

PHYCS101 – Chapter2 (Part 1)

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التسجيل

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Displacement (m):

- 1- Vector Quantity
- 2- Can be positive or negative

$\Delta x = x_f - x_i$ Or find the area under the curve

Distance (m):

- 1- Scalar quantity
- 2- Always positive

$$d = x_1 - x_2$$

Examples:

$x_i = 110$ m and ending at $x_f = 60$ m

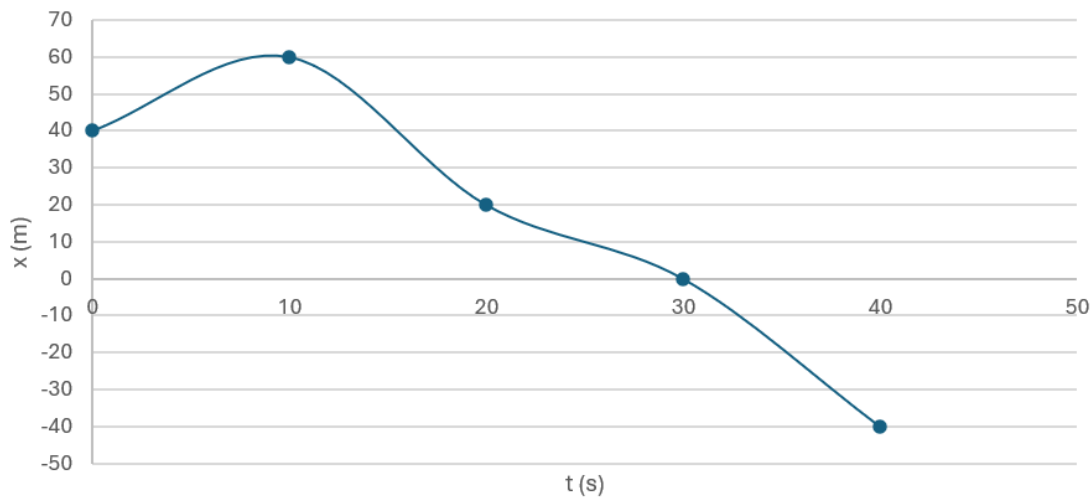
the displacement is:

The distance is:

Exercises

The position - time graph

$x - t$ plot is considered for the distance and the displacement



What is the displacement between A & B?

What is the distance between B & C?

What is the total distance?

What is the total displacement?

Average Velocity (m/s):

- 1- Can be positive or negative
- 2- Vector Quantity

Is the displacement Δx divided by time interval Δt

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$$

Average Speed (m/s):

- 1- Always positive
- 2- Scalar Quantity

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}} \text{ or } |\text{average Velocity}|$$

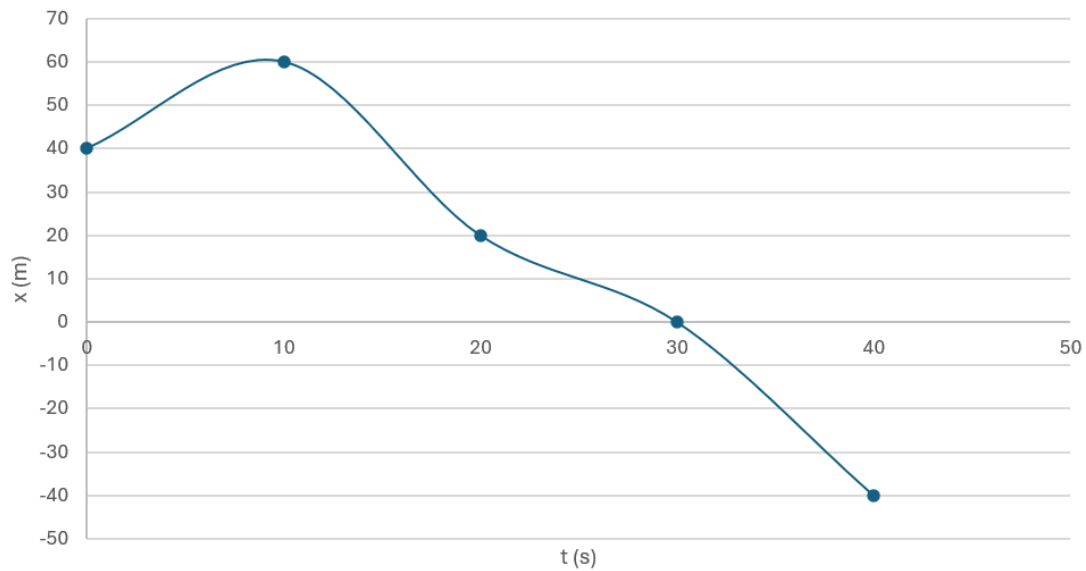
Examples

- 1- A particle moving along x-axis is located at $x_i = 12m$ at $t_i = 1s$ and at $x_f = 4m$ at $t_f = 3s$. Find its displacement, average velocity and average speed.
- 2- If a truck travels 16 m in 2 s, then its average velocity is:
- 3- If a car travels 40 km in 4 h, then its average speed is:

Instantaneous velocity

$$x(t) = at^2 + bt + c$$

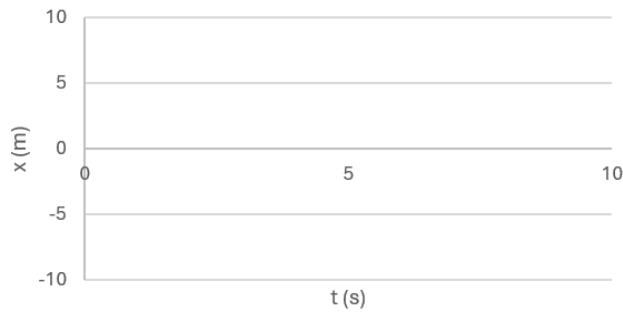
$$v = \frac{dx}{dt}$$



What is the average velocity?

What is the average speed?

Velocity cases in position – time graph



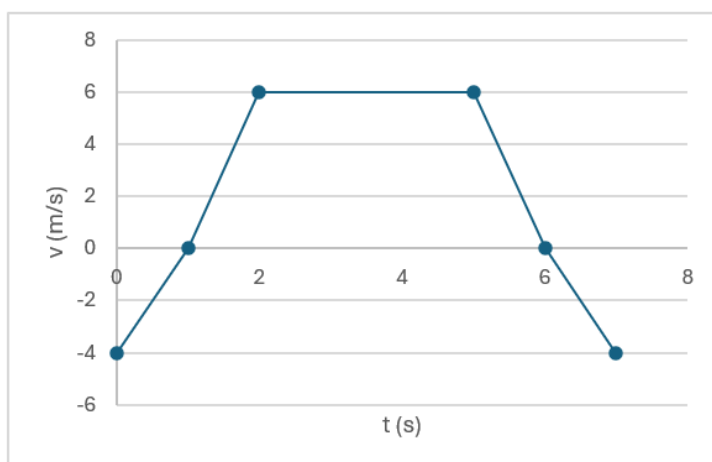
Acceleration (m/s^2):

$$a_{avg} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

Instantaneous acceleration

$$a = \frac{dv}{dt} = \frac{d^2x}{dt^2}$$

Acceleration cases in position – time graph



Example:

Find the acceleration:

From 0 – 2s?

From 2 – 6s?

One Dimensional Motion Formula:

$$v_f = v_i + at$$

$$\Delta x = v_i t + \frac{1}{2}at^2$$

$$v_f^2 = v_i^2 + 2a\Delta x$$

Examples:

1- A motorcycle starts to move from rest with constant acceleration of $2 \frac{m}{s^2}$

- a. Find the velocity in $t=2s$
- b. At what time the position be 200m?
- c. What is the position at $t=6s$?
- d. What is the velocity after travelling distance of 50 m?

2- A car has an initial speed of 15 m/s and an acceleration of 2 m/s^2 . How long will it take the car to come to stop?

3- A train starts from rest with constant acceleration 0.5 m/s^2 . Find the final velocity V_f of the train after 60s, then calculate the distance of this train during this time

4- An airplane must reach a velocity of 27.8 m/s before taking off and its acceleration is 2 m/s^2 from the rest.

a. If the runway is 150 m long, can the plane reach the proper velocity?

b. If not, what is the minimum length must the runway have?

5- A van moves at constant velocity 15 m/s at school crossing it overtook an officer who started his motion from the rest with constant acceleration of m/s^2 . When and where he will overtake the van?