Notorious Numbers

1. **Mathematics of Rabbit Breeding**

A pair of newly born rabbits, male and female, were placed in a hutch. In two months these rabbits began their breeding cycle and produced on pair of rabbits, one male and one female. The original rabbits and their offspring continued to breed in this manner, that is, the first pair of offspring appearing at the parental age of two months and then a new pair every month thereafter – always one male and one female. All rabbits survived the first year.

What then is the total number of pairs of rabbits at the beginning of each month during the first year?

a.) Complete the chart below.

Month	**Pairs of Rabbits**		
Beginning of	Productive	Nonproductive	Total
1st	0	1	1
2nd	1	0	1
3rd			
4th			
5th			
6th			
7th			
8th			
9th			
10th			
11th			
12th			

b.) The total number of rabbits is known as the Fibonacci sequence. Study the sequence and explain how the sequence is constructed.

2. **The Shapes of Numbers**

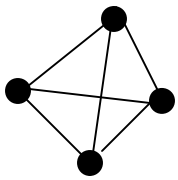
In the early days of mathematics, numbers were often represented with stones or sticks. Consequently, numbers can be categorized by the shape that they can make. Triangular numbers are natural numbers which can be represented by dots arranged in a triangular shape. For example, 3 can be drawn as:

The number 1 is also considered a triangular number even though it would be a single dot.

a.) Draw models below to help you find the next four triangular numbers.

b.) Explain the pattern in the triangular numbers and use your pattern to find the next two triangular numbers.

Numbers can be represented in three dimensions as well. Tetrahedral numbers are constructed by stacking triangular numbers. For example, using triangular numbers 1 and 3, the tetrahedral number 4 can be produced.



One is also considered a tetrahedral number.

c.) Draw the next three tetrahedral numbers.

d.) Explain the pattern and find the next two tetrahedral numbers.

Supertetrahedral numbers can be created by stacking tetrahedral numbers however these can pose a great challenge to draw since they would be in four dimensions. Nevertheless they can be easy to find.

$$1 = 1$$
$$1 + 4 = 5$$
$$1 + 4 + 10 = 15$$

e.) Find the next three supertetrahedral numbers.

3. **Where is Fibonnaci?**

a.) Construct the first 9 rows of Pascal's triangle.

b.) Describe the relationship between the number shapes and Pascal's triangle. Discuss the numbers in terms of shapes and dimensions.

c.) Complete the chart below to help you discover where the Fibonacci numbers are "hiding."

Ones	Natural Numbers	Triangular Numbers	Tetrahedral Numbers
1	*	*	*
1	*	*	*
1	1	*	*
1	2	*	*
1	_____	_____	*
1	_____	_____	*
1	_____	_____	_____
1	_____	_____	_____
1	_____	_____	_____

What conclusions can you draw?