A. Constant Velocity Motion – Definitions

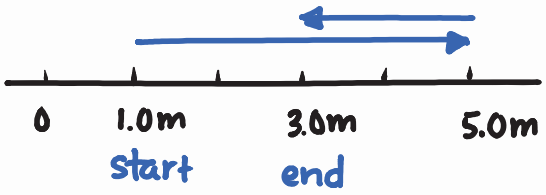
Distance the total number of units between two points

- A **scalar** quantity because it has magnitude only (no direction)
- Represented by d
- Typically measured in meters (m)

Displacement is the change in position of an object

- A **vector** quantity because it has magnitude and direction
- Represented by $\vec{d}$
- Typically measured in m

Example 1: A cat travels from the 1.0 *m* mark to the 5.0 *m* mark and then to the 3.0 *m* mark. Find the cat's distance travelled and its displacement.



distance : $d = 4.0m + 2.0m$

$d = 6.0m$

indicates direction

displacement : $\vec{d} = +4.0m + (-2.0m)$

$\vec{d} = +2.0m$

Time is a measurement of change in the universe

- Represented by t
- Typically measured in seconds (s)

Example 2: Determine how many seconds there are in a 1.25 *hr* long Physics class.

$$1.25\,\text{hr} \times \frac{60\,\text{min}}{1\,\text{hr}} \times \frac{60\,\text{sec}}{1\,\text{min}} = 4500\,\text{s}$$

÷3600 ← hr → s ×3600

Speed the rate of change of distance

- A **scalar** quantity because it has magnitude only (no direction)
- Represented by v
- Typically measured in m/s

$$v = \frac{d}{t} \quad \text{or} \quad v = \frac{\Delta d}{\Delta t}$$

"delta" means change

is the rate of change of distance

Velocity is the rate of change of displacement

- A **vector** quantity because it has magnitude and direction
- Represented by $\vec{v}$
- Typically measured in m/s

$$\vec{v} = \frac{\vec{d}}{t} \quad \text{or} \quad \vec{v} = \frac{\Delta \vec{d}}{\Delta t}$$

Example 3: Find the speed and velocity of the objects below.

a) A rock is dragged by a truck 16.0 m [E] for 4.0 s .

↖ direction (East)

speed : $v = \frac{d}{t}$ $\quad v = \frac{16.0}{4.0} = 4.0\ m/s$

velocity : $\vec{v} = \frac{\vec{d}}{t}$ $\quad = \frac{16.0\ [E]}{4.0} = 4.0\ m/s\ [E]$

b) A bale of hay is kicked from 1.0 m [E] to 5.0 m [E] then pitch-forked to 3.0 m [E]; all in 4.0 seconds.

see example 1 for number line

speed : $v = \frac{d}{t}$ $\quad = \frac{6.0\ m}{4.0\ s}$ $\quad v = 1.5\ m/s$

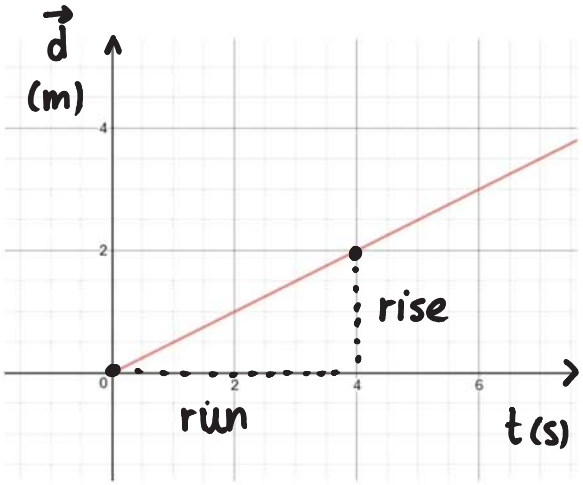
example 1

velocity : $\vec{v} = \frac{\vec{d}}{t}$ $\quad \vec{v} = \frac{+2.0\ m}{4.0\ s}$ $\quad \vec{v} = +0.5\ m/s$ or $\vec{v} = 0.5\ m/s\ [E]$

B. Constant Velocity Motion – Graphing d vs t

Displacement vs Time graphs show the position of an object over a period of time.

Consider the following displacement (or position) vs time graph:



Find the slope of the line

$$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{2 - 0\ m}{4 - 0\ s} = 0.5\ m/s$$

So, the slope of a displacement versus time graph gives us velocity. ★

The slope of a distance versus time graph gives us speed.

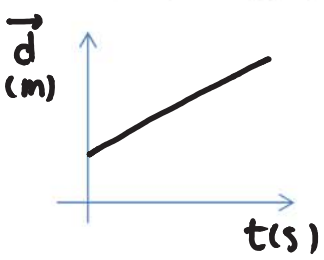
p. 45 # 1, 3 → table 3-1 on p. 43

p. 47 # 6 – 8

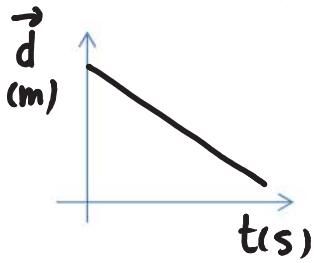
p. 49 # 1.3 , 1.4

p. 53 # 10 – 12

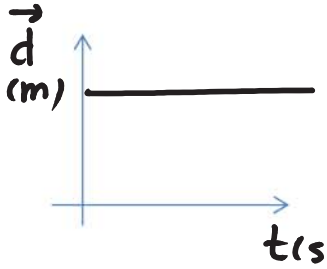
A linear (straight line) graph of d vs t will show a constant speed/velocity.



positive slope
→ positive velocity
→ object is moving forwards

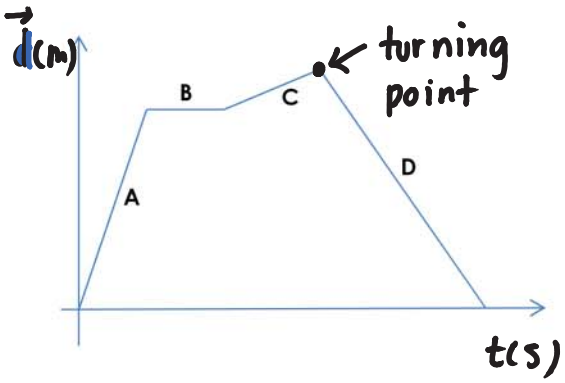


negative slope
→ negative velocity
→ object is moving backwards



zero slope
→ zero velocity
→ object has stopped

Example 4: Given the following displacement vs time graph, describe the object's motion.



A: constant positive velocity, object is moving forwards, travelling quickly (steep slope)

B: no velocity; object is stopped (at rest)

C: constant positive velocity, object is moving forwards, moving slower than A.

D: constant negative velocity, object is moving backwards, moving slower than A but faster than C.

C. Non-Uniform (changing) Velocity - Graphing d vs t

Acceleration _____.

- A **vector** quantity because it has _____
- Represented by _____
- Typically measured in _____

An object that accelerates will result in a **curved** displacement vs time graph.