

Echolocation Worksheet **Answers**

1. John and Sally are going to race their robots. John and Sally's robots begin the race at exactly the same time. If John takes 22 seconds to finish the race, and Sally takes 24 seconds, who won?

Please circle your answer: **John** Sally

2. John and Sally are very competitive, so they are once again settling an argument by using their robots. Each robot is fitted with an ultrasonic sensor so it knows when to turn around before hitting the wall and come back to the starting line. The wall is 4 feet from the starting line. John and Sally start at the exact same time from the starting line. John's ultrasonic sensor threshold is set to < 12 inches, and Sally's is set to < 23 centimeters. John's robot takes 18 seconds round trip, and Sally's takes 20 seconds. Who won the race in the fastest time?

Circle your answer: **John** Sally

3. Using the information in question 2, whose sensor detects the wall first?

Circle your answer: **John** Sally

Please justify your answer:

Example answer: Since John won the race, he should be able to detect the wall at an earlier time. And, 12 inches is longer than 23 cm, so John's threshold of <12 inches is tripped sooner than Sally's.

4. Using the information in question 2, how fast are John and Sally's robots traveling? (Show your work.)

round trip = 8 ft = 12(8)(2.54) cm

John: 243 cm/18s = 13.55 cm/s

Sally: 243 cm/20s = 12.19 cm/s

5. Does increasing the sensor's threshold value of John's robot from < 12 to < 15 inches help him detect the wall sooner or later than if he kept it at 12 inches?

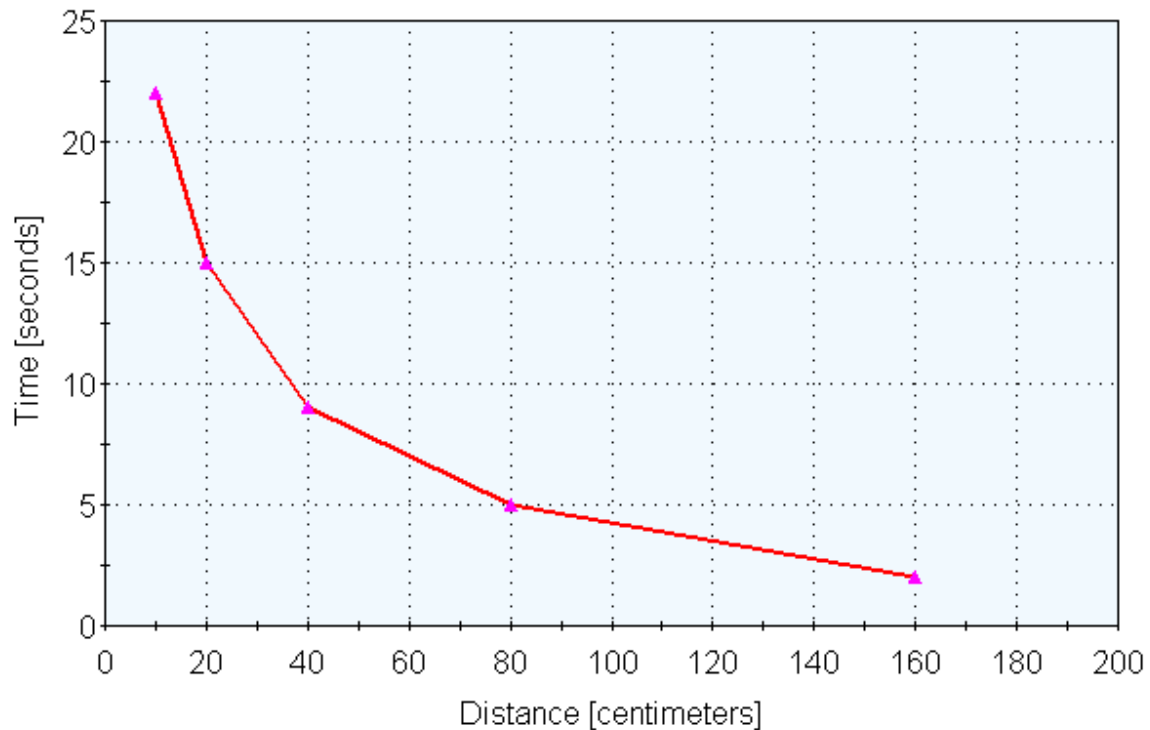
Please circle one: **Sooner** Later

Name: _____ Date: _____ Class: _____

6. Graph the following data from Sally testing her ultrasonic sensor's threshold and how long it took her robot to detect the wall before triggering it to turn around.

Data: (10 cm, 22 s), (20 cm, 15 s), (40 cm, 9 s), (80 cm, 5 s), (160 cm, 2 s)

Time vs Distance



7. Refer to question 6 and the graph. For which threshold distance does the robot take the longest to respond to the wall? Please circle your answer:

10 cm 20 cm 40 cm 80 cm 160 cm

8. Refer to question 6 and the graph. For which threshold distance does the robot take the least time to respond to the wall? Please circle your answer:

10 cm 20 cm 40 cm 80 cm **160 cm**

9. Describe how an ultrasonic sensor interacts with its environment.

Example answer: An ultrasonic sensor emits/makes a high-frequency/pitched noise that bounces/echoes/reflects off surfaces and returns back to the sensor. Half the time it takes for the sound wave to return to the sensor can be used to determine the distance the sensor is to the object. This is directly similar to how a bat's echolocation works.

10. From what animal could the ultrasonic sensor have been modeled?

Example answer: Bats, whales and dolphins are all animals that the ultrasonic sensor could have been modeled after.