Average Speed and Average Velocity Practice

Problem #1:

What is the average speed of my bunny rabbit when she hops 6 meters to the east across the room in 11 seconds? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #2:

What is the average velocity of my bunny rabbit when she hops 6 meters to the east across the room in 11 seconds? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #3:

What is the average speed across my bunny's entire trip when she hops 6 meters to the east across the room in 11 seconds and then takes another 12 seconds to hop back to her initial position? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #4:

What is the average velocity across my bunny's entire trip when she hops 6 meters to the east across the room in 11 seconds and then takes another 12 seconds to hop back to her initial position? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #5:

What is my average speed when it takes me 2 minutes to ride my bicycle all the way around a circular track with a radius of 65 meters? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #6:

What is my average velocity when it takes me 2 minutes to ride my bicycle all the way around a circular track with a radius of 65 meters? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #7:

What is Otter's average speed over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters **south**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #8:

What is Otter's average velocity over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters **south**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #9:

What is Otter's average speed over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters to the **west**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Problem #10:

What is Otter's average velocity over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters to the **west**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

Solutions

Problem #1:

What is the **average speed** of my bunny rabbit when she hops 6 meters to the east across the room in 11 seconds? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

$$average\ speed = \frac{6\ m}{11\ s}$$

$$average\ speed = 0.55\ m/s$$

Problem #2:

What is the **average velocity** of my bunny rabbit when she hops 6 meters to the east across the room in 11 seconds? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

$$average\ velocity = \frac{6\ m\ to\ the\ east}{11\ s}$$

$$average\ velocity = 0.55\frac{m}{s}\ to\ the\ east$$

Problem #3:

What is the average speed across my bunny's entire trip when she hops 6 meters to the east across the room in 11 seconds and then takes another 12 seconds to hop back to her initial position? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

$$average\ speed = \frac{(6\ m + 6\ m)}{(11\ s + 12\ s)}$$

$$average\ speed = \frac{12\ m}{23\ s}$$

$$average\ speed = 0.52\ m/s$$

Problem #4:

What is the average velocity across my bunny's entire trip when she hops 6 meters to the east across the room in 11 seconds and then takes another 12 seconds to hop back to her initial position? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

$$average\ velocity = \frac{displacement}{time} = \frac{(final\ position - initial\ position)}{time}$$

Because the bunny's initial and final positions are the same place, her displacement is zero, which is the same as 0 meters.

$$average\ velocity = \frac{0\ m}{(11\ s + 12\ s)}$$

$$average\ velocity = \frac{0\ m}{23\ s}$$

$$average\ velocity = 0\ m/s$$

Note: Even though average velocity is a vector quantity, it has no direction when it is equal to zero.

Problem #5:

What is my average speed when it takes me 2 minutes to ride my bicycle all the way around a circular track with a radius of 65 meters? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

The problem statement says I went all the way around a circular track. So, to find my distance traveled, I just need to find the circumference of the track. The circumference of a circle with radius r is equal to

$$circumference = 2\pi r$$

The radius of the track is 65 meters, and so my distance traveled is

$$distance = 2\pi(65\ m)$$

$$distance \approx 408.407\ m$$

Note: Whenever possible, you should avoid rounding until the end of the problem. So, even though I rounded the distance above, I will keep all of the decimal places in my calculator when I perform the final calculations.

$$average\ speed = \frac{408.407\ m}{2\ min}$$

$$average\ speed = \frac{408.407\ m}{2\ min} \times \frac{1\ min}{60\ s} = \frac{408.407\ m}{120\ s}$$

$$average\ speed = 3.40\ m/s$$

Problem #6:

What is my average velocity when it takes me 2 minutes to ride my bicycle all the way around a circular track with a radius of 65 meters? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

$$average\ velocity = \frac{displacement}{time} = \frac{(final\ position - initial\ position)}{time}$$

Because I rode all the way around the track, my initial and final positions are in the same place. Thus, my displacement over the trip is zero, which is the same as 0 meters.

$$average\ velocity = \frac{0m}{2\ min}$$

$$average\ velocity = 0\ m/s$$

Note: Even though average velocity is a vector quantity, it has no direction when it is equal to zero.

Problem #7:

What is Otter's average speed over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters **south**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

$$average\ speed = \frac{(100\ m + 70\ m)}{(2\ min + 1\text{min})}$$

$$average\ speed = \frac{170\ m}{3\ min}$$

$$average\ speed = \frac{170\ m}{3\ min} \times \frac{1\ min}{60\ s} = \frac{170\ m}{180\ s}$$

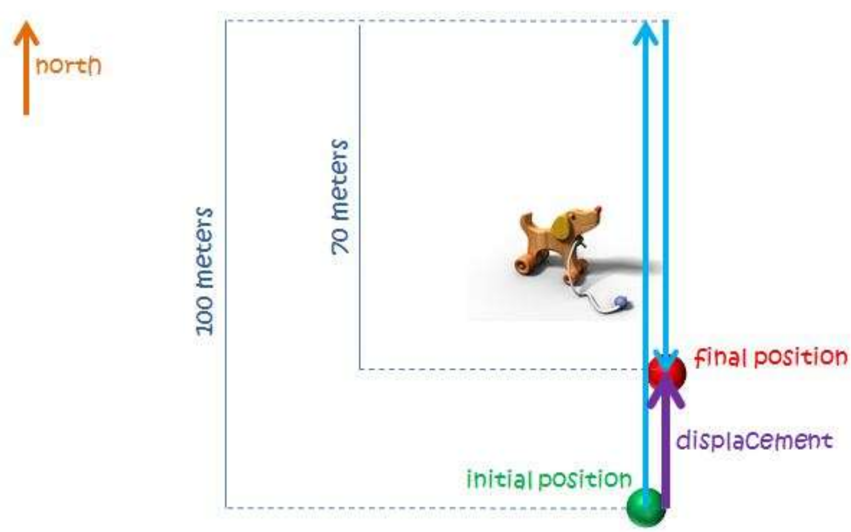
$$average\ speed = 0.94\ m/s$$

Problem #8:

What is Otter's average velocity over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters **south**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

Otter's displacement is just how far he ends up from where he started (as the crow flies) and in which direction. If he walked 100 meters north and then turned around and walked 70 meters south, he ended up 30 meters north of where he started. Thus, Otter's displacement over his entire trip is 30 meters to the north. ***See the image below.***



$$average\ velocity = \frac{30\ m\ to\ the\ north}{(2\ min + 1\text{min})}$$

$$average\ velocity = \frac{30\ m\ to\ the\ north}{3\ min}$$

$$average\ velocity = \frac{30\ m\ to\ the\ north}{3\ min} \times \frac{1\ min}{60\ s} = \frac{30\ m\ to\ the\ north}{180\ s}$$

$$average\ velocity = 0.17 \frac{m}{s} to\ the\ north$$

Problem #9:

What is Otter's average speed over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters to the **west**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

$$average\ speed = \frac{(100\ m + 70\ m)}{(2\ min + 1 min)}$$

$$average\ speed = \frac{170\ m}{3\ min}$$

$$average\ speed = \frac{170\ m}{3\ min} \times \frac{1\ min}{60\ s} = \frac{170\ m}{180\ s}$$

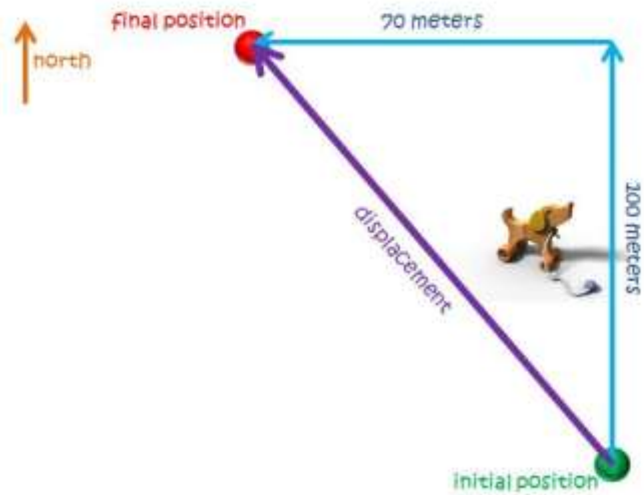
$$average\ speed = 0.94\ m/s$$

Problem #10:

What is Otter's average velocity over his entire trip when it takes him 2 minutes to walk 100 meters **north** and another 1 minute to walk 70 meters to the **west**? Express your answer using the proper SI units. Round your answer to two decimal places, and include a direction if necessary.

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

Because Otter moves first north and then west, we can draw a right triangle representing his motion with the two legs of his journey as the short sides of the triangle and his displacement as the hypotenuse. ***See the image below.***



Because we know the length of two sides of the right triangle created by Otter's motion, we can use the Pythagorean Theorem to find the length of the unknown side, which is also Otter's displacement. The Pythagorean Theorem says

$$A^2 + B^2 = C^2$$

where *A* and *B* are the short sides of a right triangle and *C* is the hypotenuse. When we plug in the information from the image above, the Pythagorean Theorem becomes

$$(70\ m)^2 + (100\ m)^2 = C^2$$

$$14{,}900\ m^2 = C^2$$

$$\sqrt{14{,}900\ m^2} = C$$

$$122.066\ m \approx C$$

$$displacment \approx 122.066\ m\ to\ the\ northwest$$

Note: Whenever possible, you should avoid rounding until the end of the problem. So, even though I rounded the displacement above, I will keep all of the decimal places in my calculator when I perform the final calculations.

$$average\ velocity = \frac{122.066\ m\ to\ the\ northwest}{(2\ min + 1min)}$$

$$average\ velocity = \frac{122.066\ m\ to\ the\ northwest}{3\ min}$$

$$average\ velocity = \frac{122.066\ m\ to\ the\ northwest}{3\ min} \times \frac{1\ min}{60\ s} = \frac{122.066\ m\ to\ the\ northwest}{180\ s}$$

$$average\ velocity = 0.68 \frac{m}{s}\ to\ the\ northwest$$