

ALL about **KINEMATICS**

BY PHYIXLAB



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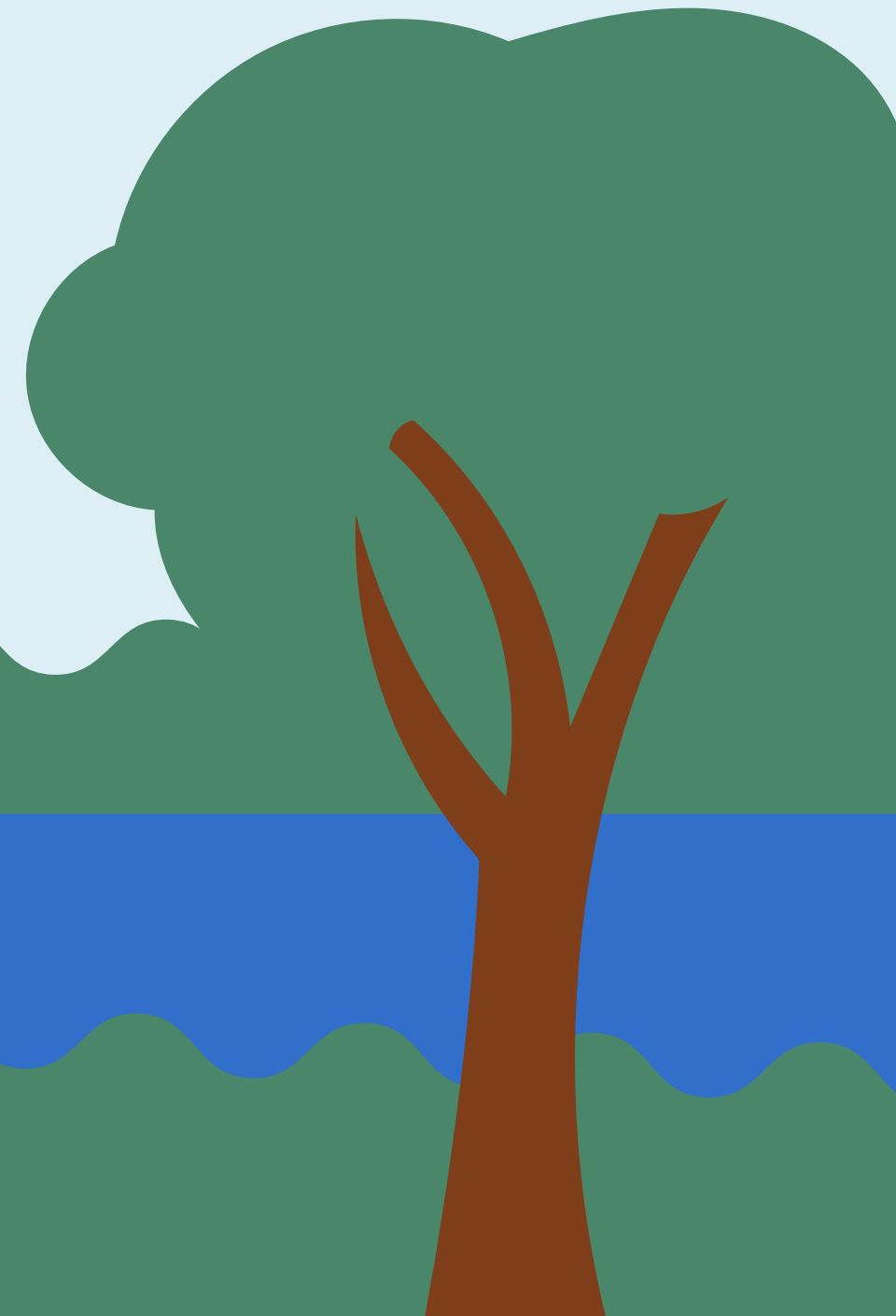
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DISTANCE VS DISPLACEMENT



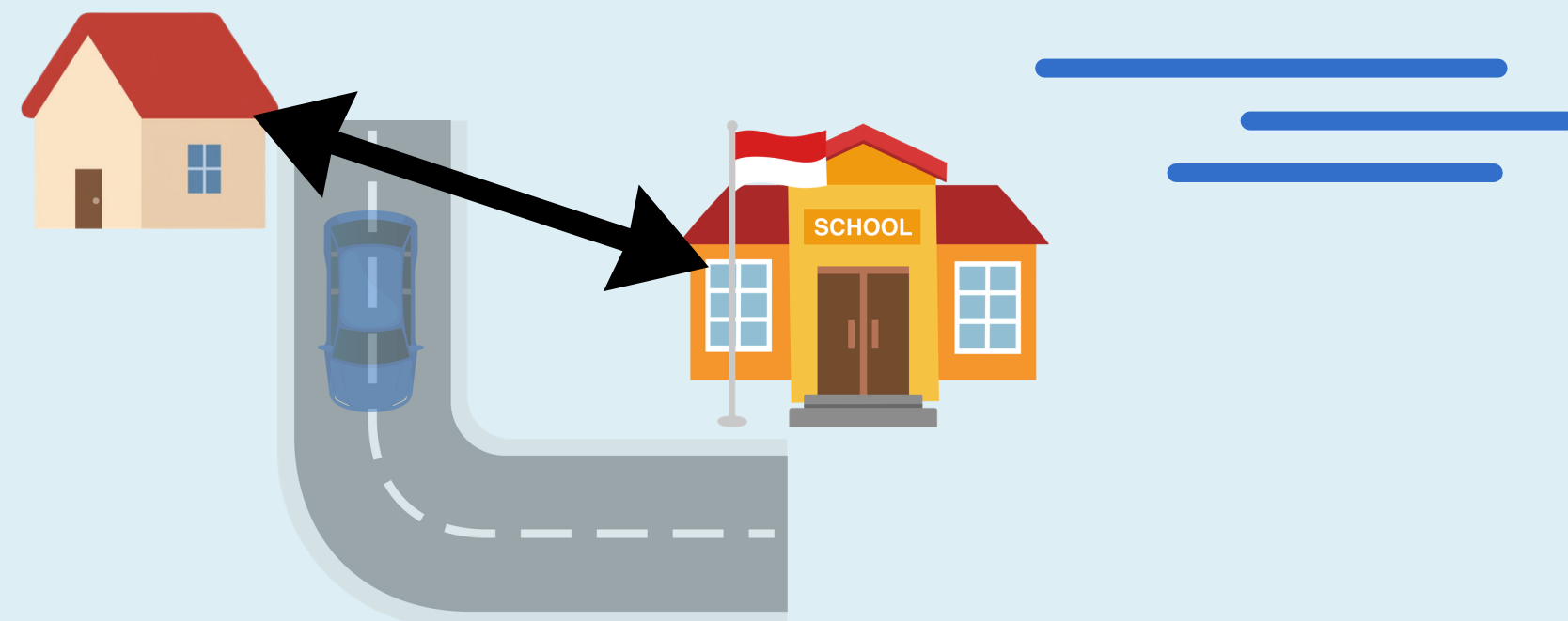
DISTANCE

Distance is a **scalar** quantity that refers to how much ground an object has covered during its motion. For example, the distance the car has travelled from a house to the school.



DISPLACEMENT

Displacement is a **vector** quantity that refers to the straight-line distance travelled in a particular direction (between the initial and final point). For example, if a car moves from a house to the school, its displacement is the relative distance of the house (initial point) to the school (final point).



Practice



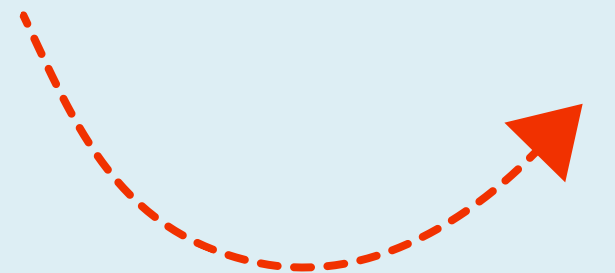
A person walks from point A to point B to point C, then back to point B along the line shown in the figure above.

- Find the distance covered by the person.
- Find the magnitude and direction of the displacement of the person.

For more examples, please visit:

<https://dashboard.blooket.com/set/6997fd6d52d9b3ba7fb39298>

SOLUTION IN NEXT SLIDE





SOLUTION



a)

$$AB = 5 \text{ km}$$

$$BC = 4 \text{ km}$$

$$CB = 4 \text{ km}$$

$$\begin{aligned} \text{Total distance covered} &= AB + BC + CB \\ &= 5 \text{ km} + 4 \text{ km} + 4 \text{ km} \\ &= 13 \text{ km} \end{aligned}$$

b)

$$\begin{aligned} \text{Magnitude of displacement} &= \\ \text{distance between initial and final point} &= AB = 5 \text{ km} \end{aligned}$$

$$\begin{aligned} \text{Direction of displacement} &= \text{direction} \\ \text{from A} \rightarrow \text{B} &= \text{right} \end{aligned}$$

**The distance covered by the person is 13 km.
The displacement of the person is 5 km to the right.**

SPEED and VELOCITY



WHAT IS SPEED?

Speed shows how fast an object is moving.

Speed = distance ÷ time

Speed does not include direction
(only how fast, not which way)

Example:

A runner runs 60 meters in 10 seconds, so his speed is 6 meters per second.



WHAT IS VELOCITY?

Velocity is speed in a particular direction.

Velocity = increase in displacement \div time

Velocity changes if the speed or the direction changes.

Example:

A swimmer moves 25 meters east in 20 seconds, so her velocity is 1.25 meters per second east.



PRACTICE

A cyclist travels 150 meters north in 30 seconds, then 50 meters south in 10 seconds.

- a) Find the cyclist's average speed.
- b) Find the cyclist's average velocity.



SOLUTION:

a)

Total distance = 150 m + 50 m = 200 m

Total time = 30 s + 10 s = 40 s

Average speed = total distance ÷ total time

Average speed = 200 m ÷ 40 s = 5 m/s

b)

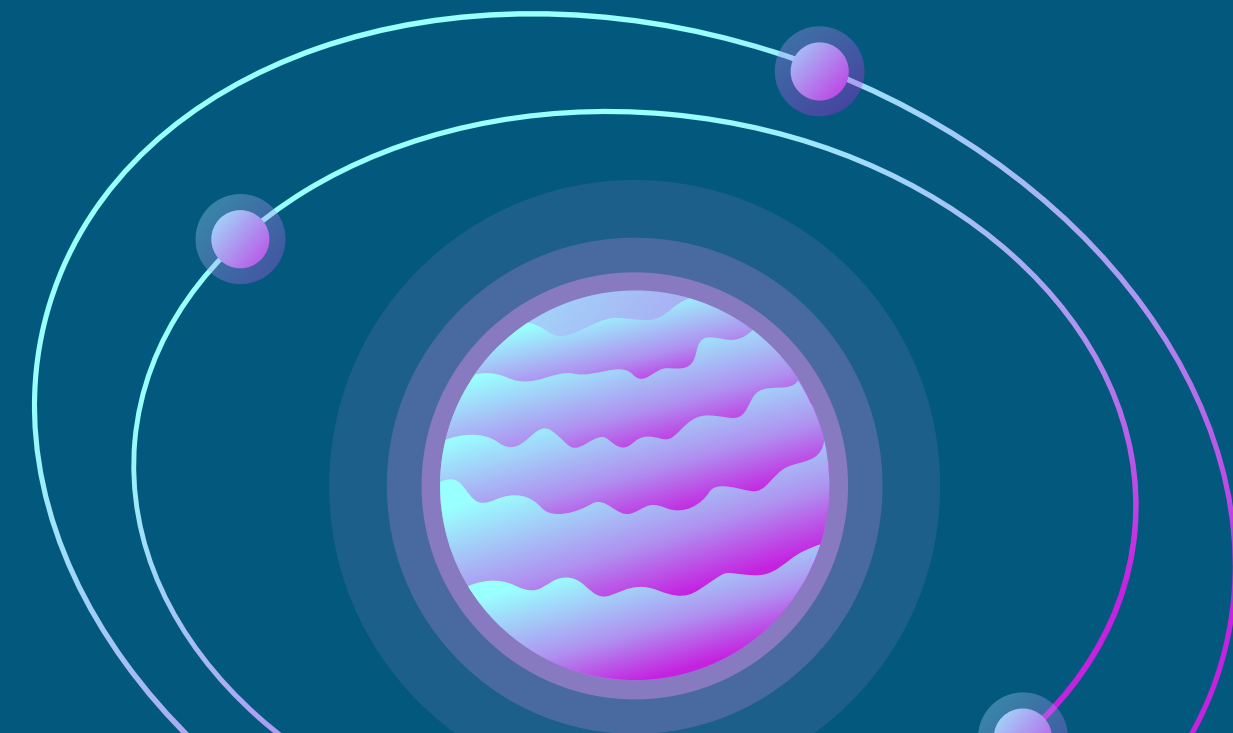
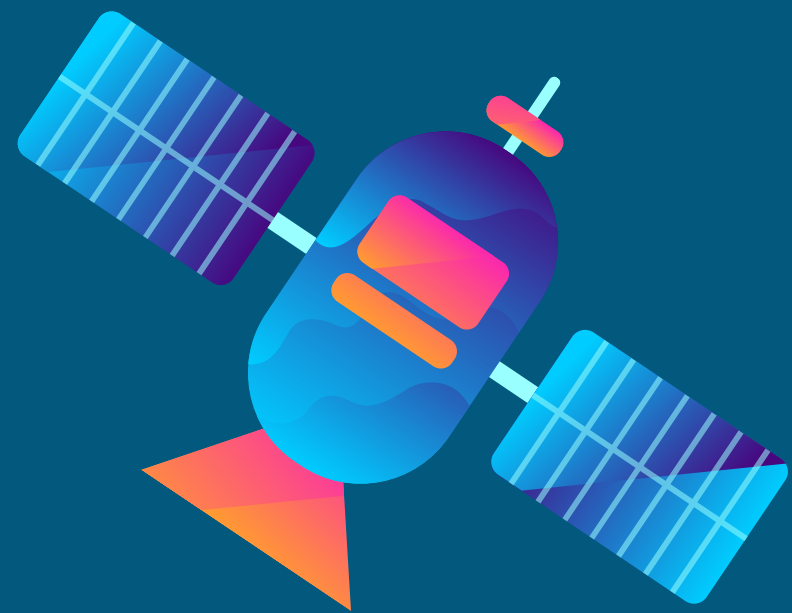
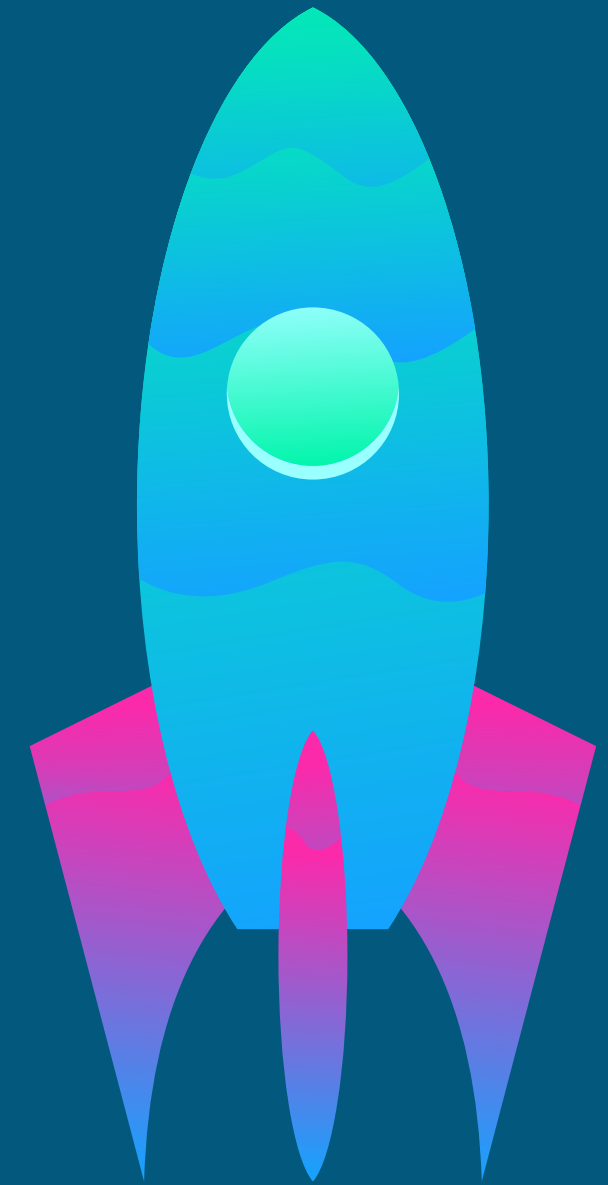
Displacement = 150 m - 50 m south = 100 m north

Average velocity =

increase in displacement ÷ time = 100 m ÷ 40 s
= 2.5 m/s north

The cyclist's average speed is 5 m/s and the cyclist's average velocity is 2.5 m/s north.

Acceleration





What is Acceleration?

Acceleration is the rate at which objects change their velocity with respect to time, It measures how quickly an object speeds up, slows down, or changes direction.



The Acceleration Formula

$$a = \frac{\text{change in velocity}}{\text{time taken}} \quad \text{or}$$

$$a = (v - u)/t$$

a = acceleration
v = final velocity
u = initial velocity
t = time





Practice

A rocket starts from 0 m/s and reaches 500 m/s in 10 seconds. Calculate its acceleration!

SOLUTION IN
NEXT SLIDE

