

Motion Calculus

Name: _____

Given a position function, its derivative is a _____ function .

Given velocity function, its derivative is a _____ function .

AVERAGE VELOCITY in the interval (a,b) , given $p(x)$ is a position function, is...

AVERAGE ACCELERATION in the interval (a,b) , given $v(x)$ is the velocity function, is...

A particle is moving to the right (or up) when _____ is positive

A particle's position is increasing when _____ is positive.

A particle is moving to the left (or down) when its _____ is negative

A particle's position is decreasing when its _____ is negative.

A particle is at rest (or is stopped) when its _____ is zero

A particle is speeding up if its _____ and _____ have the same sign (at that point)

A particle is moving towards the origin when its _____ and _____ have opposite signs

Displacement is the _____ in positions between two times. Can displacement be negative?

Total distance traveled by a particle is the sum of the amounts it displaces between the start and all stop(s) and the end. Can distance be negative?

Calculus

Name:

$$x(t) = e^{-2t} + \sin^2(3-t) - \frac{1}{2} \quad \text{over the time interval } [0,2].$$

- 1) When does the object stop?
- 2) What is the object's displacement from $[0,2]$
- 3) Is the object speeding up or slowing down at $t = \frac{1}{2}$?
- 4) Determine the object's total distance traveled from $[0,2]$

5) A particle moves along the x-axis such that its position at any time t where $0 \leq t \leq 5$ is given by the function $x(t) = 2t^3 - 15t^2 + 36t - 22$

- a) determine the velocity and acceleration functions
- b) what is the particle's average velocity from $t = 2$ to $t = 4$
- c) what is the particle's instantaneous velocity at $t = 3$
- d) when is the particle at rest
- e) when does the particle move to the right
- f) what is the total distance traveled by the particle
- g) what is the particle's maximum velocity
- h) is the particle moving towards or away from the origin at $t = 1$
- i) is the particle speeding up or slowing down at $t = 1$
- j) what is the displacement of the particle over the interval

6) A particle starts at time $t = 0$ and moves on a number line so that its position at time t seconds is given by $x(t) = (t - 2)^3(t - 6)$. Show all work that leads to your answers or justify your answer in words.

- a) Write the particle's velocity function
- b) When does the particle stop?
- c) Does the particle change direction at all its stops?
- d) What is the particle's displacement from $t = [1, 6]$?
- e) What is the total distance the particle traveled from $t = [1, 6]$?
- f) Set up an equation that could calculate a time when the particle's instantaneous velocity is equal to its average velocity over the interval $[1, 6]$. Which theorem does this illustrate?