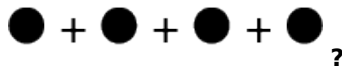


START for ALL PARTICIPANTS

1. CODE BREAKER (coefficient 1)



In this equation, each symbol represents a digit, always the same for the same shaped symbol. Different shaped symbols represent different digits.



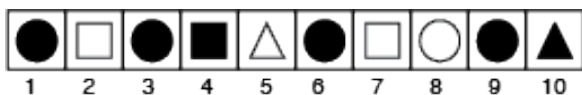
What number is

2. THE MAP OF POLDAVIA (coefficient 2)



Matthew colours a map of Poldavia with three colours in such a way that two regions having a common border are never the same colour. **Which regions will be the same colour as Region #7 will be?**

3. THE MYSTERIOUS SYMBOL (coefficient 3)

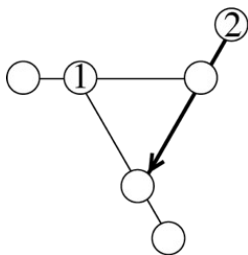


In the drawing above are displayed 10 symbols numbered from 1 to 10. Matilda chooses a symbol which has the same shape and the same colour as another symbol of the drawing. There are more discs on the left than on the right of the Matilda's chosen symbol; there is at least one disc on each side.

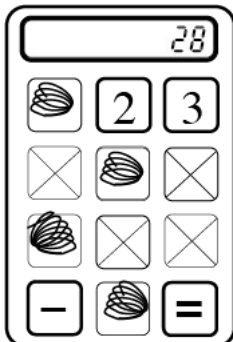
What is the number of Matilda's symbol?

4. THE BAND OF SIX (coefficient 4)

We want to place the numbers 3, 4, 5 and 6 in the empty discs so that the sum of three numbers in a straight line is always the same. Also, the three numbers on the arrow must be arranged in order, from the smallest to the largest, in the direction of the arrow. **It's your turn to play!**



5. THE OLD CALCULATOR (coefficient 5)



This old calculator has just four keys that work: the 2 key, the 3 key, the - (minus) key, and the = (equals) key. The display shows 28. Matilda wants the screen to display 0. **At least how many keypresses will she need to make?**

Example: To change from display 5 to 0, she would press five keys successively: - 3 - 2 =.

END for CE PARTICIPANTS

6. THE FOUR FRIENDS (coefficient 6)

Amandine, Basil, Claude and Dominique are four friends. One of them is only 8 years old, two of them are 9 years old and the fourth has just turned 10 years old. They are asked which of them is only 8 years old.

Amandine: "It's Basil." Basil: "It's Dominique".

Claude: "It's not me." Dominique: "Amandine is wrong". Three of them told the truth and one of them was mistaken.

Who is only 8 years old?

7. THE BALLS (coefficient 7)

In a bag, there are 9 balls, some are red and others blue. Each red ball weighs 70 grams and each blue ball 100 grams. The total weight of the balls is 720 grams.

How many red balls are in the bag?

8. A LONG SERIES (coefficient 8)

A series of digits starts with 4; 2; 8; 6; 8; ...

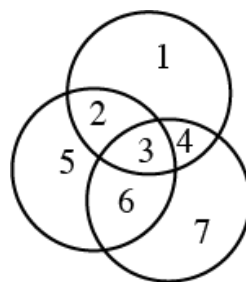
It is obtained as follows: we write 4 then 2 then each subsequent digit is the final digit of the product of the two previous digits.

What will be the 2019th digit of the series?

END for CM PARTICIPANTS

Problems 9 to 18: beware! For a problem to be completely solved, you must give both the number of solutions, AND give the solution if there is only one, or give any two correct solutions if there are more than one. For all problems that may have more than one solution, there is space for two answers on the answer sheet (but there may still be just one solution).

9. MATTHEW'S COMPASS (coefficient 9)

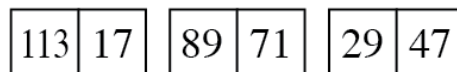
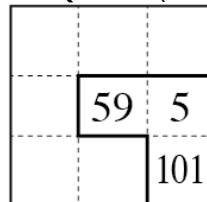


Without adjusting the opening of his new compass, Matthew has drawn three circles. These three circles define 7 closed regions.

If Matthew draws a fourth circle, still without adjusting his compass, how many closed regions will he have made, at most?

Note: we do not count the region outside all the circles.

10. MAGIC SQUARE (coefficient 10)



Place these three dominoes in the square above to make a magic square, so that the sum of three numbers in a line, column or diagonal is always the same. The orientation of the numbers in the square does not matter.

11. YEAR REPRESENTATIVE (coefficient 11)

Three students, Adrian, Basil and Clarissa, are competing for the position of representative of the 150 students of the classes of their year. Whoever wins the most votes will win. The counting is in progress. So far, Adrian has 27 votes, Basil has 35 and Clarissa has 45. **How many more votes must Clarissa receive to be sure of being elected?**

END for C1 PARTICIPANTS

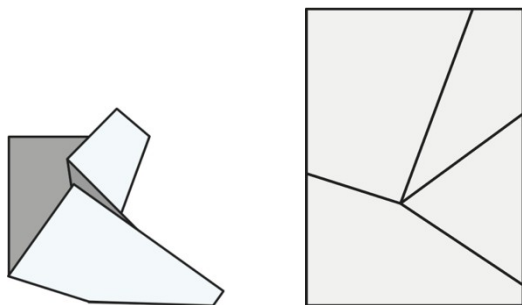
12. MATILDA'S NUMBER (coefficient 12)

Matilda writes a very large number of the form 1234567891234 ..., where the digits 123456789 are repeated in order (she does not write 0). When she stops, her number has fewer than 25 digits and is divisible by 128.

How many digits does Matilda's number have?

13. TRICKY FOLD (coefficient 13)

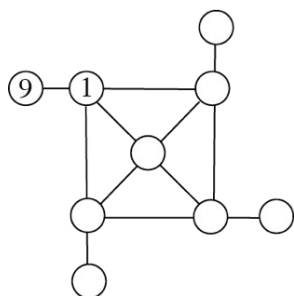
On opening her big atlas, Matilda discovers a folded page as shown in the drawing, flattened between two other pages.



She unfolds it and notices the four folds meet at one point on the page. With her brand-new protractor, she measures the four angles at that point. She observes that the four angles are all whole numbers of degrees, that one is double another, and that one is 1.5 times another. Matilda measures the smallest of the four angles.

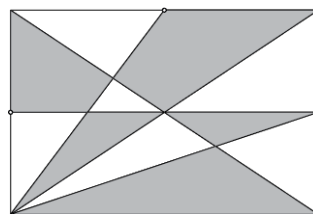
What is this angle in degrees?

Note: The figure does not necessarily represent the proportions.

14. NUMBER WHEEL (coefficient 14)

This wheel must contain the digits from 1 to 9 (1 and 9 are already filled in) so that the sum of three digits connected by a straight-line segment is always the same. **It's up to you to complete the wheel.**

END for C2 PARTICIPANTS

15. SOPHIE'S COLOURING (coefficient 15)

Sophie made this drawing in which the points on the sides of the rectangle are in the middle of these sides. She coloured in two quadrilaterals and three triangles. The rectangle is 72 mm by 38 mm.

What is the overall area of the coloured parts?

16. A SUB-PRIME SQUARE (coefficient 16)

Adelaide wrote the numbers from 1 to 25 in the square boxes so that the sum of the two numbers in

1		15		21
18				20
	12		10	
8				16
23		17		25

any two boxes with a common side is a prime number.

But her little sister Sophie has erased 13 of the numbers.

Find Adelaide's initial layout

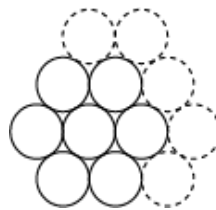
Note: a prime number is a number that has exactly two divisors: 1 and itself.

END for L1, GP PARTICIPANTS

17. PENNED IN (coefficient 17)

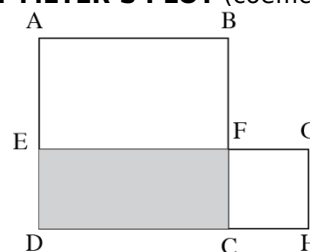
Jon Quille is a manufacturer of pens. He delivers his pens to wholesalers in boxes of hexagonal cross-section. Each box holds 919 pens in a hexagonal arrangement as in the drawing.

Each pen has a diameter of 1 centimetre.



What is the area of the hexagonal base of a box, at a minimum?

Give the answer in cm^2 , rounded to the nearest integer. If necessary, take 1,732 for $\sqrt{3}$ and 3,14 for π .

18. PERRY METER'S PLOT (coefficient 18)

Perry Meter owns a large plot of land ABEFGH consisting of two contiguous squares whose sides are whole numbers of metres.

He decides to sell the ABFE and CFGH plots to keep only the rectangular CDEF plot shown in grey.

The overall area of the two plots he sells is 2019 m^2 .

What is the area of land he keeps?

Note: The drawing is not necessarily in proportion.

END for L2, HC PARTICIPANTS