Motion worksheet 4

Average Speed and velocity

Speed links to distance

Velocity links to displacement

I.e vectors link with other vectors

And scalars link with scalars.

Average speed

To calculate the speed an object travelled you need to use the total distance it covered and the total time it took to cover it

$$\text{Speed (v)} = \frac{distance}{time}$$

$$v = \frac{\Delta x}{\Delta t}$$

Average velocity

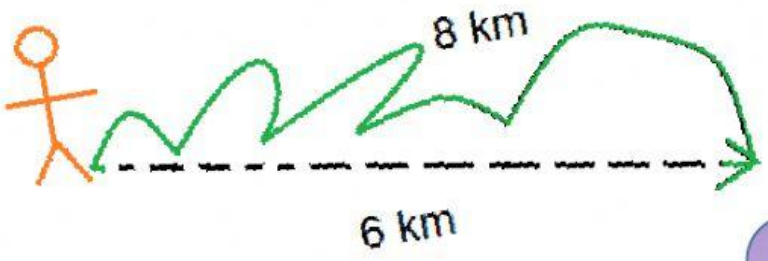
To calculate the velocity an object travelled you need to use the total displacement it covered and the total time it took to cover it.

$$\text{velocity } (\vec{v}) = \frac{displacement}{time}$$

$$\vec{v} = \frac{\vec{\Delta x}}{\Delta t}$$

Examples

Siya walks to the shop in 70 minutes along a 8 km winding path



Remember to use distance when you are calculating the speed

And to use displacement when you are calculating the velocity

Calculate his:

1.1 speed (which is a scalar)

$$v = \frac{\Delta x}{\Delta t}$$

*remember to convert the distance to meters and the time to seconds

$$= \frac{8\ x\ 1000}{70\ x\ 60}$$

= 1,9 $m.s^{-1}$ (speed does not require a direction)

1.2 velocity (which is a vector)

Conversions: km to m (x 1000)

Minutes to seconds (x60)

$$v = \frac{\Delta x}{\Delta t}$$

$$= \frac{6\ x\ 1000}{70\ x\ 60}$$

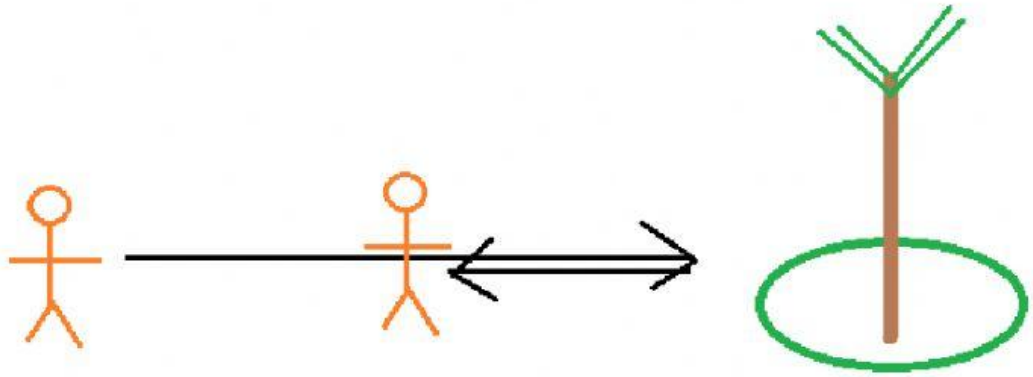
= 1,43 $m.s^{-1}$ right {it requires a direction, since it is a vector}

2. If Joshua walks 3000 m to the right towards the park and then he turns around at then walks 1000 m to the left. The walks takes him one hour to complete.

What is his

2.1 speed and

2.2 velocity



2.1 $v = \frac{\Delta x}{\Delta t}$

$= \frac{4000}{1\ x\ 60x\ 60}$

$= 1{,}11\ m.s^{-1}$

Remember to use distance when you are calculating the speed

And to use displacement when you are calculating the velocity

2.2 $v = \frac{\Delta x}{\Delta t}$

$= \frac{2000}{1\ x\ 60\ x\ 60}$

$= 0{,}56\ m.s^{-1}$ right

Hours to seconds (x60 x 60)

Thus multiply by 3600

3. Luthando runs around a 400 m athletic track and ends back at the starting point. This takes her 50 seconds.

What is her

3.1 speed and

3.2 velocity

3.1 $v = \frac{\Delta x}{\Delta t}$

$= \frac{400}{50}$

= 8 $m.s^{-1}$ right

3.2 $v = \frac{\Delta x}{\Delta t}$

$= \frac{0}{50}$

= 0 $m.s^{-1}$ {the direction is not necessary when the answer is zero, even if it is a vector}

Instantaneous velocity- is the displacement (or change in position) divided by an infinitesimal (very small) time interval

Instantaneous speed – is the magnitude of the instantaneous velocity

Exercise 5

You will need to complete this exercise in your book and then send it to your teacher via MS teams

Speed and velocity

1. A bird flies 2 km west and then turns around and flies 1,5 km east. It completes the journey in 1,5 mins. Determine: **{remember to convert to meters}**

1.1 The distance she covered (Δx)

1.2 Her total displacement ($\vec{\Delta x}$)

1.3 her average speed (v)

1.4 her average velocity ($\vec{v}$)

2 Ayanda walks to the playground (which is 3km directly north) from her house). She realises that she forgot to take her jump rope so she turns back and walks back home. The journey takes her 40 mins. Determine:

2.1 The distance she covered (Δx)

2.2 Her total displacement ($\vec{\Delta x}$)

2.3 her average speed (v)

2.4 her average velocity ($\vec{v}$)

3 Tasmin is training for a marathon. She runs to the shops, which is 8 km east of her house and then runs 6 km west to the park in 50 mins. Calculate:

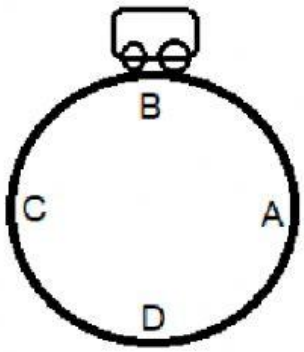
3.1 The distance she covered (Δx)

3.2 Her total displacement ($\vec{\Delta x}$)

3.3 her average speed (v)

3.4 her average velocity ($\vec{v}$)

4. Consider a car travelling around a circular track at a constant speed, while it travels the circumference of 200m in 20s.



Calculate

4.1 the average speed of the car at any point.

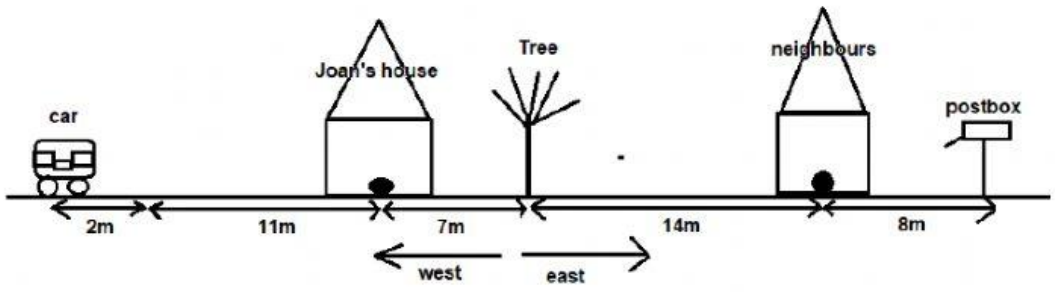
4.2 the average velocity from point A to point C

*Hint you will need to calculate the diameter of the circle here

4.3 the average velocity in completing one circuit.

5. Joan decided to go for a walk, starting from her house.

The diagram below shows the measurements between places on the route where she walks.



Take Joan's house as the point of reference and East as a positive direction.

Joan walks to the post box and home again.

She leaves home at 11.05 a.m and on the way stops off at her neighbour's house for a chat.

She returns home at 11.37.a.m.

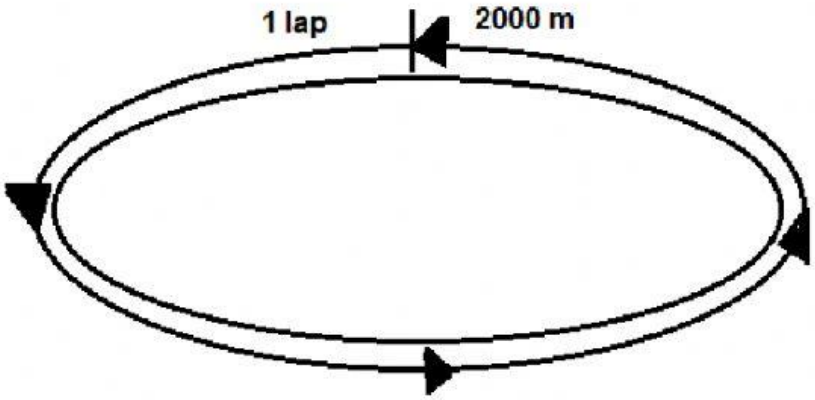
Calculate the

5.1 the distance Joan walks

5.2 Joan's displacement as she reaches home.

5.3 the average speed for Joan's journey (in $m.s^{-1}$)

6. start/finish



An oval racetrack has a lap distance of 2 000 m. A car has to complete five laps for the test.

6.1 During lap 3, which was the fastest lap trial, the driver cover track in a time of 51,43 seconds.

6.1.1 Calculate his average speed (in $m.s^{-1}$) for this lap.

6.1.2 Convert your answer in 6.3.1 to $km.h^{-1}$ and round off to the nearest whole number.

6.2 The entire 5 lap test time results are as follows

lap number	time taken (s)
1	52,07
2	52,99
3	51,43
4	52,11
5	
	Total : 261,10

6.2.1 Find the time taken for lap 5.

6.2.2 Calculate his average speed for the entire test.

7. A car travels 900 m due North from point A to point B in 15 seconds. It stops for 5 seconds. The car then turns a corner and travels to point C, 400 m due West in 10 seconds.

Calculate:

7.1 the total distance covered by the car

7.2 the total displacement covered by the car

7.3 the average speed of the car as it travels from A to B

7.4 the average velocity of the car as it travels from A to C

I have completed this worksheet and submitted my answers on teams ☺