With this bulletin board we honor **Leonardo Pisano**, better known by his nickname **Fibonacci**.

He wrote a book, *Liber abaci*, in 1202, based on the arithmetic and algebra. In it he introduced the Hindu-Arabic place-valued numeral system that we all use today. Up until then, most western cultures used the Roman Numeral system.

One section of *Liber abaci* contains a problem which brought about the introduction of the Fibonacci numbers and the Fibonacci sequence. That problem was stated as follows:

*A certain man put a pair of rabbits in a place surrounded on all sides by a wall. How many pairs of rabbits can be produced from that pair in a year if it is supposed that every month each pair begets a new pair which from the second month on becomes productive?*

The resulting monthly sequence of rabbit pairs is 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ... This sequence has proved extremely fruitful and appears in many different areas of mathematics and science.

**Directions:** **Use the black square on the bulletin board (it’s chalkboard paper), along with a piece of chalk, as a scratch pad to do your calculations for the problems below.**

1) Look at the sequence above, and on the bulletin board, and write down what you think the rule is to get each succeeding number in the sequence.

2) Based on that rule, what are the next three numbers in the sequence after 55?

3) In the rabbit problem, the number of **pairs** of rabbits born follows the Fibonacci sequence. Now that you know how to determine the next number in the sequence, determine how many pairs of rabbit there were at the end of 12 months. {Hint: The first offspring pair was born at the beginning of the 2\(^{nd}\) month. So there were 2 pair of rabbits at that time}
4) One of the most famous of the connections to the Fibonacci sequence is its relation to the Golden Ratio known as Phi (pronounced “fie”, rhymes with pie.) What is the ratio of the answer to number 3) to the Fibonacci number that preceded the answer?

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5) How close is your answer to 4) to the value of Phi shown on the bulletin board?

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6) The ancient Greeks and Romans knew of the Golden ratio (some called it the Divine Proportion), and used it in art and architecture. They arrived at that number geometrically. It results from a line segment that is divided in one very special way. It is the only number that satisfies the relation:

\[
\frac{A}{B} = \frac{B}{C}
\]

The ratio of the entire line A to segment B equals the ratio of segment B to segment C, or 

\[
\frac{A}{B} = \frac{B}{C}
\]

For this problem, use the “blackboard” again, and then make substitution noted above. Then solve for A {Hint: when you set up the equation and the right side equals 0, you have a quadratic equation in A… then substitute any integer >0 for B, the simpler the better}

Answer : A= _______________________________________________________________

(The only valid solution will be positive, since A is the length of the line.)

7) Then, as the last exercise for this worksheet: take the large chalkboard compass, set the pivot point on the upper right hand corner of the “blackboard” square, open it up so the chalk rests on the lower right hand corner…. And draw the missing part of the Fibonacci Spiral.

When you’re done, Please erase the “blackboard.” Thank you. And also, when finished with this worksheet, hand it in to Mr. O’Neill. Each problem is worth 10 extra credit points.