Kinematics

Speed, Velocity, Position, Distance and Displacement

Scalar Quantities

- include magnitude (size) but NOT direction.
- Examples: speed, distance, time, mass

Vector Quantites

- include magnitude (size) AND direction.
- Examples: velocity, displacement, acceleration, force, momentum

Average speed, v_{av}:

$$v_{av} = \frac{\Delta d}{\Delta t}$$

Δd: distance

Δt: time

Distance – the measure of the TOTAL path length travelled by an object

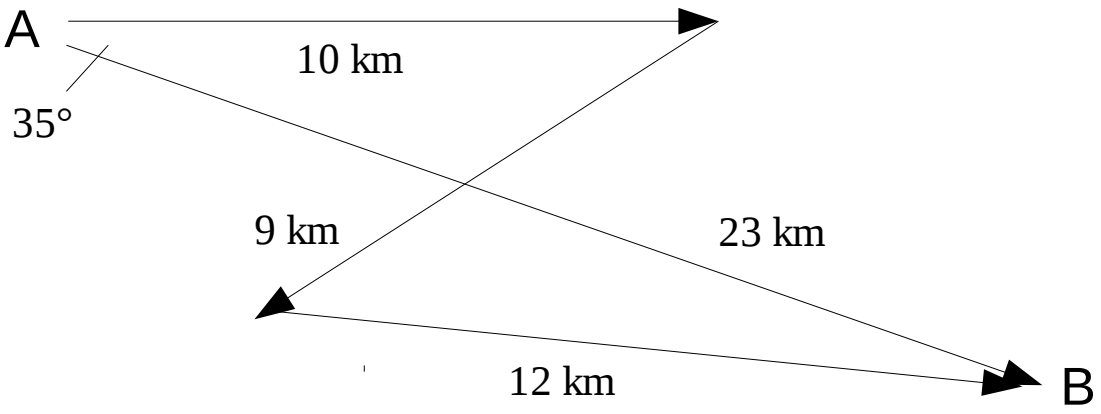
Displacement – the change in position for an object

- can be found by

i) $\vec{\Delta} d = \vec{d}_2 - \vec{d}_1$, if positions $\vec{d}_1$ and $\vec{d}_2$ are given

ii) $\vec{\Delta} d = \vec{d}_1 + \vec{d}_2 + \vec{d}_3 ...$

iii) finding the area of a velocity-time graph.



In travelling from A to B,

distance = (10 + 9 + 12) = 31 km,

displacement = 23 km [E 35° S].

Average Velocity, $\vec{v}_{av}$,

can be found by

i)

$$\vec{v}_{av} = \frac{\vec{\Delta d}}{\Delta t}$$

displacement

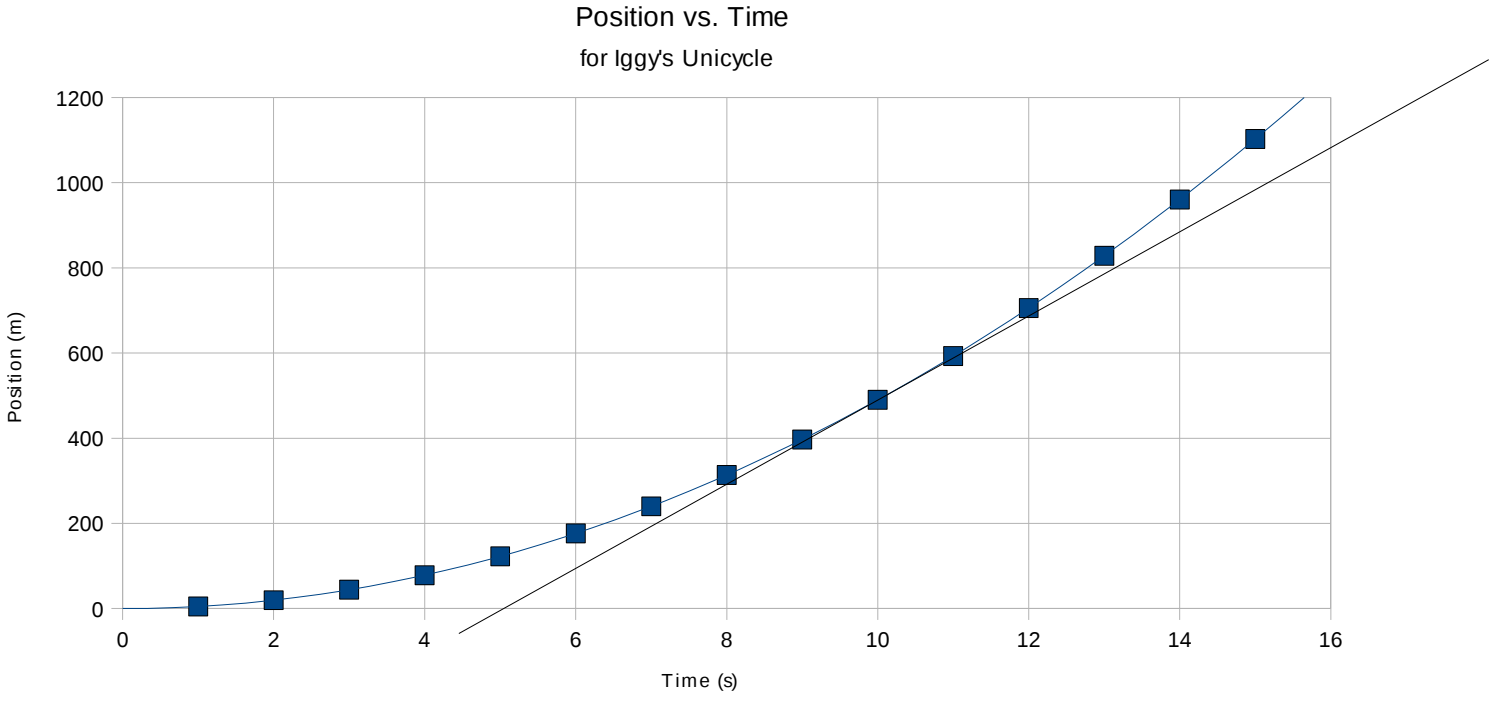
time

ii) finding the slope of the line segment joining two points on a position-time graph.

Instantaneous Velocity

- can be found by determining the slope of the tangent to a certain point on a position-time graph.

Example 1.



Assuming the positive direction is East,
In the above graph, $\vec{v}_{inst}$ at t = 10 s is

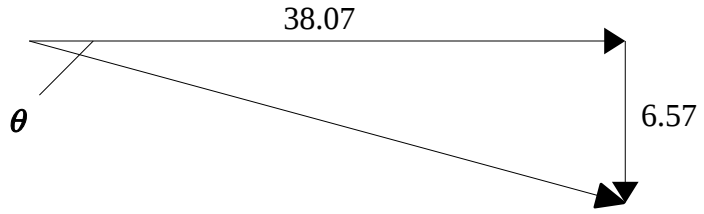
(1080 – 0) ÷ (16 – 5.0)
= 98.2 m/s [E]

2. Iggy drives his solar car from his house to work, a displacment of 36 km [NE], then drives to the fish market after work, which took him 14 km [S] and then drives to his cousin Selma's house for dinner, 22 km [S 35° E] of the market.

a) What is Iggy's total displacement for the trip?
b) If his total driving time is 65 minutes, what is his average velocity for the trip?
c) What is his average speed?

a) Δ dx = 36 sin 45° + 22 sin 35°
= 38.07 km

Δ dy = 36 cos 45° -14 - 22 cos 35°
= -6.57 km



$\Delta d = \sqrt{(38.07)^2 + (6.57)^2}$
= 38.63 km

Tan θ = 6.57/38.07

θ = 9.8°

so Δ d = 38.63 km [E 9.8° S]

b) $\vec{v}_{av} = \frac{\Delta d}{\Delta t}$

$= \frac{38.63}{65/60}$

= 35.67 km/h [E 9.8° S]

c) $v_{av} = \frac{\Delta d}{\Delta t}$

$= \frac{36 + 14 + 22}{65/60}$

= 66.5 km/h