

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

**SUJET 11 – A story of rabbits**

**Thème : Fibonacci and the golden ratio, sequence**

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

The Golden ratio is a special number found by dividing a line into two parts so that the longer part divided by the smaller part is also equal to the whole length divided by the longer part. It is often symbolized using phi, the 21<sup>st</sup> letter of the Greek alphabet.

5 As with pi, the digits go on and on, theoretically into infinity. Phi is usually rounded off to 1.618. This number has been discovered and rediscovered many times, which is why it has so many names such as the Golden mean, the Golden section, divine proportion, etc. Historically, the number can be seen in the architecture of many ancient creations like the Great Pyramids and the Parthenon. In the Great Pyramid of Giza, the length of each side of the base is 756 feet with a height of 481 feet. The ratio of the base to the height is  
10 roughly 1.5717, which is close to the Golden ratio.

Phidias (500 B.C. – 432 B.C.) was a Greek sculptor and mathematician who is thought to have applied phi to the design of the sculptures for the Parthenon. Plato (428 B.C – 347 B.C.) considered the Golden ratio to be the most universally binding of mathematical relationships. Later, Euclid (365 B.C. – 300 B.C.) linked the Golden ratio to the  
15 construction of a pentagram.

*Adapted from the website [livescience.com](http://livescience.com)*

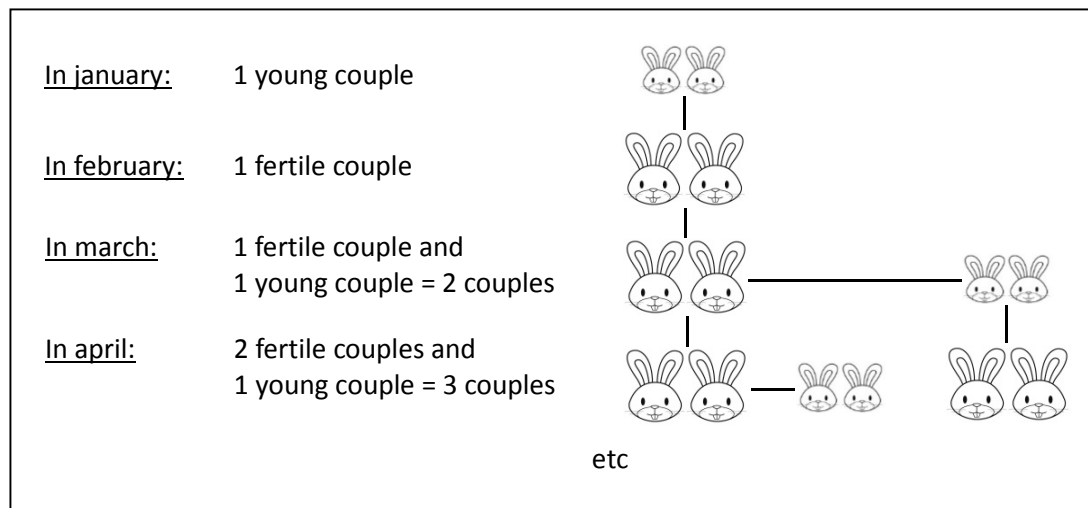
**1.** Read the first five lines of the text ending with "...to 1.618".

**2.** According to the text, what can you say about the Golden ratio?

## Exercise

The following problem has been introduced by the mathematician Fibonacci:

“Suppose a newly-born pair of rabbits, one male, one female, are put in a field. Rabbits are able to mate at the age of one month so that at the end of its second month a female can produce another pair of rabbits. Suppose that our rabbits never die and that the female always produces one new pair (one male, one female) every month from the second month on. How many pairs will there be in one year?”



1. Complete the following table.
2. How many couple of rabbits will there be in August?
3. Explain how to calculate any terms of the sequence knowing the previous two.
4. Give the solution to Fibonacci's problem.
5. Which kind of tool can we use to calculate the number of rabbits after 4 years?
6. Compute some ratio of two consecutive numbers of the sequence.  
What hypothesis can we make?
7. What else do you know about the Golden ratio?

Month	Fertile couples	Young couples	Couples
January	0	1	1
February	1	0	1
March	1	1	2
April	2	1	3
May	3	2	5
June	...	...	...
July	...	...	...
August	...	...	...