

# Speed and velocity worksheet

## Questions

1. A car travels 100 km north in 2 hours, then 50 km east in 1 hour. Calculate the car's average speed and average velocity.

( need Pythagoras)

2. A runner completes a 400-meter circular track in 80 seconds. Calculate the runner's average speed and the average velocity at the end of the lap.

3. A plane flies 600 km due east in 3 hours and then 800 km due north in 4 hours. Calculate the plane's average speed and its average velocity over the entire journey.

( need Pythagoras)

4. A cyclist travels 30 km west in 2 hours, stops for 30 minutes, then rides 40 km south in 3 hours. Calculate the average speed and average velocity.

( need Pythagoras)

5. A boat sails 120 km downriver in 4 hours and then 80 km upriver in 5 hours. Calculate the boat's average speed and its average velocity over the entire trip.

6. A drone flies 500 meters north in 50 seconds, then 200 meters east in 20 seconds. Calculate the drone's average speed and average velocity.

( need Pythagoras)

7. A hiker walks 10 km up a mountain in 5 hours and then returns by a shorter 8 km route downhill in 2 hours. Calculate the hiker's average speed and average velocity.

8. A train moves 200 km west in 2 hours, then 300 km south in 3 hours. Calculate the train's average speed and average velocity over the entire trip.

( need Pythagoras)

Answer

Question 1:

A car travels 100 km north in 2 hours, then 50 km east in 1 hour. Calculate the car's average speed and average velocity.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance North = 100 km

- Distance East = 50 km

- Total Distance = 100 km + 50 km = 150 km

- Total Time:

- Time = 2 hours + 1 hour = 3 hours

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed = 150 km / 3 hours = 50 km/h

- Displacement (Velocity):

- Displacement =  $\sqrt{(100 \text{ km}^2 + 50 \text{ km}^2)} = \sqrt{(10000 + 2500)} = \sqrt{12500} \text{ km} = 111.8 \text{ km}$

- Average Velocity:

- Average Velocity = Displacement / Total Time

- Average Velocity = 111.8 km / 3 hours = 37.3 km/h

Question 2:

A runner completes a 400-meter circular track in 80 seconds. Calculate the runner's average speed and the average velocity at the end of the lap.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance = 400 meters (since the track is circular, distance is the same as the length of the track)

- Total Time:

- Time = 80 seconds

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed = 400 meters / 80 seconds = 5 m/s

- Displacement (Velocity):

- Since the runner returns to the starting point, Displacement = 0 meters

- Average Velocity:

- Average Velocity = Displacement / Total Time

- Average Velocity = 0 meters / 80 seconds = 0 m/s

Question 3:

A plane flies 600 km due east in 3 hours and then 800 km due north in 4 hours. Calculate the plane's average speed and its average velocity over the entire journey.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance East = 600 km

- Distance North = 800 km

- Total Distance = 600 km + 800 km = 1400 km

- Total Time:

- Time = 3 hours + 4 hours = 7 hours

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed =  $1400 \text{ km} / 7 \text{ hours} = 200 \text{ km/h}$
- Displacement (Velocity):
  - Displacement =  $\sqrt{(600 \text{ km}^2 + 800 \text{ km}^2)} = \sqrt{(360000 + 640000)} = \sqrt{1000000} \text{ km} = 1000 \text{ km}$
- Average Velocity:
  - Average Velocity = Displacement / Total Time
  - Average Velocity =  $1000 \text{ km} / 7 \text{ hours} = 142.9 \text{ km/h}$

Question 4:

A cyclist travels 30 km west in 2 hours, stops for 30 minutes, then rides 40 km south in 3 hours. Calculate the average speed and average velocity.

Step-by-Step Calculation:

- Total Distance (Speed):
  - Distance West = 30 km
  - Distance South = 40 km
  - Total Distance =  $30 \text{ km} + 40 \text{ km} = 70 \text{ km}$
- Total Time:
  - Time =  $2 \text{ hours} + 0.5 \text{ hours (30 minutes)} + 3 \text{ hours} = 5.5 \text{ hours}$
- Average Speed:
  - Average Speed = Total Distance / Total Time
  - Average Speed =  $70 \text{ km} / 5.5 \text{ hours} = 12.7 \text{ km/h}$
- Displacement (Velocity):
  - Displacement =  $\sqrt{(30 \text{ km}^2 + 40 \text{ km}^2)} = \sqrt{(900 + 1600)} = \sqrt{2500} \text{ km} = 50 \text{ km}$
- Average Velocity:
  - Average Velocity = Displacement / Total Time
  - Average Velocity =  $50 \text{ km} / 5.5 \text{ hours} = 9.1 \text{ km/h}$

Question 5:

A boat sails 120 km downriver in 4 hours and then 80 km upriver in 5 hours. Calculate the boat's average speed and its average velocity over the entire trip.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance Downriver = 120 km

- Distance Upriver = 80 km

- Total Distance = 120 km + 80 km = 200 km

- Total Time:

- Time = 4 hours + 5 hours = 9 hours

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed = 200 km / 9 hours = 22.2 km/h

- Displacement (Velocity):

- Displacement = 120 km - 80 km = 40 km (net displacement downriver)

- Average Velocity:

- Average Velocity = Displacement / Total Time

- Average Velocity = 40 km / 9 hours = 4.4 km/h

Question 6:

A drone flies 500 meters north in 50 seconds, then 200 meters east in 20 seconds. Calculate the drone's average speed and average velocity.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance North = 500 meters

- Distance East = 200 meters

- Total Distance = 500 meters + 200 meters = 700 meters

- Total Time:

- Time = 50 seconds + 20 seconds = 70 seconds

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed = 700 meters / 70 seconds = 10 m/s

- Displacement (Velocity):

- Displacement =  $\sqrt{(500 \text{ meters}^2 + 200 \text{ meters}^2)} = \sqrt{(250000 + 40000)} = \sqrt{290000} \text{ meters} = 538.5 \text{ meters}$

- Average Velocity:

- Average Velocity = Displacement / Total Time

- Average Velocity = 538.5 meters / 70 seconds = 7.7 m/s

Question 7:

A hiker walks 10 km up a mountain in 5 hours and then returns by a shorter 8 km route downhill in 2 hours. Calculate the hiker's average speed and average velocity.

Step-by-Step Calculation:

- Total Distance (Speed):

- Distance Up = 10 km

- Distance Down = 8 km

- Total Distance = 10 km + 8 km = 18 km

- Total Time:

- Time = 5 hours + 2 hours = 7 hours

- Average Speed:

- Average Speed = Total Distance / Total Time

- Average Speed = 18 km / 7 hours = 2.57 km/h

- Displacement (Velocity):

- Since the hiker returns to the starting point, Displacement = 0 km
- Average Velocity:
- Average Velocity = Displacement / Total Time
- Average Velocity = 0 km / 7 hours = 0 km/h

Question 8:

A train moves 200 km west in 2 hours, then 300 km south in 3 hours. Calculate the train's average speed and average velocity over the entire trip.

Step-by-Step Calculation:

- Total Distance (Speed):
- Distance West = 200 km
- Distance South = 300 km
- Total Distance = 200 km + 300 km = 500 km
- Total Time:
- Time = 2 hours + 3 hours = 5 hours
- Average Speed:
- Average Speed = Total Distance / Total Time
- Average Speed = 500 km / 5 hours = 100 km/h
- Displacement (Velocity):
- Displacement =  $\sqrt{(200 \text{ km})^2 + (300 \text{ km})^2} = \sqrt{40000 + 90000} = \sqrt{130000} \text{ km} = 360.6 \text{ km}$
- Average Velocity:
- Average Velocity = Displacement / Total Time
- Average Velocity = 360.6 km / 5 hours = 72.1 km/h