Kinematics

Demo – Ultrasonic locator

Graph representation

Kinematics

- Position
- •**Displacement** $\Delta \vec{x} = \vec{x}_2 \vec{x}_1$
- •**Speed** = distance traveled / time elapsed
- •Velocity = displacement / time elapsed $\vec{v} = (\vec{x}_2 - \vec{x}_1)/(t_2 - t_1) = \Delta \vec{x}/\Delta t$
- •Instantaneous velocity $\vec{v} = \lim \Delta \vec{x} / \Delta t$ $\Delta t \rightarrow 0$

Acceleration

- Average Acceleration
- $\vec{a} = \Delta \vec{v} / \Delta t$
- Instantaneous Acceleration
- $\vec{a} = \lim \Delta \vec{v} / \Delta t$

 $\Delta t \longrightarrow 0$

Position as a function of time.



- Position as a function of time.
- Calculate the average velocity from such a graph?

Position and velocity as a function of time.



Position as a function of time.

Calculate the instantaneous velocity from such a graph.

Velocity and Position as a function of time.



Velocity as a function of time.

How to calculate the displacement from such a graph?

Velocity as a function of time.



Velocity as a function of time.

Calculate the average velocity from such a graph.

Velocity and acceleration as a function of time.



Velocity as a function of time.

Calculate the average and instantaneous acceleration from such a graph.

Position, velocity and acceleration as a function of time.



A simple example: The motion with constant acceleration

Q1. Distance and Displacement

A person travels from one point A in space to another B. The magnitude of the displacement is:

- 1. either greater than or equal to
- 2. always greater than
- 3. always equal to
- 4. either smaller than or equal to the distance traveled.



Q2: Velocity and displacement

When the velocity decreases from +5m/s to zero, the displacement is

- 1) zero;
- 2) positive;
- 3) negative;
- 4) undecided.



Q2. Velocity and acceleration

- 1. If one is positive the other one has to be positive.
- 2. If one is equal zero at some time t, the other has to be zero.
- 3. Their signs are independent.
- 4. Acceleration is always smaller then velocity.

