CALCULATING VELOCITY

An object's **speed** is how fast the object is moving. When the speed of an object is steady, you can calculate the speed of that object by dividing the distance that the object moved by the time it spent moving. Speed is measured in units of distance per unit of time, such as meters per second or kilometers per hour.

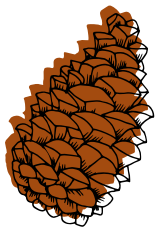
An object's **velocity** has two parts: the object's speed and the direction of its movement. So, to find an object's velocity, first calculate its speed and then indicate the direction of its movement.

Let's practice with an example!
A car traveled 135 miles west at a constant velocity. It traveled that distance in 3 hours.

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{135 \text{ miles}}{3 \text{ hours}} = 45 \text{ miles per hour}$$

velocity = 45 miles per hour to the west

Find the velocity! Write and solve an equation for each problem.



1. A pine cone fell 240 centimeters straight down at a constant velocity. It fell that distance in 2.5 seconds. What was its velocity?

$$\frac{240 \text{ centimeters}}{2.5 \text{ seconds}} = 96 \text{ centimeters per second straight down}$$

2. In 1.8 hours, a sailboat sailed 81 kilometers east across the sea at a constant velocity. What was the sailboat's velocity?

$$\frac{81 \text{ kilometers}}{1.8 \text{ hours}} = 45 \text{ kilometers per hour to the east}$$

3. A remote-controlled drone was 924 meters away from a large oak tree. It flew north at a constant velocity and reached the oak tree in 88.0 seconds. What was the drone's velocity?

$$\frac{924 \text{ meters}}{88.0 \text{ seconds}} = 10.5 \text{ meters per second to the north}$$

4. A raindrop fell straight toward the ground at a constant velocity for 4.0 seconds. In that time, it fell 8.8 meters. While falling, the raindrop passed a flower petal that was falling at 1 meter per second. What was the raindrop's velocity?

$$\frac{8.8 \text{ meters}}{4.0 \text{ seconds}} = 2.2 \text{ meters per second straight towards the ground}$$

5. Andrew was biking west at a constant velocity. He biked 840 meters, which took him 5.6 minutes. During that time, Andrew passed a woman walking at 54 meters per minute. What was Andrew's velocity?

$$\frac{840 \text{ meters}}{5.6 \text{ seconds}} = 150 \text{ meters per minute to the west}$$

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Keep going! Write and solve an equation for each problem.

6. A pigeon was 240 meters south of an apartment building. The pigeon then flew north at a constant velocity, and in 15 seconds, it had flown halfway to the apartment building. What was the pigeon's velocity?

$\frac{240 \text{ meters}}{2} = 120 \text{ meters}$

$\frac{120 \text{ meters}}{15 \text{ seconds}} = 8 \text{ meters per second to the north}$

7. Rosie ran directly toward her home at a constant velocity for 78 seconds. In one-third of that time, she ran 52 meters. What was Rosie's velocity?

$\frac{78 \text{ seconds}}{3} = 26 \text{ seconds}$

$\frac{52 \text{ meters}}{26 \text{ seconds}} = 2 \text{ meters per second directly towards her home}$

8. Anna and Sarah were both competing in the 100 meter dash. They started at one end of the track and raced toward the finish line. Anna ran the first 20.5 meters of the race in 2.5 seconds, and Sarah ran the first 40.0 meters in 5.0 seconds. Assuming both of their velocities remained constant, who crossed the finish line first?

Anna's velocity = $\frac{20.5 \text{ meters}}{2.5 \text{ seconds}} = 8.2$ meters per second towards the finish line

Sarah's velocity = $\frac{40.0 \text{ meters}}{5.0 \text{ seconds}} = 8.0$ meters per second towards the finish line

Anna's velocity was greater than Sarah's velocity, so Anna won the race.

9. Quinn and Shawnak are training for a triathlon. They both swim in Birch Lake as a part of their training. One morning, Quinn swam south at a constant velocity for 12.5 minutes. He swam 615 meters in that time. Later that day, Shawnak swam south at a constant velocity for 10.0 minutes. He swam 484 meters in that time. Who swam at a greater velocity, Quinn or Shawnak?

Shawnak's velocity = $\frac{484 \text{ meters}}{10.0 \text{ minutes}} = 48.4$ meters per minute to the south

Quinn's velocity = $\frac{615 \text{ meters}}{12.5 \text{ minutes}} = 49.2$ meters per minute to the south

Quinn swam at a greater velocity than Shawnak.

10. The Ming family and the Harmon family are taking a road trip together but in separate cars. A few hours into the trip, both cars are traveling due east at a constant velocity. During that time, the Ming family's car traveled 33 miles in 0.6 hours, and the Harmon family's car traveled 90 miles in 1.5 hours. Which family's car had the greater velocity?

The Ming car's velocity = $\frac{33 \text{ miles}}{0.6 \text{ hours}} = 55$ miles per hour to the east

The Harmon car's velocity = $\frac{90 \text{ miles}}{1.5 \text{ hours}} = 60$ miles per hour to the east

The Harmon family's car had the greater velocity.