building big things

angles, triangles and sides

name ____________ Class ______
team ________ seat _____ date _____

Our goal is to find ways that math mixes with science. Our goal is to find the length of the ramp if we know other information about it.

[redacted]

world book encyclopedia

PYTHAGOREAN THEOREM, *pih THAG oh REE un THEE oh rum,* in geometry, states that in a right triangle the square of the hypotenuse equals the sum of the squares of the other two sides. A right triangle is one in which one angle equals 90°. The hypotenuse is the side opposite the right angle. Here is the theorem as a formula:

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

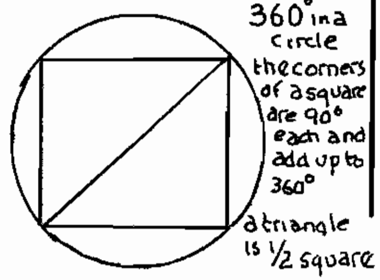
In this formula, *c* is the length of the hypotenuse and *a* and *b* are the lengths of the other two sides. If you know two sides of a right triangle, you can substitute these values in the formula and find the missing side.

Origins

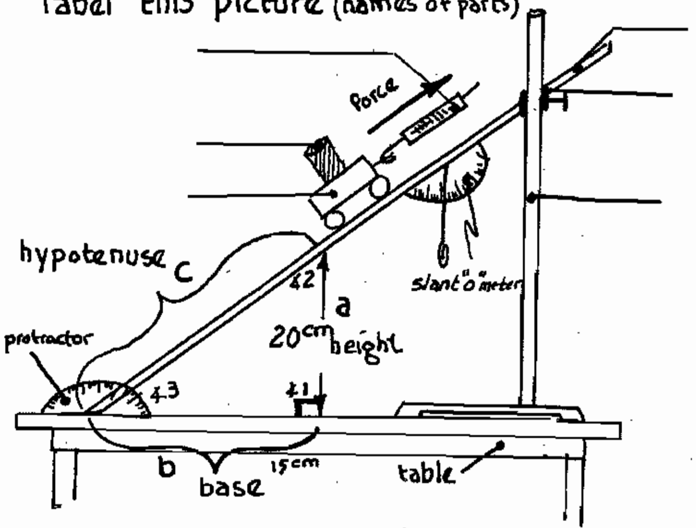
The ancient Egyptians wanted to lay out square (90°) corners for their fields. They had few of the tools we have today. How could they make a 90° angle? About 2000 B.C., they discovered a "magic 3—4—5" triangle. Workmen took a loop of rope knotted into 12 equal spaces. They took three stakes and stretched the rope to form a triangle around the stakes. They placed the stakes so the triangle had sides of 3, 4, and 5 units. The side of 5 units was what we would call the hypotenuse, and the angle opposite it equaled 90°.

The ancient Greeks learned this trick from the Egyptians. Between 500 and 350 B.C., a group of Greek philosophers called the Pythagoreans explored the 3—4—5 triangle. *They learned to think of the triangle's sides as the sides of three squares.* The area of a square is a side multiplied by itself. In the 3—4—5 triangle, the area of a square of which the hypotenuse is a side equals the sum of the areas of the squares of the other two sides: 5×5=3×3 + 4×4. Then the Pythagoreans generalized this rule about the 3—4—5 triangle to apply to *all* right triangles. This general statement became the Pythagorean Theorem.

a triangle has ___ sides and ____ angles. The prefik tri means



label this picture (names of parts)



If you add together the angles of a triangle you get ____°.

∡1 + ∡2 + ∡3 = ____ .

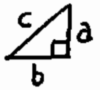
∡1 = 90° Right angle
∡3 is measured by the protractor (slant or slope of ramp)

figure out what ∡2 is.

∡3 from part 3 of our experiment

in my head question

lets use the pythagorean theorem



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

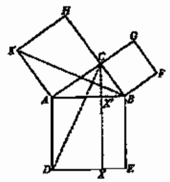
a= 20 cm
b= 15 cm
c= ?

find the length of the slant or hypotenuse.

$3^2=9=3\times3$
$4^2=16=4\times4$
$5^2=25=5\times5$

Euclid's Proof

In formal geometry, the Pythagorean Theorem has had many proofs. One of the most famous proofs belongs to the Greek mathematician Euclid (c. 300 B.C.). In this drawing, *ABC* is the original right triangle:



The squares are drawn for each side, and the right angle is at *C*. How can we prove that the square on the hypotenuse equals the other two squares?

Here are the steps in Euclid's proof. The reasons for each step come from axioms, postulates, and other theorems in geometry. First, by a series of statements, you show that the area of the square on side *AC* is twice the area of triangle *ABK*. Next, you show that triangles *ABK* and *ACD* are congruent (corresponding). Third, you show that the area of rectangle *ADXX'* equals twice the area of triangle *ACD*. So the area of the square on side *AC* equals the area of rectangle *ADXX'*. In the same way, you show that the area of the square on side *BC* equals the area of rectangle *BX'XE*. Finally, because the square on the side *AB* is equal to the sum of its parts (*ADXX'* and *BX'XE*), it is equal to the sum of the squares on the other two sides.

standard
S7b, S7d, S7e

pythagorean theorem

building big things - inclined planes

bob

bob