**Teacher Directions: *Walking Pythagoras***

**Materials**

* Copies of Walking Pythagoras (Data Collection & Questions)
* Parking lot or black top
* Chalk (1 piece per group)
* 25 Foot Measuring Tape (if parking lot is not available)
* Rulers (after returning to the classroom)

**Activity Notes:**

***Inside Classroom Demo***

The following steps are included in the student version of *Walking Pythagoras*. Do an inside classroom demo first with two student helpers to show the steps in collecting their data.

**Step One: Marking the Triangle**

* Find a straight line in which to mark the base of your triangle. (Use a wall as your guide, find an existing line such as found in a parking lot if outside, etc.) If existing lines are not available, mark off a right triangle on the ground using the tape measure and a corner. It is very important that the right angle is accurate.

Leg#1

Leg #2

**Step Two: Determining the Roles**

The three roles for the activity are:

1) Walker: Paces out the triangle

2) Vertex #1: Stands on the spot where the walker has paced out leg #1

3) Vertex #2: Stands on the spot where the walker has paced out leg #2

**Step Three: Walk the Legs**

* The team chooses a number for the length of leg #1. The walker takes the required number of steps chosen by the team. This becomes the first vertex of the triangle.
* **It is very important that the length of each step remains constant for all three sides** of the triangle. In order to do so, the walker should proceed toe to toe.
* The team chooses a number for the length of leg #2. The walker goes back to the vertex and takes the required number of steps chosen by the team for leg #2. This becomes the second vertex of the triangle.

**Step Four: Make a Conjecture**

* The side of the triangle that connects vertex #1 and vertex #2 is the hypotenuse. First make a conjecture as to the minimum and maximum length that the hypotenuse could be.
* Make an estimate of the exact length of the hypotenuse.
* Record your conjecture on the chart. Leave the column “What Would Pythagoras Do?” for later.
* **Encourage students to look for a pattern after the first couple triangles are finished.**

**Step Five: Walking the Hypotenuse**

* The Walker walks the hypotenuse and the team records the number of steps on the chart under the “Actual Hypotenuse”
  + Remember that The Walker needs to walk toe to toe to ensure the validity of the data.

***Outside Data Collection***

After demonstrating on a triangle inside, give students the *Walking Pythagoras* activity sheet. Put students in groups of 3-4. Once outside, be sure to check that students are estimating the length of the hypotenuse **before** walking it. Ask students to tell you how they came up with their estimates. Push them to think about their own thinking and reasons for their estimates.

Note: Students will rotate roles and repeat the steps so that each team member is the Walker once. For each Walker on the team, new side lengths should be chosen. Encourage students to try more triangles if they have time and make sure that the students vary the look of the right triangle, i.e. close to isosceles or with very different length legs.

***Inside Discussion***

Continue with page 3. Give students 10 minutes to answer questions 1,2 & 3 individually. Then ask students to share, first with their team and then with the class about how they made their conjectures about the third side of the triangle. Ask questions to help them clarify their estimation techniques and the relationships that they found in the triangle. Record on the board various methods that people used. Focus on questions 2 & 3 to help students clarify their methods.

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**Complete Right Triangle Investigation before moving on.**

Pass out rulers to each student. With a partner, give students about 8 minutes to complete questions 4 & 5. Emphasize that they are returning to the data collection table and making conjectures once again based on triangles they are drawing with given lengths for the legs (see *Walking Pythagoras*). Encourage students to incorporate methods discussed previously for making conjectures about the length of the hypotenuse.

Bring the class together and introduce the method described in problem 6. Specifically, go over the procedure for problems 4 & 5 as shown on *Walking Pythagoras* and below.

Question #4:





9 + 16 = 25

25 = 25

Focus student attention on the fact that you are searching for a number with a square of 25. Students can simply guess and check to find the closest number. Use the last column of the data collection page to show what the Pythagorean theorem would give for the hypotenuse. The column is labeled WWPD (What Would Pythagoras Do?).

**Teacher’s Note 1:** The goal of this activity is not for the students to necessarily discover the Pythagorean theorem based on the walking of the sides of right triangles. Instead, encourage students to look for relationships to help them make their conjectures. For example, a student might discover that the hypotenuse is a larger number than either of the other two legs, but never longer than the two legs put together. This type of reasoning is enough to make a close estimate of the hypotenuse for this activity and it is often enough to correctly answer multiple choice questions on standardized tests. A second purpose of the activity is to introduce the procedure for finding the hypotenuse using the Pythagorean theorem in a meaningful and memorable way.

**Teacher’s Note 2:** It is possible to show students the use of the square root key on a calculator during this activity, but it is not necessary and probably distracts attention away from the main concept of the Pythagorean theorem and moves it toward a set of steps with a calculator. For that reason, using guess and check is preferred that students learned in the Rational and Irrational Numbers Unit.