

HARD SUMS CLUB

October 2005 Newsletter www.hardsumsclub.com

Was it really Pythagoras' theorem?

It is virtually impossible to do a maths quiz without in the end having to use Pythagoras' theorem.

Pythagoras' most famous theorem is one that is quoted as "*for a right-angled triangle the square on the hypotenuse* is equal to the sum of the squares on the other two sides*".

When we think of squares in this form we think of a number multiplied by itself. So $a^2 + b^2 = h^2$. However, to Pythagoras the square on the hypotenuse would certainly not be thought of as a number multiplied by itself, but rather as a geometrical square drawn on that side of the triangle. To say that the sum of two squares is equal to a third square meant that the two squares could be cut up and reassembled to form a square identical to the third square.

This is all very well but in terms of quizzes there are some sets of numbers that are called Pythagorean triplets and these go together

3^2	+	4^2	=	5^2
5^2	+	12^2	=	13^2
7^2	+	24^2	=	25^2

All multiples of these also work.
For example: $6^2 + 8^2 = 10^2$

See if you can spot some in this month's quiz.

*Footnote: the hypotenuse of a triangle is the longest side. The side opposite the right angle.

The question is was this Pythagoras' theorem? The Old Babylonian Empire flourished in Mesopotamia between the Tigris and Euphrates rivers around 1900 BC to 1600 BC (about 1000 years before Pythagoras). A translation of a Babylonian tablet which is preserved in the British Museum goes as follows:-

4 is the length and 5 the diagonal. What is the breadth?

Its size is not known. 4 times 4 is 16.

5 times 5 is 25. You take 16 from 25 and there remains 9. What times what shall I take in order to get 9?

3 times 3 is 9. 3 is the breadth.

Before that around 2500 BC the Egyptian pyramids had certain constructions that were made so that the triangle which was formed by the base, height and slope height of the pyramid was a 3, 4, 5 triangle.

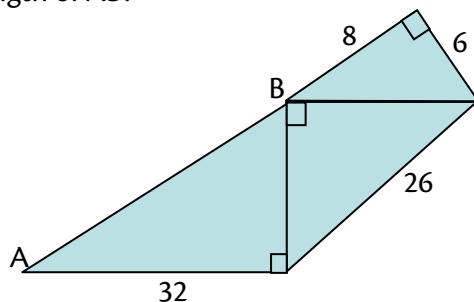
Finally, one of China's most famous mathematical books is a book call the *Zhoubi suanjing* or *Nine chapters of mathematical art*. This was written about the same time that Pythagoras was alive and contains a rule called the *Gougu* rule and applies it to surveying, astronomy, and other topics. This is the same rule that we call Pythagoras' theorem.

So did Pythagoras invent his theorem? Well, we think he was one of the first to prove it but as we have none of his written work we are only working on hearsay. However, undoubtedly many more ancient civilizations had already "discovered" some special right-angled triangles where all the sides were integer values and used this in their everyday life.

October quiz

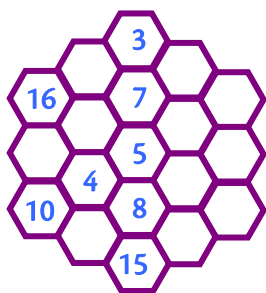
Send your solutions to bcl@hardsumsclub.com

- Jennie decided to walk home one day through the country. She set off due East but after 3 miles she came across a nasty looking bull. She turned round and ran back to where she had started from. After that she decided to walk straight home going due North for 4 miles. How far was she from home when she came across the bull?
- Three right-angled triangles are placed together as shown in the diagram below. What is the length of AB?



- You all know the story of Goldilocks. Well this is the day before Goldilocks visits the forest and Daddy, Mummy and Baby bear have time to finish their porridge without being disturbed. They all start eating at the same time but after 10 mins Daddy bear has finished his third so he helps Mummy bear on hers. Five minutes later they've both polished off Mummy bear's porridge so they go and help Baby bear. After 5 mins they have finished all the porridge. How much porridge does Baby bear actually get?

October hex-sum



Fill in the numbers so that every column or diagonal has the same sum.

October's strategy game – Mock Turtles

Start with 10 coins in a row all heads-up. At your move you must turn over at least one coin and up to at most three coins. The right-most coin that you turn must be from heads-up to tails-up.

The winner is the person who can get all the coins tails-up.

Websites of the month

<http://www.funbrain.com/brain/MathBrain>

So these games aren't exactly Playstation 2 however they are quite fun games for years 6 and 7.

<http://www.vnunet.com/spotlight/sudokuindex>

A daily Sudoku puzzle to get your mind thinking logically. These are logic rather than mathematical puzzles but still good for "the little grey cells".

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Find out the solutions to last month

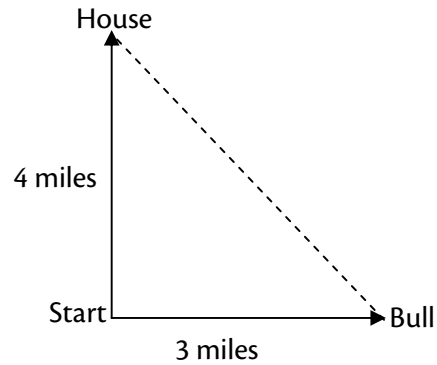
A final thought

Sudoku puzzles can trace their lineage from the magic square (*carrés magiques*) of 18th century mathematical genius **Euler**, via Latin squares, through American and then Japanese versions in the 80s (from which the name arises- roughly translated, it means *solitary number*). Euler is normally famous for his work with polygons and polyhedra.

October's answers

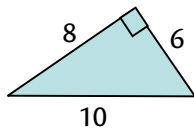
October quiz

1. It helps if you draw a diagram for this one.

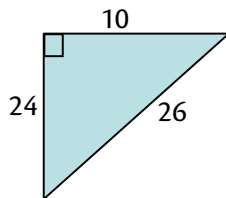


Now you can see it is the classic Pythagoras triangle that the Babylonians used. $3^2 + 4^2 = 5^2$. Therefore she was 5 miles away.

2. This uses the first two Pythagorean triplets. Firstly, divide the diagram up into 3 triangles.

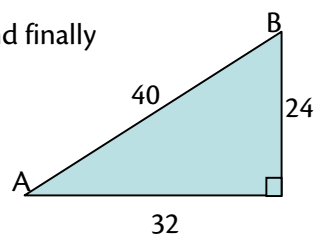


This is the 3, 4, 5 triangle with each side doubled.



This is the 5, 12, 13 triangle with each side doubled.

And finally



We are back with the 3, 4, 5 triangle with each side now multiplied by 8.
Hence, length $AB = 40$

3. This is a fractions question.

Daddy bear eats $\frac{1}{3}$ in 10 mins so in 5 mins he eats $\frac{1}{6}$

Therefore in 15 mins, Mummy bear eats $\frac{1}{3} - \frac{1}{6} = \frac{2}{6} - \frac{1}{6} = \frac{1}{6}$. So in 5 mins she must

eat $\frac{1}{3}$ of $\frac{1}{6} = \frac{1}{18}$.

This leaves Baby bear with $\frac{1}{3} - \frac{1}{6} - \frac{1}{18} = \frac{6}{18} - \frac{3}{18} - \frac{1}{18} = \frac{2}{18} = \frac{1}{9}$

October hex-sum

