41st CHAMPIONSHIP: MATHEMATICAL AND LOGIC GAMES
FFJM Quarter final: category L1

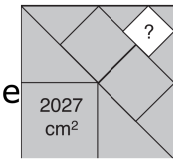
Information and results at http://www.ffjm.org/

For the problems, as needed, take:
$\pi \approx 3{,}1416$; $\sqrt{2} \approx 1{,}414$; $\sqrt{3} \approx 1{,}732$.

1. ADD 1 OR MULTIPLY BY 3

You have just two operations available on your calculator: add 1 or multiply by 3.
The screen displays 0.
What is the minimum number of operations needed to reach 2027?

2. SMALL SQUARE



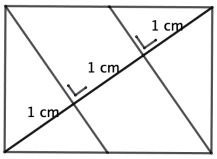
Inside a large square, there are four other squares. The area of one these squares is given.
What is the area of the small white square?
Answer as a fraction in simplest form.

3. TWO INTEGERS

The numbers *x* and *y* are two strictly positive integers such that $x < y < 100$. **What is the value of $x + y$ if they satisfy the equation:**

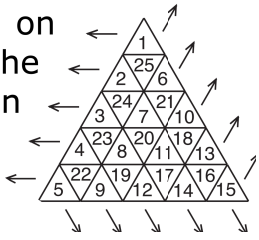
$$x + y + xy = 2027?$$

4. RECTANGLE



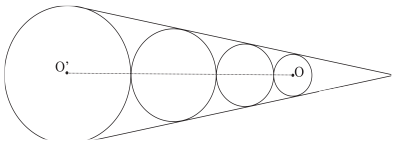
A diagonal of this rectangle is divided into three segments, each 1 cm long, by two perpendicular lines drawn from opposite vertices.
What is the area of the rectangle?
Give the answer in cm², rounded to the nearest hundredth.

5. RINGS



Gold coins are placed on each triangular tile of the triangular mat shown in the figure, with the quantity as indicated.
Matthew has rings and can place as many as he wishes on the mat, with each ring occupying a single tile, provided that no two rings are located in the same row (row directions are indicated by arrows). He will then collect all the coins from the tiles where he has placed rings.
What is the maximum number of gold coins Matthew can win?

6. FOUR CIRCLES



Four circles are tangent to one another and to the sides of the same angle.
We know that the smallest of the four circles has a radius of 4 cm and the largest has a radius of 13.5 cm.
Give the distance OO', rounded to the nearest tenth if necessary.

7. CRYPTARITHM

In this cryptarithm, a letter always represents the same digit, and two different letters always represent two different digits. The first digit of a multi-digit number is never 0.

7 × ZERO + UN + UN = DEUX

Furthermore, no letter stands for 7.
What is the value of DEUX?

8. MUMMY, THE LITTLE BOATS

A small boat's sail is shaped like a right-angled triangle with side lengths that are whole numbers of cm. Its longest side measures 65 cm, and none of its angles measure less than 30°.
What is the length of its shortest side?

9. NO FORBIDDEN NUMBERS

What is the maximum number of consecutive positive integers such that the sum of the digits of none of them is a multiple of 11?

10. THE SCRIBE'S FRACTION

An Egyptian scribe must write the fraction 3/5 as a sum of fractions, all with numerators of 1 and distinct denominators. However, he only likes powers of 2, so he begins writing: 1/2 + 1/16 + 1/32 + …, adding at each step the largest possible fraction of the form $1/2^n$ without exceeding 3/5. After writing 11 of these fractions, the resulting denominator is so large that the scribe can go no further and stops.

What was this eleventh denominator?