Physics 2204

Uniform Motion Review

Kinematics

A branch of physics dealing with the physical description of motion (eg. speed, velocity, distance, displacement, acceleration).

The word comes from the Greek “kinema” which means motion.

Uniform Motion: Straight line movement at a constant speed.

Terms

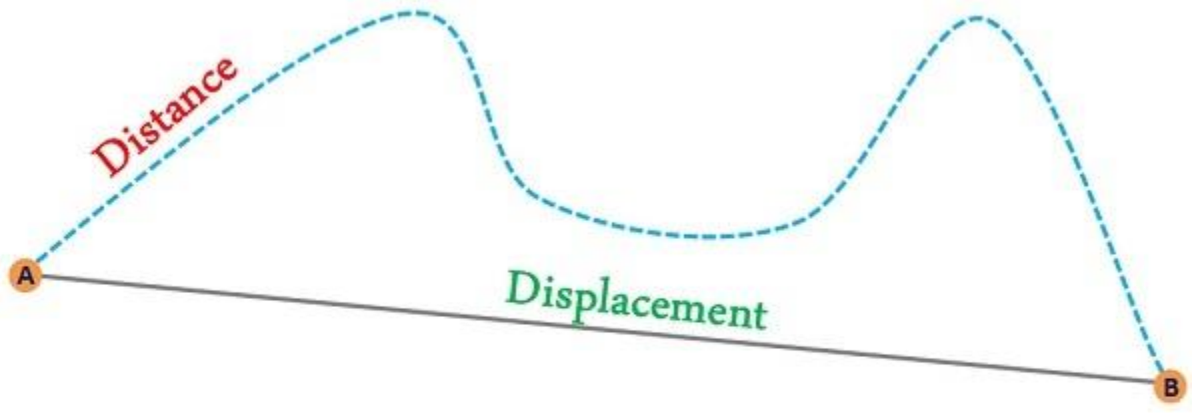
Scalar Quantities: have magnitude (value) and units. (eg. time, mass)

Vector Quantities: have magnitude (value), units <u>and</u> direction. (eg. displacement, velocity and acceleration)

Distance & Displacement

Distance: a measure of the total amount travelled regardless of direction.

Displacement: a change in position measured from start to finish.



Average Speed

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

$$v = \frac{d}{t}$$

Average Velocity

$$\textit{average velocity} = \frac{displacement}{total\ time}$$

$$\vec{v} = \frac{\vec{d}}{t}$$

Note that the direction of the velocity is the same as the direction of the displacement.

Example

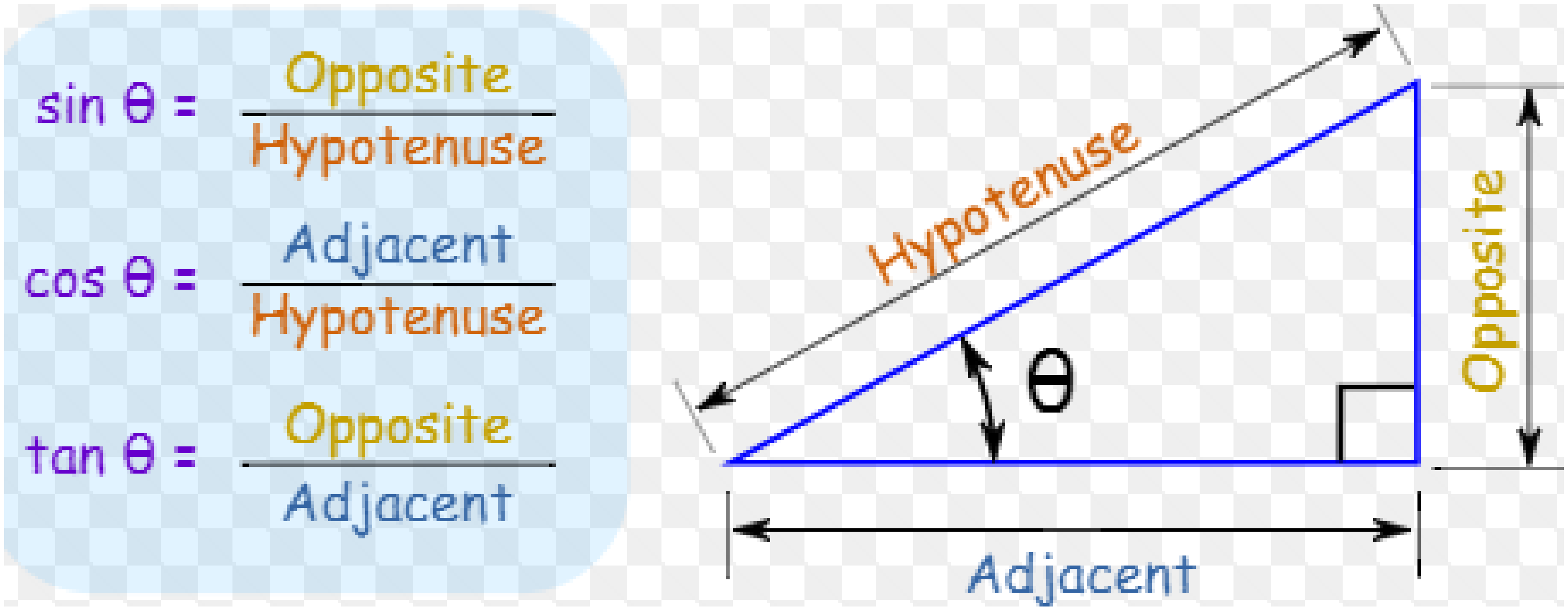
1. If a car travels 140.0 km in 1.5 h, what is its average speed?

Example

1. John swims 400.0 m (E) and then 150.0 m (W). If the trip took 2.5 min, find:
   a) the average speed.

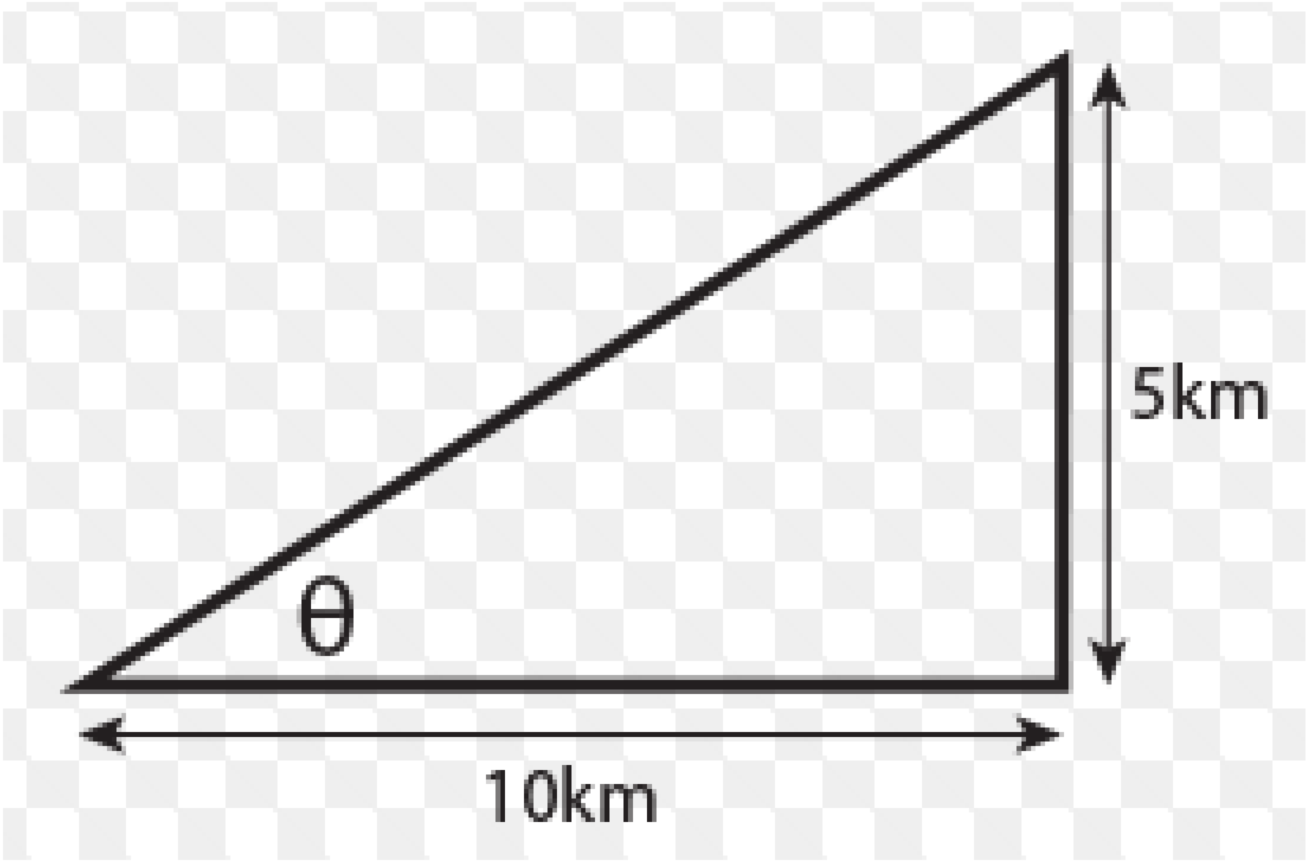
   b) the average velocity.

Trigonometry Review

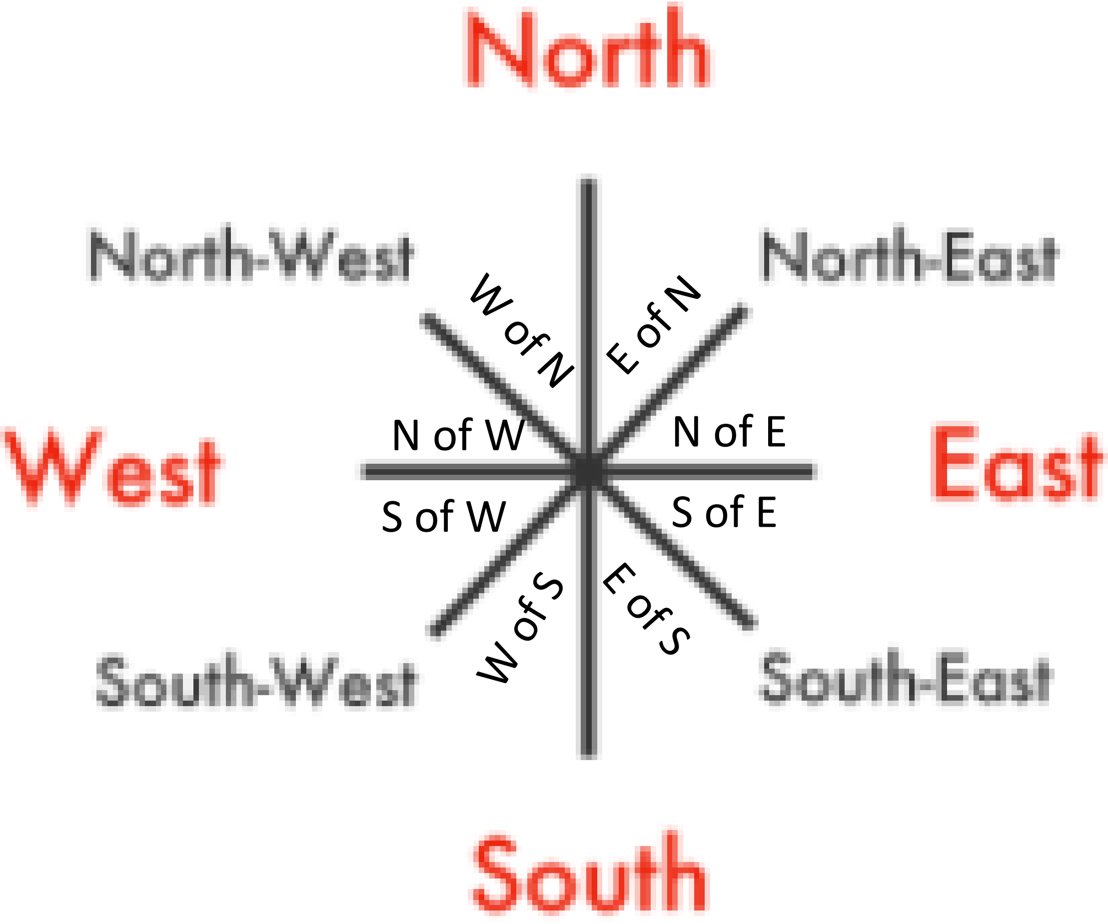


Trigonometry Review

What is ϴ?



Compass Direction



Example

1. John swims 400.0 m (E) and then 150.0 m (N). If the trip took 2.5 min, find:
   a) the average speed.

   b) the average velocity.

Example

John runs down the road at 8.0 km/h. Twelve minutes later Mary chases after him at 12 km/h. Calculate:

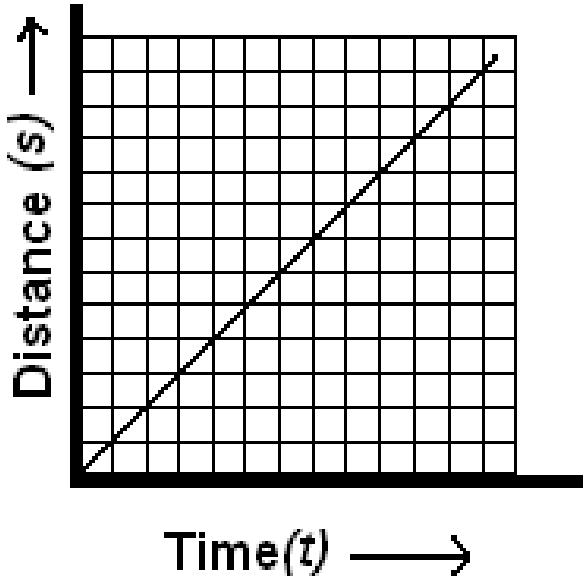
a) The time it takes Mary to catch John.

b) The distance John has travelled when he is caught.

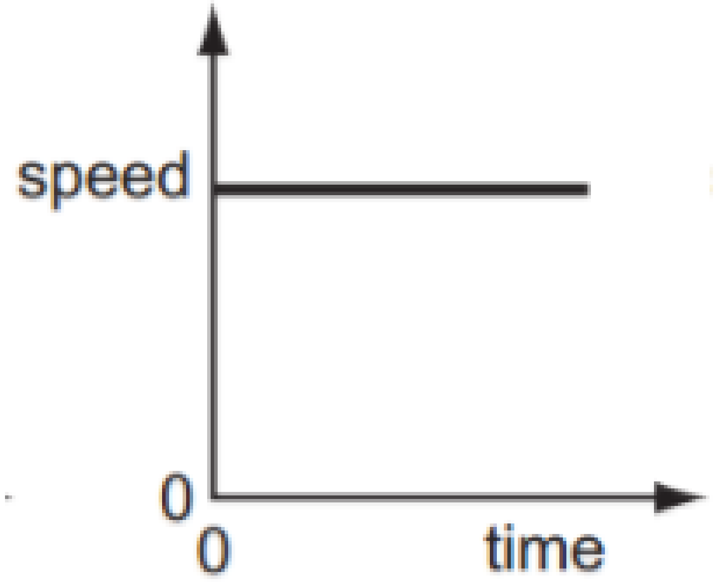
Example

Car A is moving at 55 km/h (E) towards car B moving at 68 km/h (W). If the distance between the cars is 3.4 km, calculate how long it will take for them to meet.

Graphing



Slope = speed

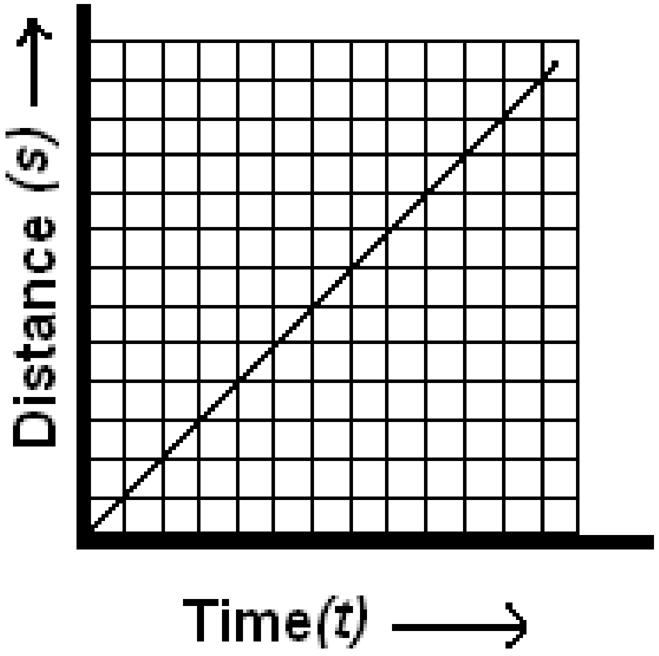


Area = distance

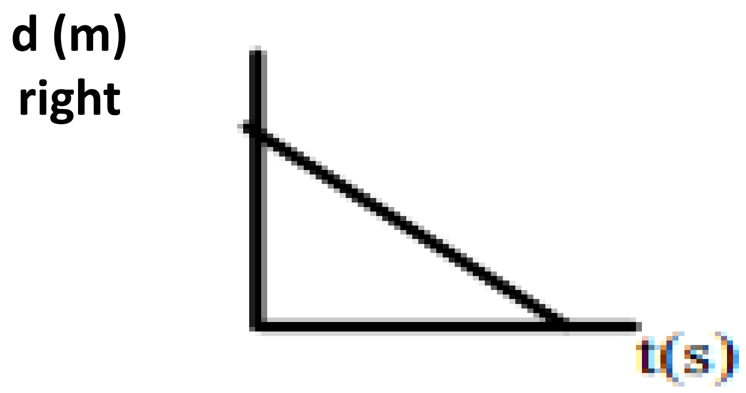
Displacement-Time Graph

0 is the reference point – where we measure the motion from.

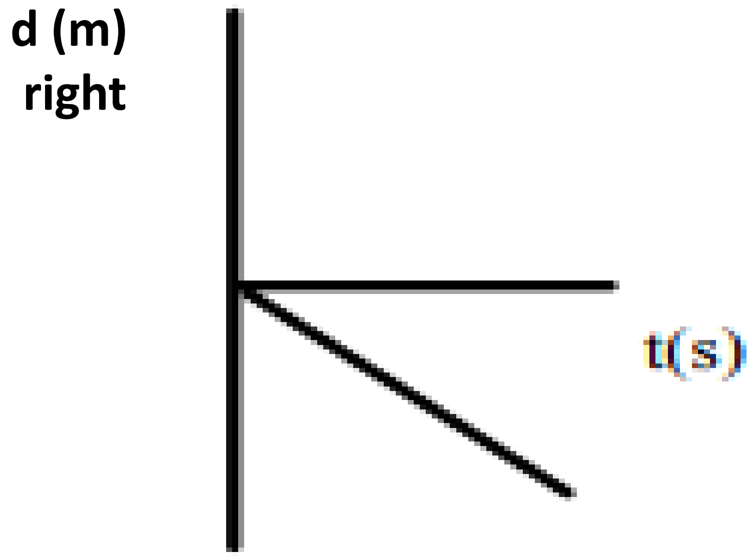
Positive slope indicates movement to the right. Negative slope is movement to the left. Zero slope indicates the object is at rest.



Displacement-Time Graphs

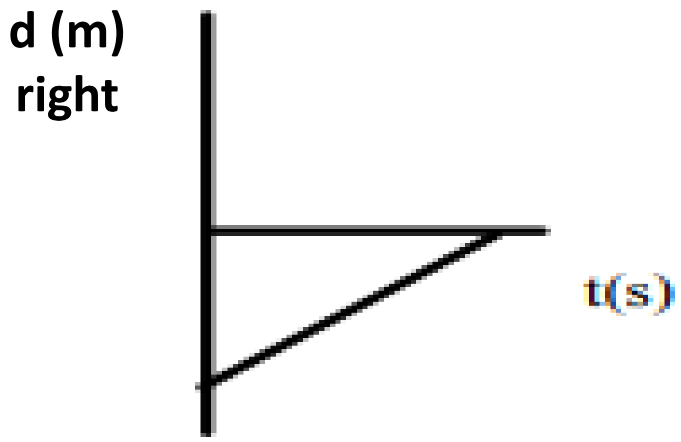


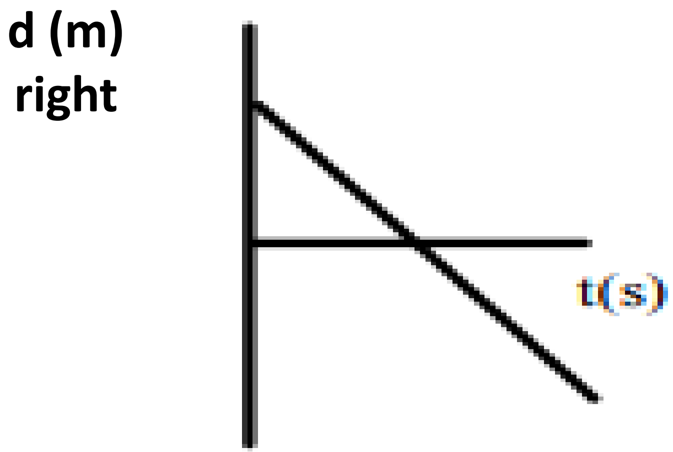
Object starts to the right of the reference point.
Moves left at constant speed.
Ends up at reference point.



Object starts at the reference point.
Moves left at constant speed.

Displacement-Time Graph



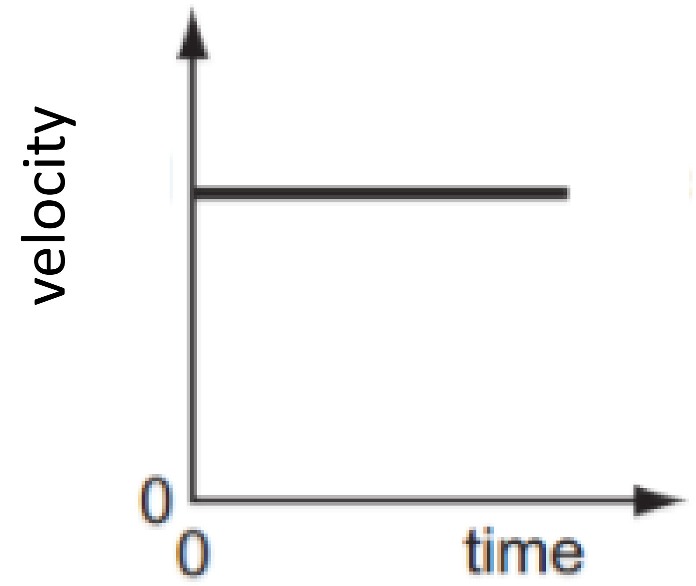


Object starts to the left of the reference point.
Moves right at constant speed.
Ends up at reference point.

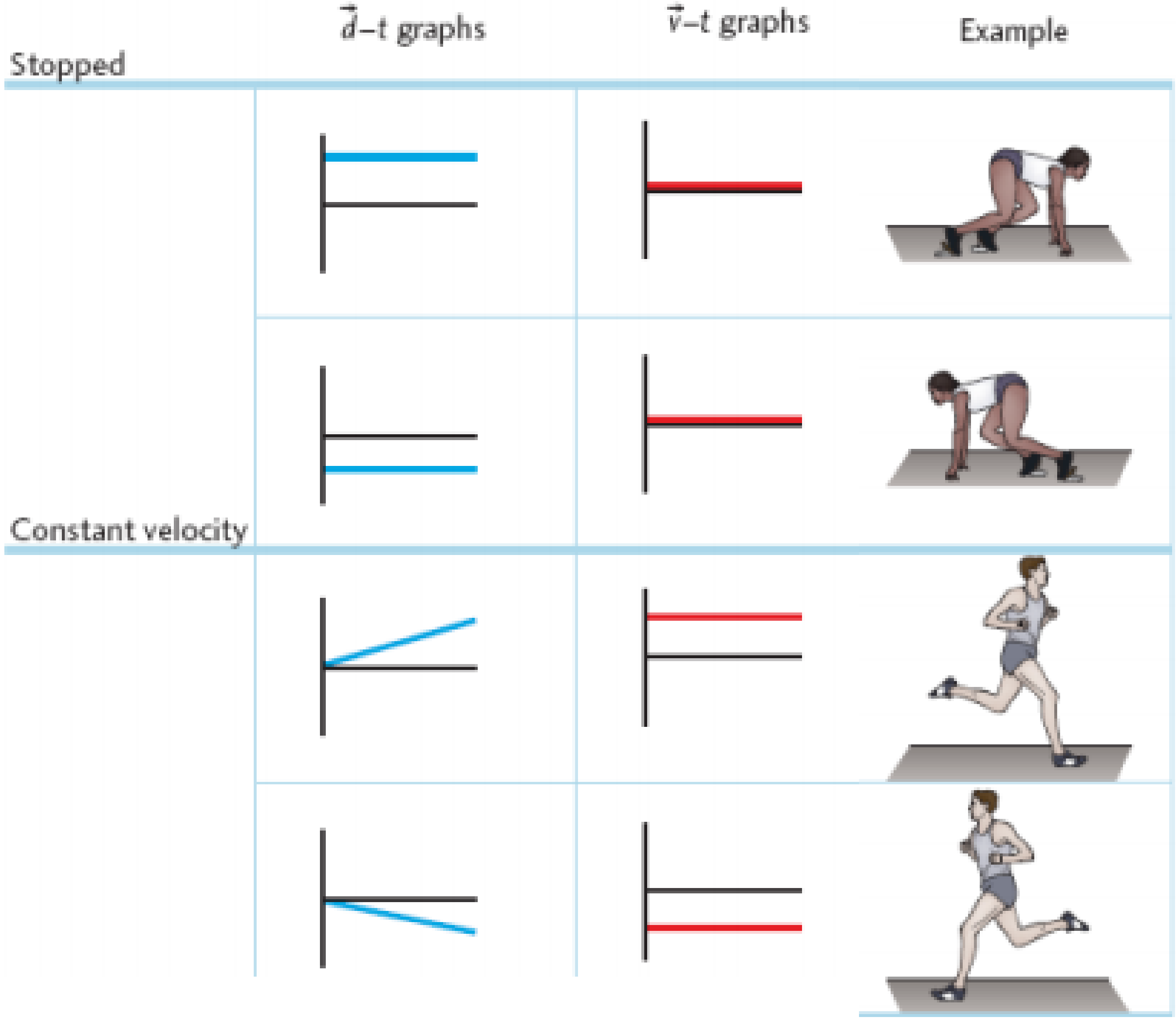
Object starts to the right of the reference point.
Moves left at constant speed.
Keeps moving past reference point.

Velocity-Time Graph

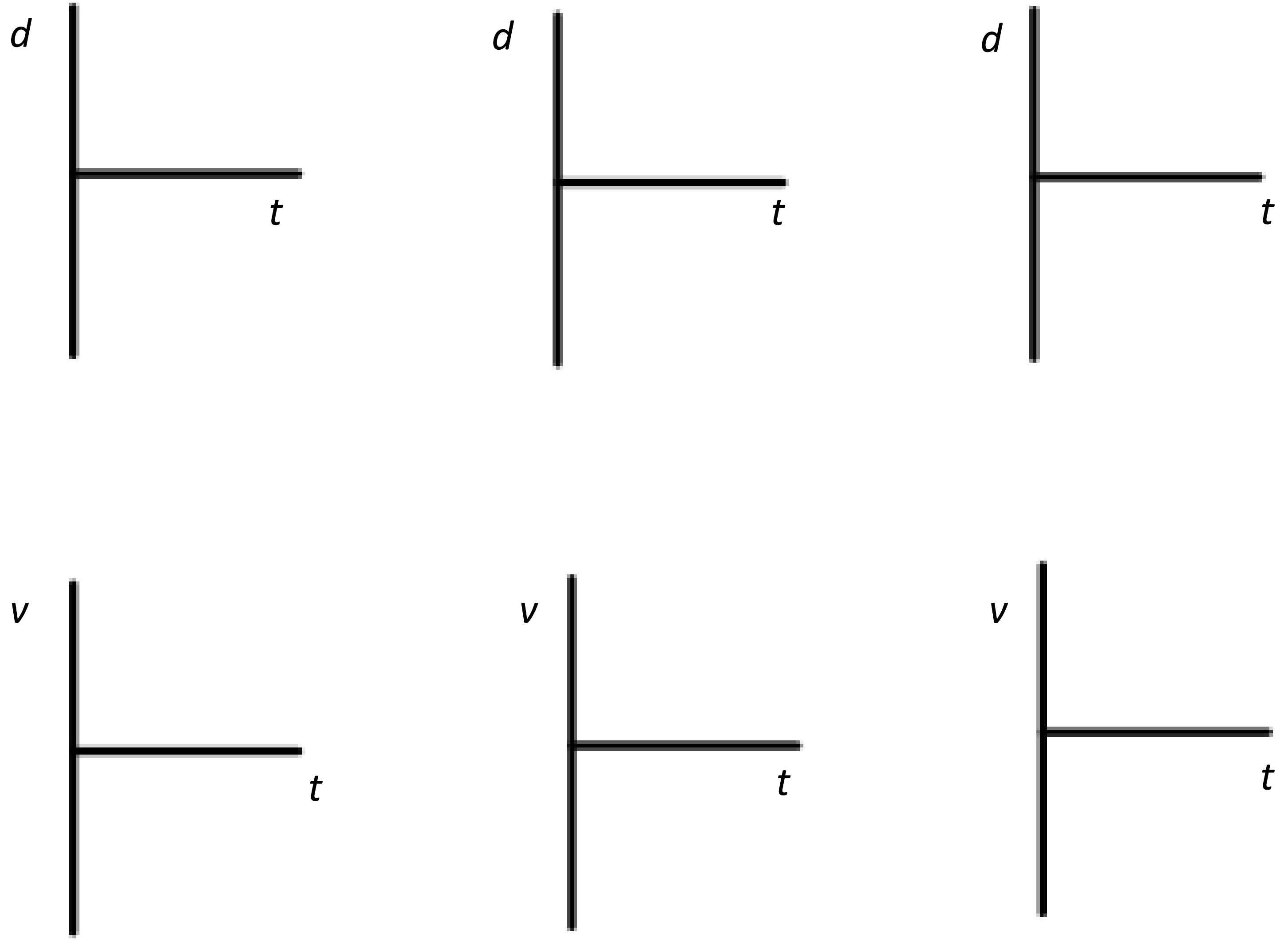
- 0 means the object is not moving.
- Graph drawn above 0 indicates movement to the right.
- Graph drawn below 0 indicates movement to the left.



Graph Matching



Walk the Graph



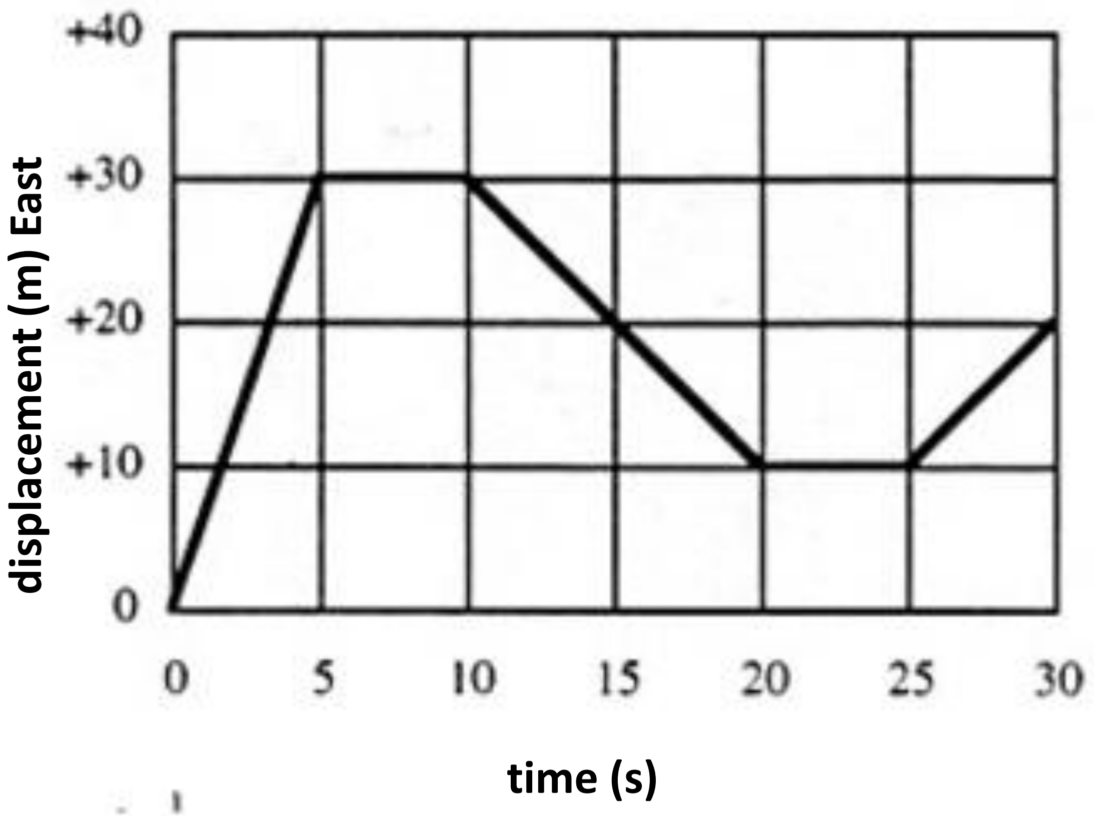
Graphing Numerical

a) What is the speed of the object at 3 s?

b) What is the object doing at 6 s?

c) What is the velocity of the object at 15 s?

d) What is the total distance moved?



Graphing Numerical

a) What is the object’s velocity at 2 s?

b) What distance has the object travelled from 0 to 5 s?

c) What is the object’s displacement at 12.5 s?

d) What is the object’s distance at 12.5 s?