

Self-Driving Cars

Answer Key

Name: _____

Date: _____

Vocabulary

LiDAR - A technology that uses lasers to measure distances and create 3D maps of objects. Stands for Light Detection And Ranging.

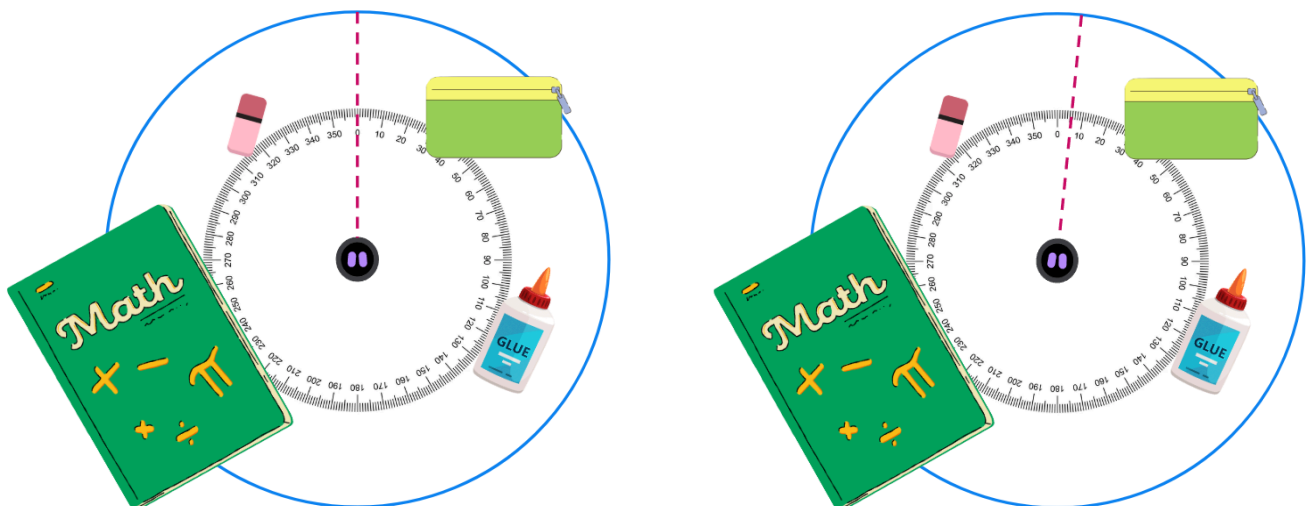
Time-of-Flight Sensor - A sensor that emits a signal and calculates the distance to an object based on how long it takes for the signal to return.

Point Cloud - A set of data containing points, each point representing a position in 3-dimensional space. The points together create a visual representation of an object.

Activity 1

For this activity, you will split your group into builders and mappers. The builders will create “buildings” around Ari using materials provided by your teacher. It’s the mappers’ job to carefully collect data points in order to try to reconstruct a point cloud map of Ari’s surroundings.

- ☐ Obtain the necessary materials from your teacher. Split your group into two halves: the builders and the mappers.
- ☐ **Mappers:** From this point on, you should not be looking at Ari or the builders.
Builders: Place a 360-degree protractor on a flat surface with Ari in the middle. Place objects around Ari however you like.
- ☐ **Builders:** Turn on Ari’s distance app. Starting at 0 degrees, provide distance readings to the mappers every 5 degrees.
Mappers: Record the distance readings in your table on the next page.



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☐ Once all data points are collected, switch roles and repeat Activity 1.

Degree	Distance
0	120
5	120
10	120
15	120
20	105
25	100
30	95
35	95
40	95
45	100
50	105
55	110
60	115
65	120
70	120
75	120
80	120
85	120
90	120
95	115
100	110
105	103
110	105
115	106

Degree	Distance
120	107
125	108
130	109
135	110
140	120
145	120
150	120
155	120
160	120
165	120
170	120
175	120
180	120
185	120
190	120
195	120
200	110
205	105
210	100
215	103
220	100
225	97
230	94
235	92

Degree	Distance
240	94
245	97
250	100
255	103
260	105
265	108
270	110
275	113
280	115
285	117
290	120
295	120
300	120
305	120
310	110
315	90
320	105
325	110
330	115
335	120
340	120
345	120
350	120
355	120

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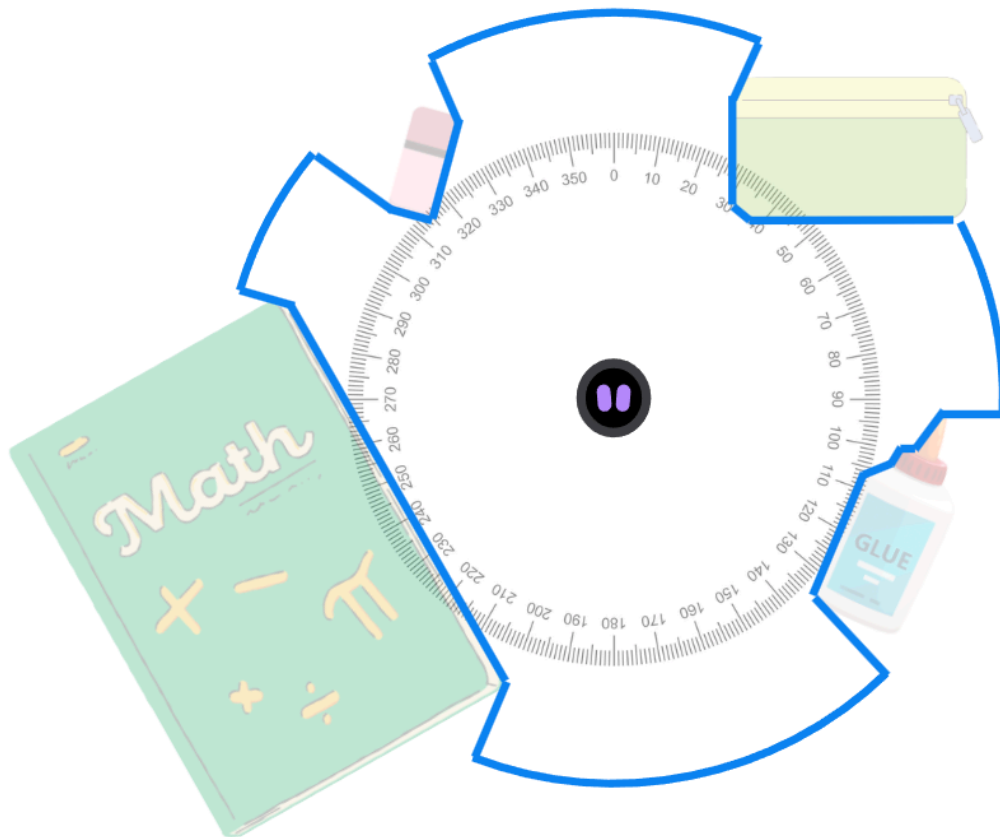
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Activity 2

For the second activity, you will use the values obtained from Activity 1 to create a radial map of Ari's surroundings.

- ☐ Get a piece of chart paper from your teacher.
- ☐ Using a 360-degree protractor and Ari (or a ruler), map out the points from your data table to create a map of Ari's surroundings.
- ☐ Your map should look something like the one below. In this image, the blue lines represent Ari's surroundings, with the circular boundary being the farthest distance Ari can measure.



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Exit Ticket

Please answer the following prompts.

Remember to include your **name** and **date** on this paper!

1. If you had to improve the LiDAR measurements taken in Activity 1, what changes would you make to get a better map of Ari's surroundings?

Taking measurements at smaller angles would improve the accuracy of the map. If we wanted to take 3D maps, Ari could be tilted up at certain angles to generate a 3-dimensional map.

2. Imagine you're designing a self-driving car that uses LiDAR to navigate a city. What might be some challenges when using LiDAR in complex environments like city streets?

Some possible challenges present in complex environments are:

- Difficulty detecting smaller objects like curbs or debris
- Reflective surfaces, like glass or mirrors, might confuse LiDAR sensors
- Weather conditions, like rain, fog, or snow, might interfere with LiDAR signals
- A city has many moving people and objects, which might make it difficult to process such large amounts of data