



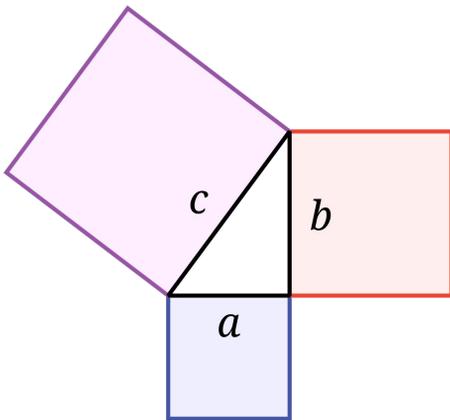
Helping With Math

Understanding Pythagorean Theorem

GRADE 8



Pythagorean theorem states that the area of a square whose side is the hypotenuse of the right triangle is equal to the sum of the areas of the square on the two other sides of the right triangle.



$$a^2 + b^2 = c^2$$

(Pythagorean equation)

(Pythagorean equation)

where:



c is the hypotenuse of the right triangle; and **a** and **b** are the other sides of the right triangle

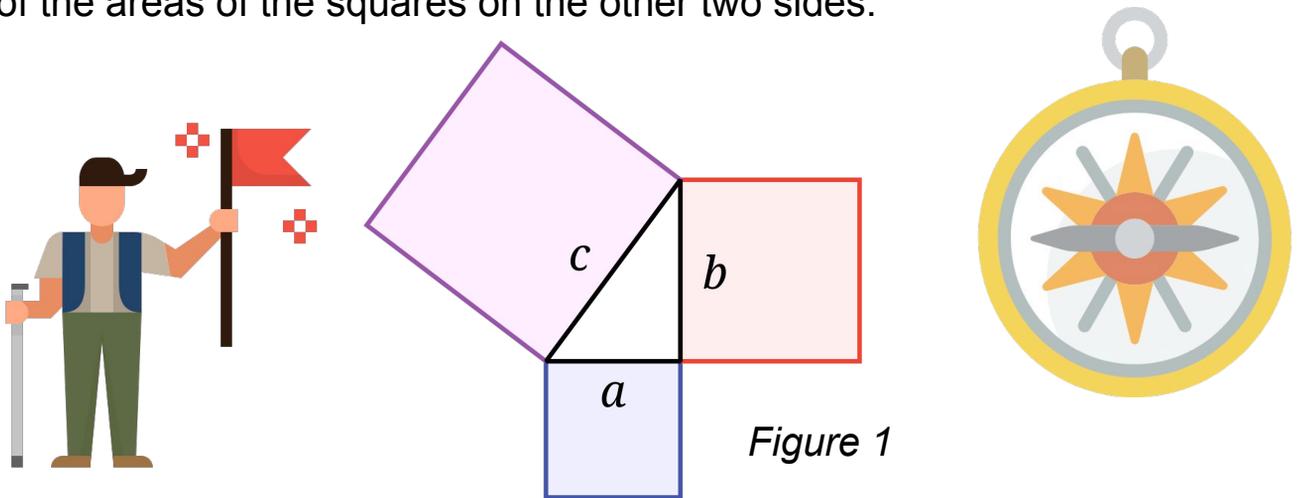
- ❖ We use Pythagorean Theorem in solving right triangles and complex geometry.
- ❖ Pythagorean theorem is only applicable on right triangles.
- ❖ Pythagorean theorem is the foundation of many principles in geometry.
- ❖ Pythagorean theorem is one of the best mathematical formulae.



ORIGIN OF THE THEOREM

The origin of the theorem is the subject of much debate. Though named after the ancient Greek philosopher Pythagoras (c. 570 – c. 495 BCE), historians whose focus is Mesopotamian mathematics concluded that the theorem was used extensively during the Old Babylonian period - 20th to 16th centuries BCE, years before the birth of Pythagoras.

The Pythagorean theorem is the fundamental relation between the three sides of a right triangle stating that the area of the square whose side is the hypotenuse - the side opposite the right angle - is equal to the sum of the areas of the squares on the other two sides.



In figure 1, the pythagorean theorem can be expressed as:

$$a^2 + b^2 = c^2$$

If the lengths of both a and b are known, then c can be calculated as:

$$c^2 = a^2 + b^2$$

If the length of the hypotenuse c and of one side (a or b) are known, then the length of the other side can be calculated as:

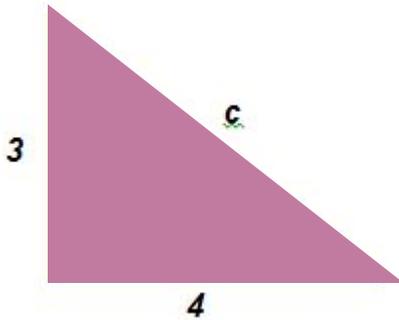
$$a^2 = c^2 - b^2 \quad \text{or} \quad b^2 = c^2 - a^2$$



ILLUSTRATIVE EXAMPLES

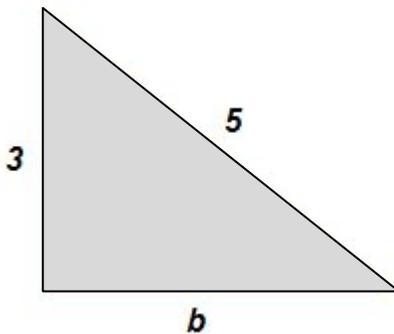
Solve for the unknown sides of the right triangles using pythagorean equation.

1.)



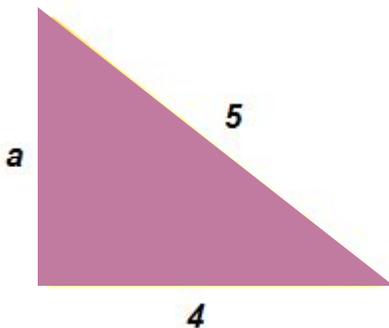
$$\begin{aligned}c^2 &= a^2 + b^2 \\c^2 &= (3)^2 + (4)^2 \\c^2 &= 9 + 16 \\c^2 &= 25 \\c &= \sqrt{25} \\c &= 5\end{aligned}$$

2.)



$$\begin{aligned}c^2 &= a^2 + b^2 \\b^2 &= c^2 - a^2 \\b^2 &= (5)^2 - (3)^2 \\b^2 &= 25 - 9 \\b^2 &= 16 \\b &= \sqrt{16} \\b &= 4\end{aligned}$$

3.)



This is left for you to do.



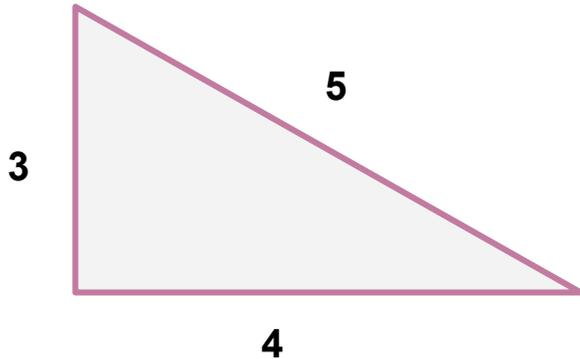
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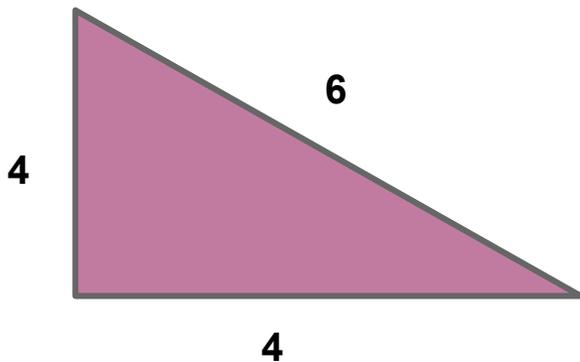


WHICH WAY TO GO?

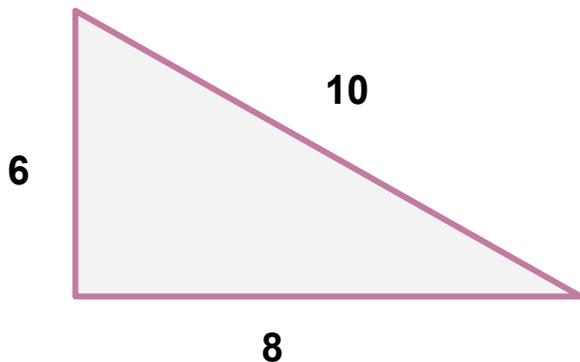
Arnold and his friends lost their way to the hiking camp. Help them identify which way to go by using the concept of pythagorean theorem to verify if the following triangles are right triangles or not. Show your solution.



1.



2.



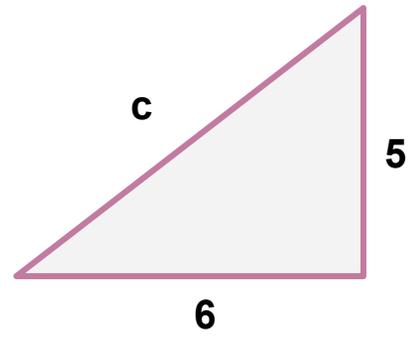
3.



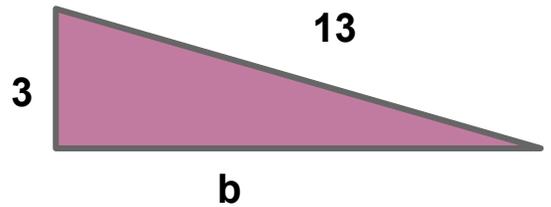
THE HIKER'S JOURNEY

Guide this hiker to his final base by finding the missing length of each right triangle's side.

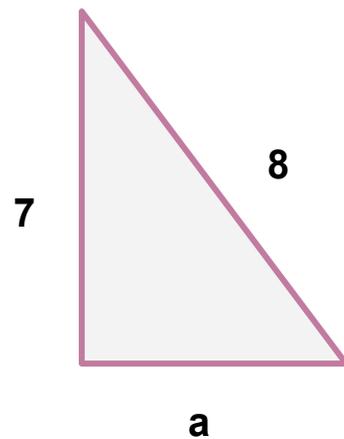
1.



1.



1.



THE CAMPING SITE

Welcome to the camping site! Explore this adventurous place by solving for the missing measurement.

1. Triangle HWM is a right triangle. What is the length of its hypotenuse if the two sides are 5 cm and 12 cm respectively?

Illustration:

Solution:

2. Right triangle MGB is has its shorter side of 7 in and its longer side is 24 in. Compute for the length of its hypotenuse.

Illustration:

Solution:



THE LADDER SAVES THE DAY

The group of hikers brought a portable ladder with them in case they need it. Help them solve their problems about the ladder using the concept of pythagorean theorem?

How far from the base of a camp house do you need to place a 15 ft. ladder so that it exactly reaches the top of a 12-ft. wall?

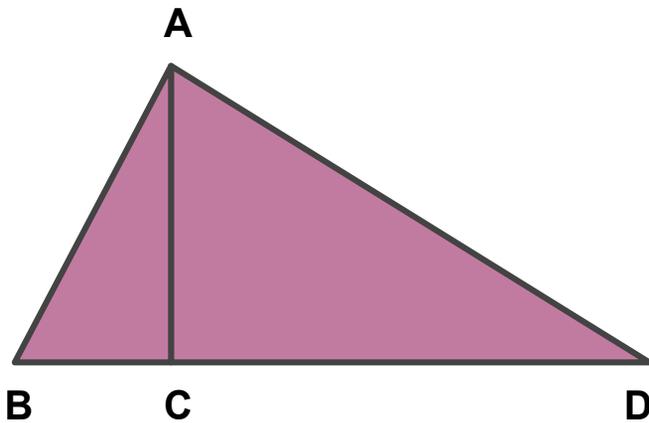
You need a ladder that will reach up a 25 foot tall camp house when placed 10 feet away from the house. How tall does the ladder need to be?



CAMP'S QUEST

As the night of the camping event gets longer, the camping master ask the campers to answer this question.

Two Triangles ABC and ACD are combined as shown, calculate CD based on given measurements:



Given:

$$AB = 4$$

$$BC = 2$$

$$AD = 7$$

Solution:



THE MYSTERIOUS TENT

Look at these word problems involving the tent of your camping site. Solve them and show your complete solution.



1. The slanted sides of a tent are both 8 feet long and the width of the tent is 7 feet across. What is the height of the tent?
2. If to be sketch in a pad, a tent looks like a right triangle and has a hypotenuse of 16. What is value of the smallest side of the right triangle if the smallest side is one-third of the other side?

Solution:



HIKERS' DISTANCE

The following are scenarios in a hiking event. Do your best to solve them.

1. Michael walks 1 mile west and then 2 miles north. What is shortest distance that Michael must travel to return to his starting point?



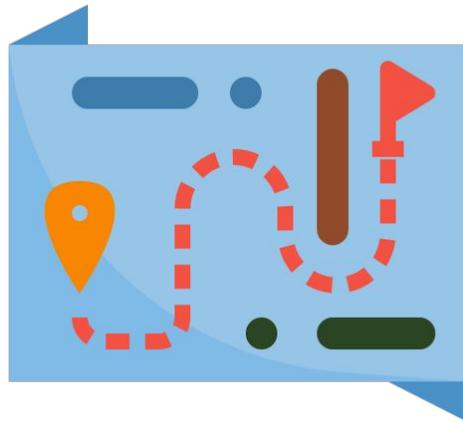
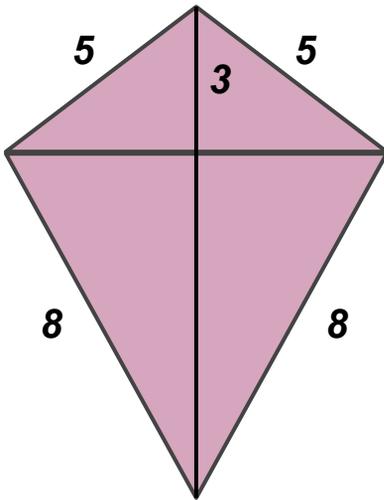
2. Jack and Rose are 300 feet apart. Jack walks 200 feet North while Rose walks 160 feet South. How far are they from each other after walking ?



THE MAP OF ADVENTURE

Whoa! You just receive the map of your hiking today. It has an amazing path that looks like a kite and it is given below. Solve the related problem given.

Calculate the length of the horizontal and vertical sticks of the kite which dimensions are shown below.



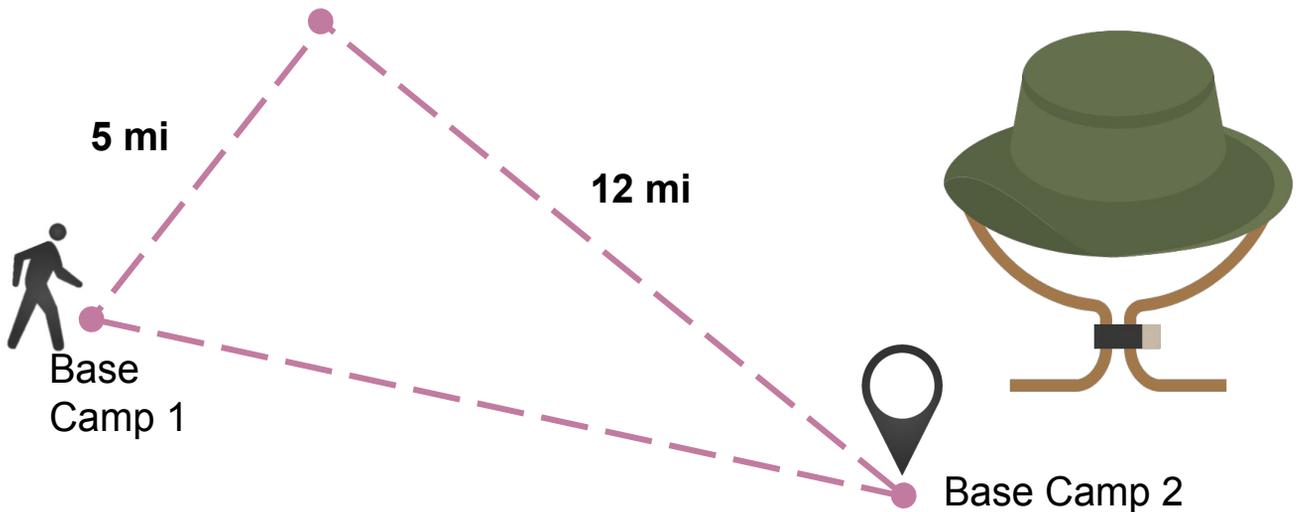
Solution:

Answers : _____



THE SHORTEST DISTANCE

Help the campers calculate the shortest route that they can take to arrive at Base Camp 2.



1. What is the shortest possible distance that the man should travel from Base camp 1 to Base camp 2?

2.

If instead of 5 miles and 12 miles, the given are 6 miles and 11 miles. What is the shortest distance that he can travel to arrive at Base Camp 2?



CAMP BAGS ON THE GO

Prepare your things before going to the site! Answer the following questions related to Pythagorean Theorem.

1. What is the formula of getting the hypotenuse of a right triangle if the sides are x , y , and z , where z is a hypotenuse?

2. Is Pythagorean Theorem applicable to all types of triangles? Explain your answer in 3-5 sentences.



ANSWER GUIDE

Activity 1

1. Right triangle
2. Not a right triangle
3. Right triangle

Activity 2

1. $c = \sqrt{61}$ or 7.81
2. $b = 4\sqrt{10}$ or 12.65
3. $a = \sqrt{15}$ or 3.87

Activity 3

1. The hypotenuse is 13 cm
2. The hypotenuse is 25 in

Activity 4

1. The ladder should be placed 9-ft away from the base of a camp house.
2. $5\sqrt{29}$ ft. or 26.93 ft.

Activity 5

To calculate CD, we need first to calculate AC.
 $AC = \sqrt{12}$ or 3.46. Then, compute for CD by getting the difference of the squares of AD and AC. Thus, $CD = \sqrt{37}$ or 6.08.

Activity 6

1. 7.19 ft
2. 5.06 units



ANSWER GUIDE

Activity 7

1. 2.24 miles
2. 468.61 ft

Activity 8

The answers are 8 and 9.93 .

Activity 9

1. 13 miles
2. 12.53 miles

Activity 10

1. $z^2 = x^2 + y^2$ for hypotenuse
2. No, not all triangles can use the concept of pythagorean theorem. The only type of triangle that can use it is right triangle. Scalene and obtuse triangles cannot use it.



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