Name:_____

The Pythagorean Theorem

The Pythagorean Theorem is an immensely powerful mathematical relationship. It was actually, probably not discovered by Pythagoras, but somewhat ironically we associate him and his group of followers with the Theorem because the Pythagorean Theorem actually kind of destroyed all of their philosophies. Hopefully, after this activity, you will see how the Pythagorean Theorem has revolutionized the way we can use math to solve real world problems.

Activity 1: What do you know already about the Pythagorean Theorem? Do you know what shape it's associated with? Do you know the formula? Write whatever you can remember below.

Activity 2: The Proof-There are many ways to show that the Pythagorean Theorem is true, but this is my favorite one and it's pretty easy.

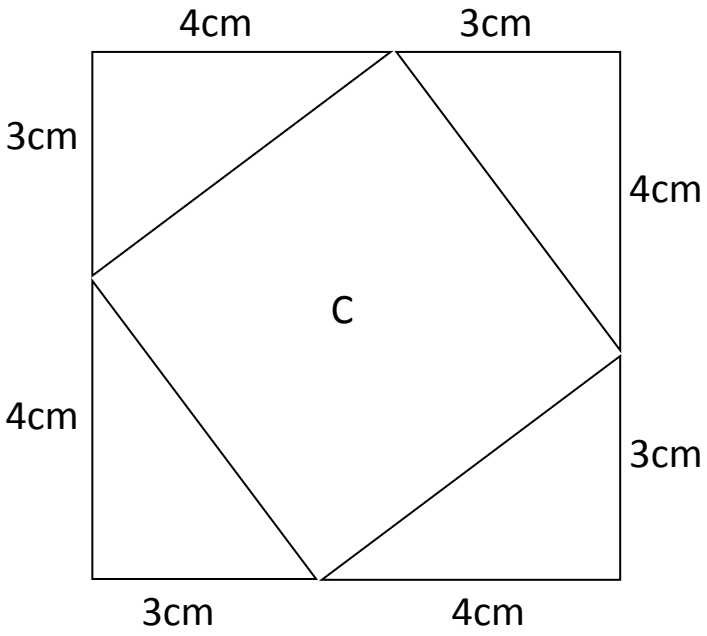
1.) Rip of the back page of this packet. Look at Figure A. Calculate the area for squares A and B and write them *inside* the correct square.

2.) Cut out the 6 parts of the square.

3.) Rearrange the 4 triangles to form a square that looks like the figure, and check that C, which should be empty, is also a square.

4.) Answer the following questions

a. What is the total area of the two squares, A and B that were not used to form the figure on the right?



b. What is the area of the square C inside the second square?

c. Explain why: Area of A + Area of B=Area of C

d. What must the length of the third side (called the hypotenuse) of each of these triangles be? How do you know?

e. Why do you think this formula, the Pythagorean Theorem, only works for **right** triangles?

Activity 3: Use what you learned- Use the Pythagorean Theorem that you proved above to answer the following questions about the following triangles.

1.) A **right** triangle has leg lengths of 5 and 12. What is the length of the hypotenuse? (try drawing the triangle below to give you a start)

2.) A **right** triangle has a leg length of 6 and a hypotenuse length of 10. What is the length of the other leg? (Draw the triangle to help you)

3.) A **right** triangle has leg lengths 4 and 5. What is the length of the hypotenuse? Estimate or use a calculator.

4.) If a triangle has leg lengths of 1.2 and 0.5 and a hypotenuse length of 1.3, is the triangle a right triangle? How do you know?

Activity 4: Applications-We're going to play around and see how the Pythagorean Theorem can help us with real world problems.

1.) Find a partner. Have one person stand up and step a little bit away from the desk.
   a. How can you find the distance from the tip of your shoe to the edge of the desk? Have your partner help you with the measurements. Record measurements taken and work done ***neatly***.

   b. In what real world situations would you want to find out a distance in this manner? Think of at least three.

2.) Look at the map of SJS that's in the supplemental material. Suppose you wanted to blow up the SJS building. You want to mark the roof of SJS with a giant yellow X so that the plane knows where to drop the bomb. How much tape will you need to make the yellow X? It would be smart to go measure the sides indicated in the picture.

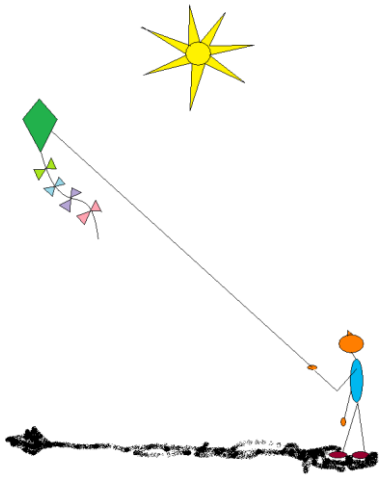
Homework

1.) A **right** triangle has leg lengths measuring 9 and 40. What's the length of the hypotenuse?

2.) A **right** triangle has a hypotenuse measuring 100 inches. A leg length measures 80 inches. What's the length of the third leg?

3.) A triangle has leg lengths of 7 and 9 and a hypotenuse length of 13. Is it a right triangle?

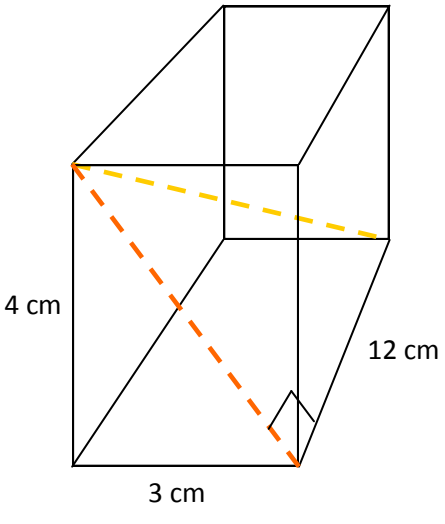
4.) Now you're tired of doing your math homework, so you go outside to fly a kite. You release 26 feet of string and the kite is flying, the sun is out and you're really happy you're not doing math homework. You notice that the sun is directly overhead and is casting a shadow of the kite on the ground. It occurs to you to wonder about how high your kite has gone. You yell at your little brother to go get you a measuring tape.



   a. What quantities can your little brother measure to help you find the height of the kite?

   b. If your hand is 3 ft off the ground, and the shadow length is 10 feet, how high is your kite?

5.) For some strange reason, you want to find the longest pole possible that could fit in the following box of dimensions 3cm x 4cm x 12cm. I've put in an orange dotted line to symbolize the pole you want to fit into the box. The red dotted line forms the outline of a right triangle that the pole would make with the right bottom edge of the box. See if you can find the length of the pole.



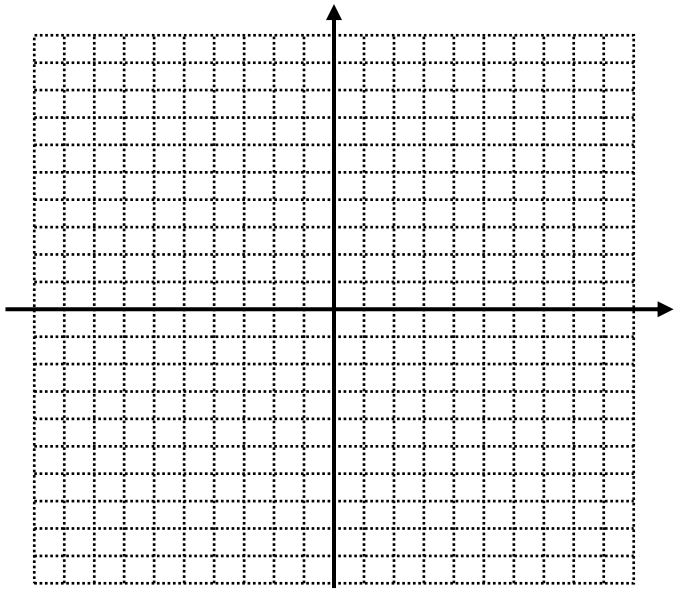
6.) Finally, these types of problems pop up a lot in algebra. In algebra, we use the **Cartesian coordinate** plane. You're all familiar with plotting points. Sometimes, we may be interested in how far apart two points are on a plane. Use your brain power and the Pythagorean Theorem to try to figure out the following coordinate problems. Use the grid at the bottom of the page for each of these problems if you need to.

a. Plot the point (0,3) and (4,0). What's the length of the line segment that connects these two points? Make a right triangle using the coordinate grid to help you.

b. Plot the point (-5,-1) and (7,4). What's the length of the line segment that connects these two points? Make a right triangle using the coordinate grid to help you.

c. Suppose this Cartesian coordinate grid represented a map, and each number represents 10 miles. McMinnville is at the origin. DeLacy-sensei that there's a town in Oregon called Idiotville. She realizes that this is the perfect home for Scott-sensei. To get to Idiotville, Scott-sensei must drive 50 miles due North, then 10 miles due west. Of course, DeLacy-sensei wants to find a home for herself to so she things that Boring, Oregon would suit her well. To get there, she must drive 30 miles north and 30 miles due East. Plot Idiotville and Boring on the grid. If Scott-sensei moves to Idiotville and DeLacy-sensei moves to Boring, how far away are DeLacy-sensei and Scott-sensei from each other?

d. **Bonus:** Imagine plotting a point at the coordinate (x_1, y_1). Plot another point at the coordinate (x_2,y_2). Come up with a formula for finding the distance between the two points.



Supplemental Material

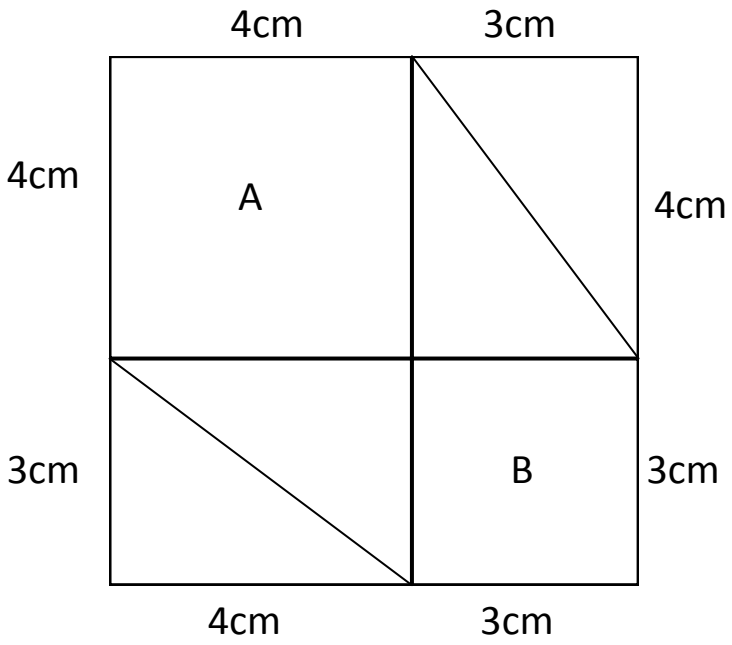


Figure A

Figure B→