

**BACCALAURÉAT GÉNÉRAL ET TECHNOLOGIQUE
ÉPREUVE SPÉCIFIQUE DES SECTIONS EUROPÉENNES
MATHÉMATIQUES – ANGLAIS**

SUJET 14 – The Numbers Game

Thème : Numbers and sequences

Ce sujet comporte 2 pages. L'usage de la calculatrice est autorisé.

Mathematics has given form and order to our sciences of the past, the present, and it has set the groundwork for the future.

In addition to practical intellectual values, mathematics has its appealing recreational aspects.

- 5 An example is a simple game played with numbers. It has a most intriguing feature: you *can't* lose.

The rules are as follows:

- (a) Only two players (A and B) at a time
- (b) Player A mentions any number between 1 and 10. Then player B mentions any
10 number between 1 and 10 and this is added to A's number. This process continues until 100 is reached, each player adding to the growing total
- (c) Whoever is the first to reach exactly 100 is the winner

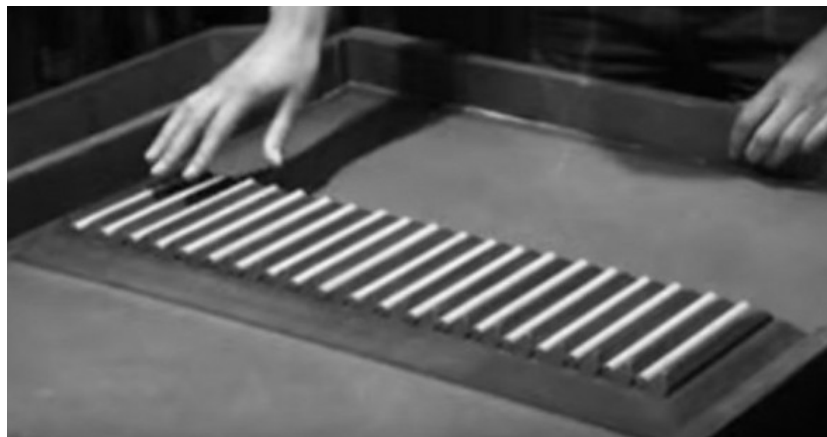
- 15 The system is based upon "key" numbers. You will not have to memorize these "keys" as they fit into a pattern which will be obvious to you: 12, 23, 34, 45, 56, 67, 78 and 89. Let's assume you've reached the first "key": your opponent adds another number, for instance 4, making the total 16. You must now bring the total to your second "key", 23. Thus, to 16 you must add 7, so you call 7... And this is continued until you arrive to 89: of course, at this point it is impossible for your opponent to reach 100. After he mentions any number, you can bring the total to 100!

Adapted from William Simon, *Mathematical Magic*, 1964

1. Read the article from "*Mathematics has given form ...*" to "*... the winner*".
Explain what the text deals with and comment on it.

Exercise:

2.
 - a) Let's assume you are Player B. Player A has started with 8. What number do you need to choose to follow the system explained above?
 - b) Let's assume you are Player A. What number do you need to start with if you want to be sure to win?
 - c) What happens to the statement "*It has a most intriguing feature: you can't lose*" if the other player also knows the system?
3. "*You will not have to memorize these "keys" as they fit into a pattern which will be obvious to you: 12, 23, 34, 45, 56, 67, 78 and 89*"
 - a) What kind of sequence is that?
 - b) If we consider that $a_1 = 12$, $a_2 = 23$ and so on, what would be the expression of a_n in terms of n ?
4.
 - a) A famous game, from the French TV-show **Fort Boyard**, follows the same rules, except that instead of reaching 100, you try to reach 20, and instead of choosing a number between 1 and 10, you choose a number between 1 and 3.
Can you set the sequence of the "key" numbers?



- b) General case: Same question if the number to reach is N , and the player has to choose a number between 1 and P .