

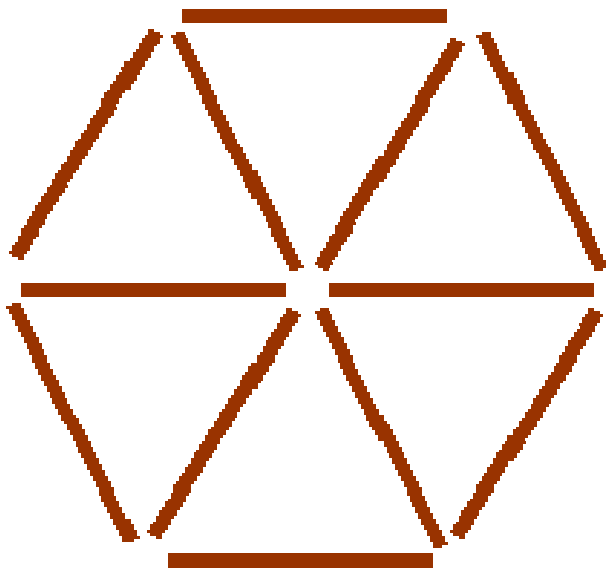
# Quiz 2006

This is a quiz designed for fifth year post-primary students. Students work in teams of 3 and have an hour to complete as many problems as possible.

Many of the questions here are taken from  
[www.nrich.maths.org](http://www.nrich.maths.org)

**Question 1.**

Move 4 matches to make 4 triangles



## Question 2. Birthday Chocolate

First of all, pick the number of times a week that you would like to eat chocolate (try for more than once but less than 10 times as more than this is simply greedy).

Multiply this number by 2 (just to be bold).

Add 5 (for Sunday).

Multiply it by 50.

If you have already had your birthday this year add 1754.

If you haven't had your birthday yet this year add 1753.

Now subtract the four digit year that you were born.

You should have a three digit number.

The first digit of this was your original number.

The next two numbers are your age.

This problem was first published in 2004. How does this work? Does this work for any year? If not, can you adapt it so that it does?

**Question 3.** Find all solutions to

$$x = \left(\sqrt{2}\right)^x$$

#### **Question 4. Smith and Jones**

Mr Smith and Mr Jones are two maths teachers, who meet up one day. Mr Smith lives in a house with a number between 13 and 1300. He informs Mr Jones of this fact, and challenges Mr Jones to work out the number by asking closed questions.

Mr Jones asks if the number is bigger than 500. Mr Smith answers, but he lies.

Mr Jones asks if the number is a perfect square. Mr Smith answers, but he lies.

Mr Jones asks if the number is a perfect cube. Mr Smith answers and (feeling a little guilty) tells the truth for once.

Mr Jones says he knows that the number is one of two possibilities, and if Mr Smith just tells him whether the second digit is 1, then he'll know the answer. Mr Smith tells him and Mr Jones says what he thinks the number is. He is, of course, wrong.

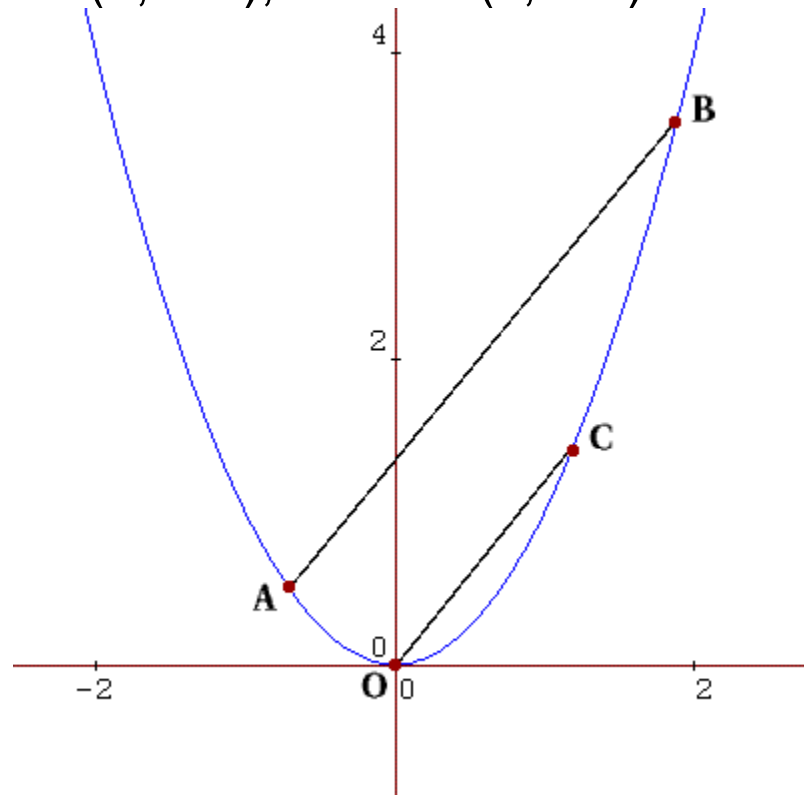
What is the number of Mr Smith's house?

### Question 5. Parabolas

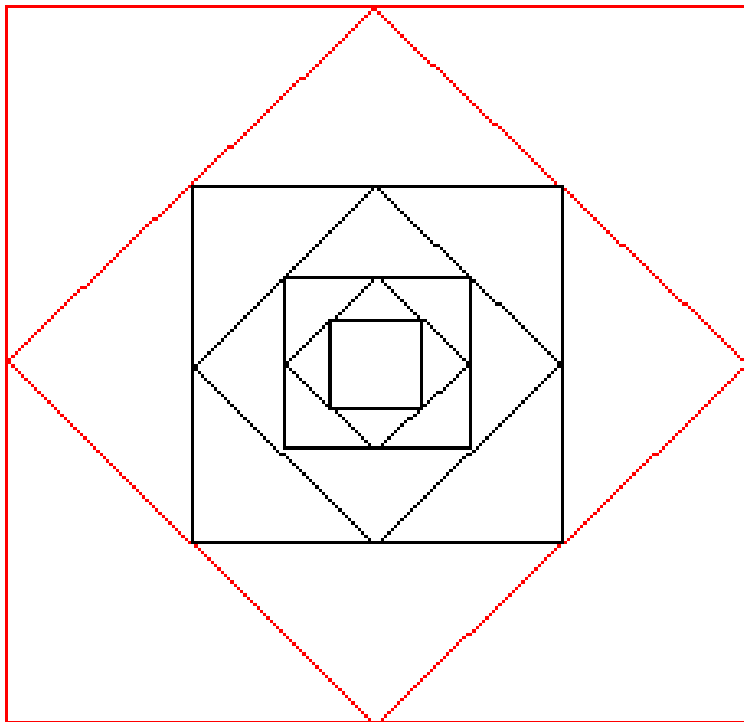
Take any two points  $A$  and  $B$  on the parabola  $y=x^2$ .

Draw the line  $OC$  through the origin, parallel to  $AB$ , cutting the parabola at  $C$ .

Let  $A=(a, a^2)$ ,  $B=(b, b^2)$ , and  $C=(c, c^2)$ . Prove that  $a+b=c$ .



**Question 6.** Seven squares are set inside each other. The centre points of each side of the outer square are joined to make a smaller square inside it and so on. The centre square has the area of 1 (one) square unit. What is the total area of the four outside triangles that are outlined in red?



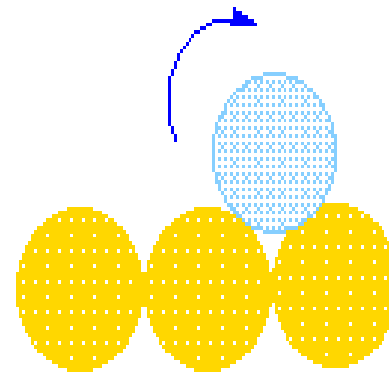
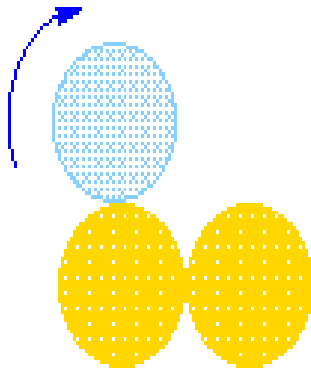
## Question 7. Why 24?

Take any prime number greater than 3, square it, subtract one and divide by 24. Make a statement about what you notice about dividing by 24 (a conjecture) and prove that what you say is always true.

**Question 8.** A blue coin rolls round two yellow coins which touch. The coins are the same size.

How many revolutions does the blue coin make when it rolls all the way round the yellow coins?

Investigate for a line of 'n' coins (starting at  $n = 1$ )



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