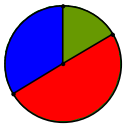
Day 12: Geoboards and the Pythagorean Relationship — Grade 8



Description

- Develop the Pythagorean relationship.

Materials

- geoboards
- BLM 12.1, 12.2, 12.3

Assessment Opportunities

Minds On…

Whole Class → Connecting to previous lesson and orientating students to an activity

Ask students to recall the problem posed during the previous class and to share their findings. If the connection is not made to putting the piece of plywood on a diagonal, introduce the idea of diagonal by drawing a rectangle to represent a window and making a right-angled triangle using one corner.

Action!

Pairs → Exploration

Give students BLM 12.2 and go over the instructions with them. Mixed-ability student pairs pick a card from BLM 12.1. Students do their constructions or take their measurements and enter the data, select another card, and repeat the process. In the end, there should be a minimum of fifteen entries in the table, with more than one pair working on each entry.

Curriculum Expectations/Question & Answer/Mental Note: Circulate among the groups, observing student strategies for calculating the area of the square on the diagonal side (TIP 5).

Use probing questions to prompt student thinking as needed:

- What are the largest and smallest right-angled triangles that can be constructed on a 5 × 5 geoboard?
- Which of the geoboard triangles have two sides that are the same length?
- Are you able to make a right-angled triangle with three equal sides? Explain.
- Where is the largest square in relation to the triangle's 90-degree angle?

Challenge some students to confirm that the shapes on the diagonals are indeed squares (TIP 4).

Consolidate Debrief

Whole Class → Making Connections and Summarizing

Students examine the data, as displayed on BLM 12.2, and identify patterns. Provide sufficient time before accepting any student answers so that each student has an opportunity to participate in the thought process. Be prepared to discuss any rows on BLM 12.2 where the answers do not fit the pattern due to student error. (For each row, Value of Column 3 + Value of Column 4 should = Value of Column 6.) Guide students to describe the Pythagorean relationship in words. Debriefing should include:

- the articulation of the $a^2 + b^2 = c^2$ relationship which refers to the relationship of the areas of squares built on the sides of a right-angled triangle
- the convention of labelling the sides containing the right angle "*a*" and "*b*" and the hypotenuse "*c*" but reinforcing that any variable can be used to indicate the sides of the triangle.

Home Activity or Further Classroom Consolidation

You are a mathematical advice column writer responding to this letter:

> "Dear Math Maniac,
> I pride myself in being quite a well-informed Grade 8 math student, but when I was watching the Wizard of Oz as I was babysitting, I heard the Scarecrow make a mathematical statement that confused me. It was: Once the Scarecrow received his "brains" he immediately tried to impress his friends by reciting the following mathematical equation, "The sum of the square roots of any two sides on an isosceles triangle is equal to the square root of the remaining side." Was the Scarecrow correct? What did he mean?

Complete worksheet 12.3.

Application
Concept Practice
Reflection

Provide a large sheet of paper in the centre of a table as a Placemat. Students write their conjectures in their own space on this Placemat without talking. Once each student has written a conjecture, the group decides on the best conjecture and how to word it.

Source: http://www.geocities.com/Hollywood/Hills/6396/ozmath.htm

12.1: Pairs Investigation Cards

Triangle 1 Side a is 1 cm Side b is 1 cm	**Triangle 2** Side a is 2 cm Side b is 2 cm	**Triangle 3** Side a is 3 cm Side b is 4 cm
Triangle 4 Side a is 6 cm Side b is 8 cm	**Triangle 5** Side a is 5 cm Side b is 12 cm	**Triangle 6** Side a is 3 cm Side b is 3 cm
Triangle 7 Side a is 1 cm Side b is 3 cm	**Triangle 8** Side a is 1 cm Side b is 4 cm	**Triangle 9** Side a is 2 cm Side b is 3 cm
Triangle 10 Side a is 4 cm Side b is 5 cm	**Triangle 11** Side a is 3 cm Side b is 5 cm	**Triangle 12** Side a is 3 cm Side b is 6 cm
Triangle 13 Side a is 5 cm Side b is 6cm	**Triangle 14** Side a is 4 cm Side b is 7 cm	**Triangle 15** Side a is 2 cm Side b is 5 cm

12.2: Squares on Sides of a Right-angled Triangle

Names:
Date:

1. Using a geoboard and coloured elastics or square dot paper, or both, construct the right triangle described on your card. Remember the two sides of the triangle are at 90° to each other. Construct the third side (the hypotenuse).
2. Construct a square on each side of the triangle, using each side length.
3. Complete the row that corresponds to your triangle number on the chart (first 5 columns only).
4. Use the area of the square on the hypotenuse to determine the length of side "c" (column 6). Check with a ruler.
5. Add this data to the class chart.

	1	2	3	4	5	6
Triangle #	**Length of Side "*a*"**	**Length of Side "*b*"**	**Area of Square on Side "*a*"**	**Area of Square on Side "*b*"**	**Length of hypotenuse "*c*"**	**Area of Square on hypotenuse "*c*"**

12.2: Squares on Sides of a Right-angled Triangle (continued)

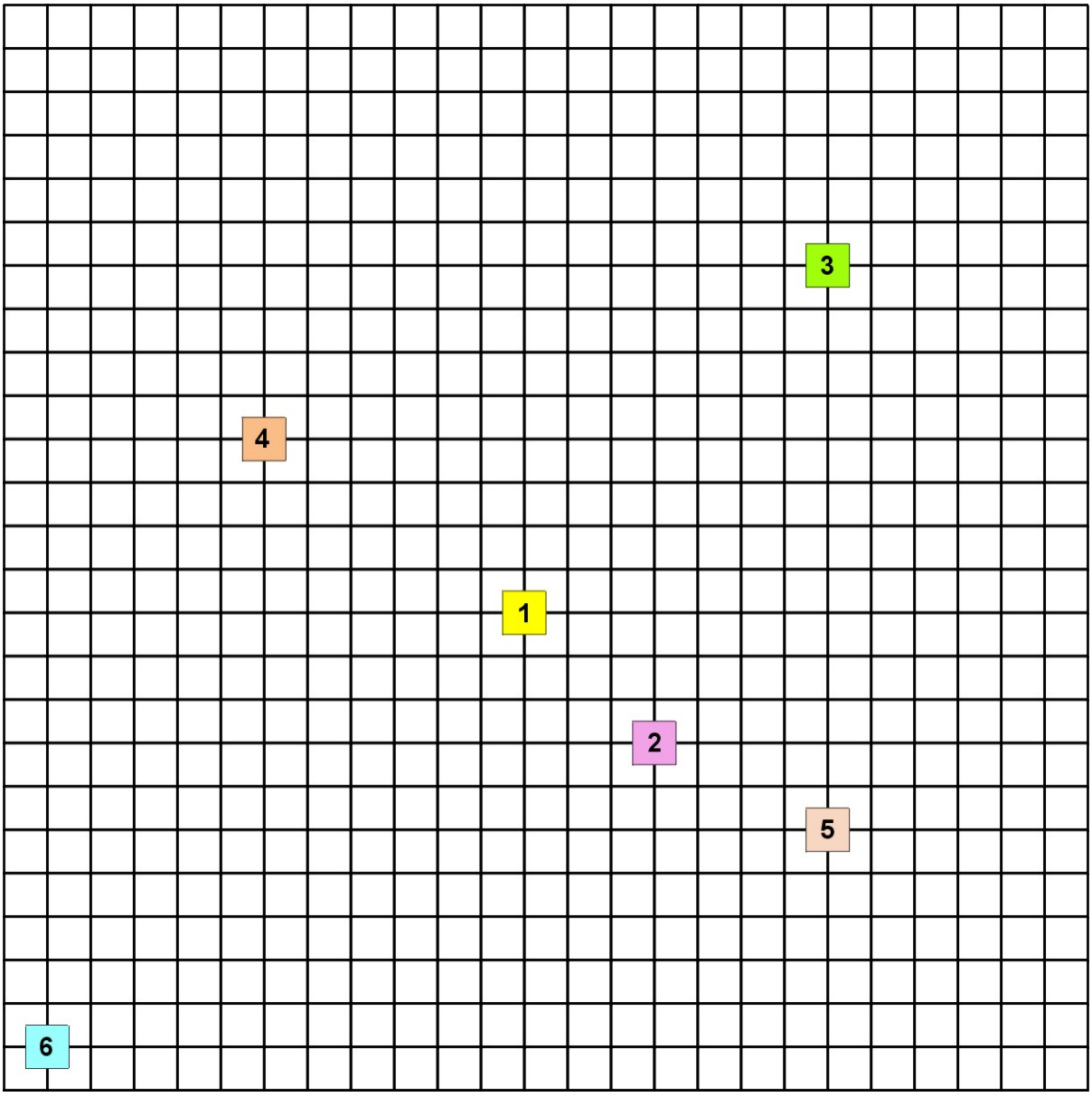
Class Chart

	1	2	3	4	5	6
Triangle #	**Length of Side "*a*"**	**Length of Side "*b*"**	**Area of Square on Side "*a*"**	**Area of Square on Side "*b*"**	**Length of hypotenuse "*c*"**	**Area of Square on hypotenuse "*c*"**
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

12.3: Social Triangles

Name:
Date:

Each square represents 0.5 m x 0.5 m.



1. You live at the location of rectangle #1. The other numbered rectangles represent the homes of your friends. The scale is 500 m per unit length. Calculate the distance between your home and that of each of your friend's. Show your work in good form.
2. A new friend lives exactly five kilometres away from your home.
   a) Show all possible locations for this friend's home.
      How is this set of possible locations shown on your grid?
   b) Use an X to mark which of these locations is on a grid point.
      How did you determine the locations?