

# Ari Tells Height:

## Answer Key

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Vocabulary

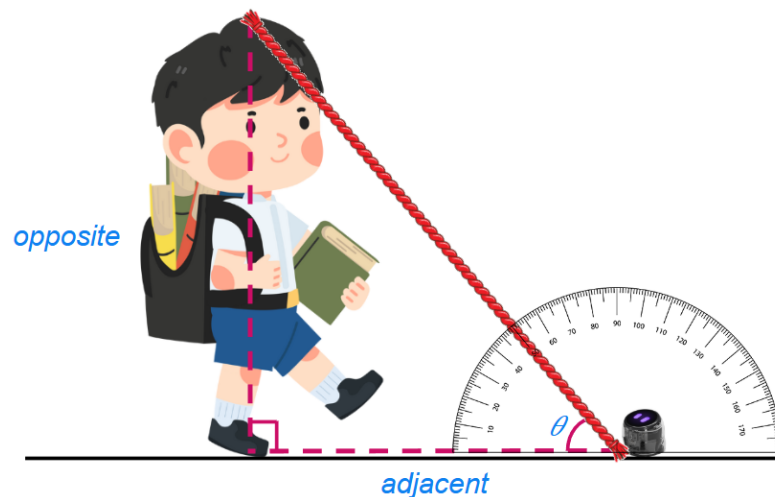
**Right Triangle** - A triangle with two perpendicular sides, which form a 90-degree angle, also called a right angle.

**Perpendicular** - Two lines that cross to make a 90-degree angle.

### Activity 1

For this activity, the goal is to use trigonometric functions to calculate your height. To do this, you will need to find one side length and one angle. To do this, we will use Ari and a protractor.

- ☐ Get the materials from your teacher. You will need Ari, yarn, and a protractor.
- ☐ Pick one person in your group to measure. Place Ari on the floor a short distance away from the person.
- ☐ Use Ari's distance sensor to measure the distance from Ari to the person in centimeters. Record the value in your table on the next page.



- ☐ Using a protractor, find the angle from Ari to the top of the person's head. To make it easier to find the angle, you can use a piece of yarn, like in the image above.

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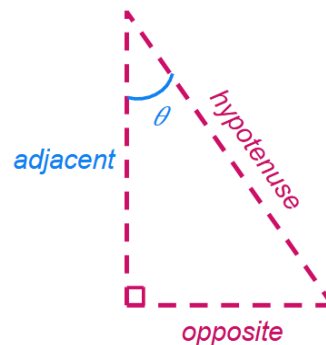
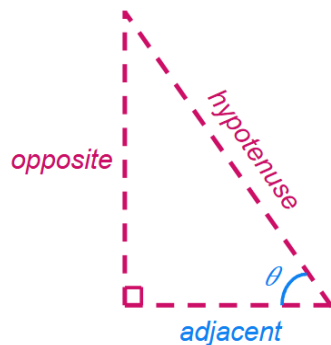
Date: \_\_\_\_\_

| Person | Adjacent Distance (cm) | Angle | Calculated Height (cm) | Actual Height (cm) | Percent Error |
|--------|------------------------|-------|------------------------|--------------------|---------------|
| Maria  | 64                     | 70    | 175.8                  | 177                | 0.68 %        |
| Ollie  | 50                     | 73    | 163.5                  | 166                | 1.51 %        |
| Jaina  | 62                     | 68    | 153.5                  | 151                | 1.66 %        |
|        |                        |       |                        |                    |               |

- ☐ Repeat the previous two steps for the rest of your group members.

### Activity 2

For the second activity, you will use your knowledge of trigonometric functions to calculate the heights of the people in your group.



$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

- ☐ Pick the appropriate trig function to calculate your height.

If you get stuck, think about which values you have so far from **adjacent**, **opposite**, and the **angle**. Then pick the trig function that would help you find the value you are missing.

- ☐ Solve the equation for the unknown value.

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- ☐ Using the new equation, plug in the values you measured in Activity 1 to calculate your height. Record this in the **Calculated Height** section of your table.
- ☐ Repeat this step for the rest of your group members.
- ☐ Enter your actual height in the **Actual Height** section of the table. If you do not know your height, use a measuring tape to find it. Make sure your units are in centimeters.
- ☐ Calculate the percent error for each person in your group. Record it in your table.

### Percentage Error

$$\left| \frac{\text{Measured} - \text{True}}{\text{True}} \right| \times 100$$

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#### Exit Ticket

Please answer the following prompts.

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

1. A local recreational center is building a water slide and needs help figuring out how long the slide will be so they know how much material to purchase.

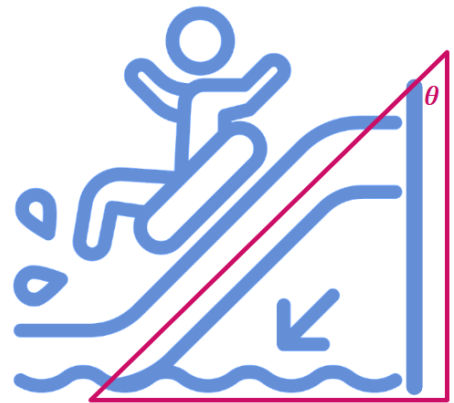
They know the angle  $\theta$  from the slide to the wall is 50 degrees and the height of the slide is 9.1 meters.

If each meter of material costs \$300, what will be the total cost of materials needed to build the slide?

$$\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{hypotenuse} = \frac{\text{adjacent}}{\cos(\theta)} = \frac{9.1 \text{ m}}{\cos(50)} = 14.16 \text{ m}$$

$$14.16 \text{ m} \times \$300/\text{m} = \$4,248$$



2. An airplane takes off at a 15-degree angle up into the sky. What is the distance traveled when it reaches an altitude of 9400 meters?

$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\text{hypotenuse} = \frac{\text{opposite}}{\sin(\theta)} = \frac{9400 \text{ meters}}{\sin(15)} = 36,319 \text{ meters}$$