PFS 27-9 Third Grade   2/27/14   _____

Fibonacci Numbers

Leonardo of Pisa, also called Fibonacci, was born in Pisa, in Italy, about the year 1170. His father was a diplomat in North Africa, and Leonardo traveled a great deal as a young man. In 1202 he was back in Pisa and had published his first book, *Liber Abaci.* It was the first book to introduce Hindu-Arabic numerals, the kind we use today, to Europe.

1)   Before *Liber Abaci,* people in Europe used Roman numerals to write numbers. Find out how Roman numerals work and write some numbers in Roman numerals.

2)   Is the Roman numeral system a place value system? What does that mean? Why do you think people liked the Hindu-Arabic system better?

3)   The most famous math problem in *Liber Abaci* concerns some rabbits who reproduce according to mathematical rules. Here's the problem: Assume a "pair" always means a male/female pair, and that each pair, after they're two months old, will give birth to one new pair every month. (And assume none of the rabbits die.) If you start with a new-born pair on January 1st, how many pairs will you have at the end of a year? Try using a function chart like this:

month   number of pairs

January   1
February   1
March   2
April   3

4)   The numbers that come up in that problem about rabbits from 1202 are now known as the Fibonacci numbers or the Fibonacci sequence: 1, 1, 2, 3, 5, 8, 13.... Can you state a rule for continuing this sequence? Can you write down the first twenty Fibonacci numbers?

5)   What happens if you square a Fibonacci number, and compare that to the product of its neighboring numbers? For example, 8^2 compared to 5 x 13. Can you show some examples and state a rule?

6)   The French mathematician Edouard Lucas, who lived in the 19th century, studied the Fibonacci sequence.   He also invented a new sequence, called the Lucas sequence in his honor. It follows the same rule as the Fibonacci sequence, but it begins with 1, 3, 4, 7... Write out the beginning of the Lucas sequence under the Fibonacci sequence:

1, 1, 2, 3, 5...
1, 3, 4, 7, 11...

Compare and contrast them! Do you see any connections between the sequences when they're written next to each other?

7)   Can you show the Fibonacci numbers in a Fibonacci tree? Make it artistic!

8)   Can you show the Fibonacci numbers in a "square spiral"? Make a beautiful final copy!

9)   The first four Fibonacci numbers add up to 4. Can you find a shortcut for adding up the first n Fibonacci numbers? Make a function chart like this to help you discover a rule:

Fibonacci number	Total so far
1	1
1	2
2	4
3	7

10)   The Fibonacci numbers can be found in nature. (For example, in pineapples!) Do some research to find some examples.

11)   Have fun!