the way down?

c) When does the rock hit the ground?

d) What is the average velocity of the rock for the first 3 seconds?