Can Pythagoras Swim?

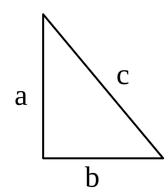
Overview	Math Concepts	Materials
Students will investigate relationships between sides of right triangles to understand the Pythagorean theorem and then use it to solve problems. Students will simplify expressions using radicals and exponents in this activity.	• multiple representations of numbers • equation solving • exponents • geometric representations of two-dimensional objects • Pythagorean theorem	• TI-30XS MultiView™ • pencil • paper • scissors

Activity

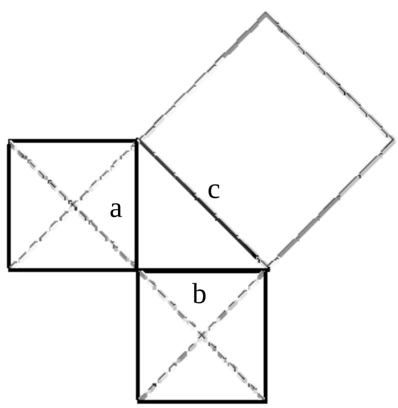
Introduce the Pythagorean theorem first by trial and error; then share the formula with students.

By experimenting, we are going to discover one of the most famous theorems in all of math, and probably the most famous in geometry: the Pythagorean theorem.

Consider the right triangle below.



Form a square along each side of the right triangle.



At this point in the activity, give each student (or group of students) the enlarged photocopy of the diagram above (attached).

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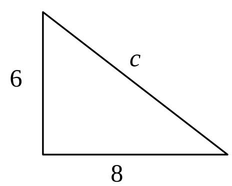
Now, cut each of the smaller squares along the outside edge and along the dotted lines. Can you use those eight pieces to completely cover the largest square?

Ask the students to summarize this activity mathematically. Their vocabulary does not have to be accurate, but they need to recognize that if we square the two smaller sides of the triangle and add them together, the sum equals the square of the larger side.

You've just seen the Pythagorean theorem. In words, it says that the sum of the squares of the legs of a right triangle equals the square of the hypotenuse. Mathematically, the formula is: $a^2 + b^2 = c^2$.

Let's practice.



The legs measure 6 and 8 units, so a = 8 units and b = 6.

$$82 + 62 = c^2$$
$$64 + 36 = c^2$$
$$100 = c^2$$
$$\sqrt{100} = c$$

Therefore, c = 10.

Give the students more examples of right triangles, using numbers that do not result in perfect squares. The TI-30XS MultiView calculator is an appropriate tool for those calculations.

Let's use the TI-30XS MultiView calculator for the following problems:

(a) *Find the length of the hypotenuse if the legs are 5 and 10 units long.*

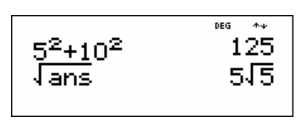
(b) *Find the length of the missing leg if one leg is 6 in. and the hypotenuse is 8 in.*

(c) *Find the length of the hypotenuse if the legs measure ½ and ¾ cm.*

Note: Be careful with fraction entry.

Follow these steps:

1. Press 5 [x^2] [+] 10 [x^2] [enter].
2. Then press [2nd] [√].
3. Press [2nd] [ans] to copy previous.
4. Press [enter] for simplified answer:



5. Press 1 [n/d] 2 [▶] [x^2] [+] 3 [n/d] 4 [▶] [x^2].
6. Press [enter] to see what c^2 equals.
7. Press [√] 13 [▶] [n/d] [√] 16 [▶] [▶] [enter] for simplified answer.

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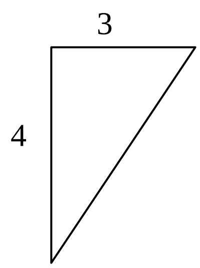
Name ____________________

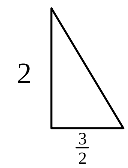
Date ____________________

Directions: Find the length of the hypotenuse. Do not round your answers.

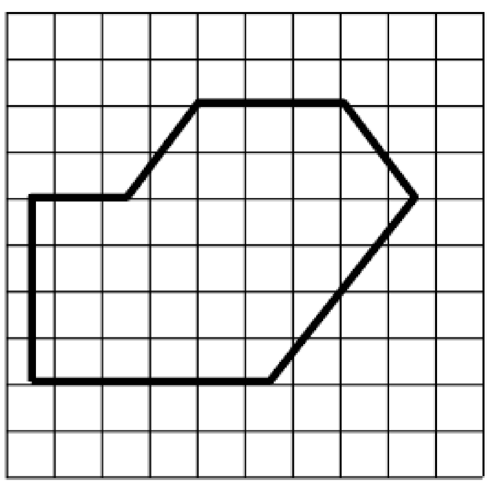
1.



2.



3. Mr. P. is putting a pool in his yard. He has a small backyard, and therefore must put in an odd-shaped pool rather than a rectangular one. He is not sure how much the pool installation will cost, but he knows the company will determine the cost using area and perimeter of the pool.



(a) Compute the perimeter of the pool. Divide the pool into regions; then find the missing lengths. (Hint: Use 1 & 2.) Your answer should be rounded to the nearest unit. SHOW THE REGIONS.

(b) Compute the area of the pool, using the regions you drew above. The answer should be rounded to the nearest square unit. Show your work.

4. If each square above is 4 ft by 4 ft,

(a) what is the perimeter of the pool in feet?

(b) what is the area of the pool in square feet?

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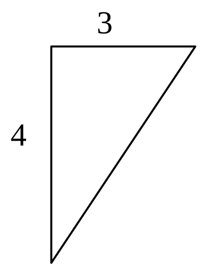
Answer Key

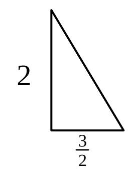
Directions: Find the length of the hypotenuse. Do not round your answer.

1.



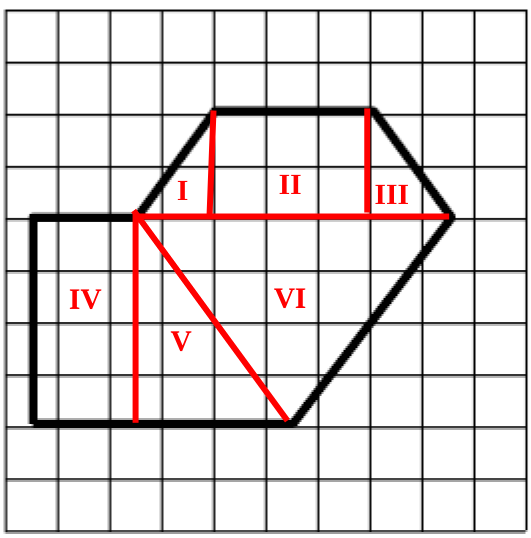
$c = 5$

2.



$c = \frac{5}{2}$

3. Mr. P. is putting a pool in his yard. He has a small backyard, and therefore must put in an odd-shaped pool rather than a rectangular one. He is not sure how much the pool installation will cost, but he knows the company will determine the cost using area and perimeter of the pool.



(a) Compute the perimeter of the pool. Divide the pool into regions; then find the missing lengths. (Hint: Use 1 & 2.) Your answer should be rounded to the nearest unit. SHOW THE REGIONS.

$\frac{5}{2} + 3 + \frac{5}{2} + 5 + 3 + 2 + 4 + 2 = 24$ units

(b) Compute the area of the pool, using the regions you drew above. The answer should be rounded to the nearest square unit. Show your work.

I: $\frac{1}{2}\left(\frac{3}{2}\right)(2) = \frac{3}{2}$, II: $3(2) = 6$,

III: $\frac{1}{2}\left(\frac{3}{2}\right)(2) = \frac{3}{2}$, IV: $2(4) = 8$,

V: $\left(\frac{1}{2}\right)(3)(4) = 6$, VI: $\left(\frac{1}{2}\right)(6)(4) = 12$

Total = 35 units^2

4. If each square above is 4 ft by 4 ft,

(a) what is the perimeter of the pool in feet? $24(4) = 96$ ft

(b) what is the area of the pool in square feet? $35(16) = 560$ ft

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Student Handout