Uniform Linear Motion

Ch. 2.1-2.5
Scalars and Vectors

Important Kinematics Terms

Average Speed and Velocity

Graphical Representation of Velocity

Instantaneous Velocity

Solving a Problem
Scalars and Vectors

- A Scalar represents magnitude
  
  **Scalar** ➔ “How much?”

  Examples?

- A Vector represents magnitude and direction
  
  **Vector** ➔ “How much?” and “What direction?”

  Examples?
Important Kinematics Terms

 Scalars

 Distance

 Speed

 Vectors

 Displacement

 Velocity
Average Speed and Velocity

Definitions

average speed = $\frac{\text{distance}}{\text{time taken}}$

average velocity = $\frac{\text{displacement}}{\text{time taken}}$

Questions

What is the average speed in the ‘journey’ from A to D in diagram?

What is the average velocity?
Consider just linear motion: Speed and velocity differ only in that velocity uses +/- for direction.

Velocity \[ \text{slope of displacement (y-axis)} - \text{time (x-axis)} \] curve
(Careful of meaning of \( x \)!)
Instantaneous Velocity

- In general, velocity is slope of the time-distance curve.
- If motion is uniform, average and instantaneous velocity are the same.
- If distance-time curve changes continuously, the slope which is velocity is given by the derivative.

Example: $x=4t^2-10t+4$

- What is $v$ at $t=3$ s?
- Where is $v=0$?
This motion is linear, but not uniform. Why not uniform?
$x = 4t^2 - 10t + 4$
Questions

1. What distance does the particle travel between $t = 1.5$ and $4.0$ s?

2. What is the displacement of the particle between $t = 1.5$ and $4.0$ s?

3. What is the average velocity of the particle between $t = 1.5$ and $4.0$ s?

4. What is the instantaneous velocity of the particle at $t = 2.0$ s?

5. What is the average speed of the particle between $t = 0.0$ and $4.0$ s?

6. What is the average velocity of the particle between $t = 0.0$ and $4.0$ s?

7. What is the average speed of the particle between $t = 0.50$ and $2.0$ s?

8. What is the average velocity of the particle between $t = 0.50$ and $2.0$ s?