Names: _____ _____ Date: _____

Math Adventurers Worksheet Answers

We are learning about the amazing number Φ (phi, pronounced "fee"). This number appears many places in our world, and today as math adventurers, we are going to find this number and see why it is so special.

Part 1 – Φ in Nature

The answers in Part 1 will vary, depending on the measurements students take, but all the ratios in the second column should be close to phi: 1.61803

1. Looking at the **human hand** picture, measure the following line segments in centimeters:

   A _____

   B _____ $\frac{B}{A}$ = _____ (divide)

   C _____ $\frac{C}{B}$ = _____ (divide)

   D _____ $\frac{D}{C}$ = _____ (divide)

2. Looking at the **nautilus shell** picture, measure the following line segments in centimeters:

   A _____

   B _____ $\frac{B}{A}$ = _____ (divide)

   C _____ $\frac{C}{B}$ = _____ (divide)

   D _____ $\frac{D}{C}$ = _____ (divide)

3. Looking at the **star** picture, measure the following line segments in centimeters:

   A _____

   B _____ $\frac{B}{A}$ = _____ (divide)

   C _____ $\frac{C}{B}$ = _____ (divide)

   D _____ $\frac{D}{C}$ = _____ (divide)

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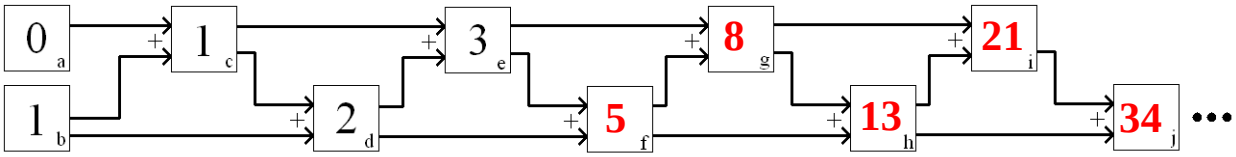
Part 2 – Φ in Math: The Fibonacci Sequence

Definition: Sequence (noun) An ordered set of numbers, shapes, or other mathematical objects, arranged according to a rule.

Example: 1,2,3,4,5,6,7… The rule for this sequence is to add 1 to the previous number.

Leonardo of Pisa, known as Fibonacci, introduced a specific sequence of numbers to the Western world in his 1202 book, *Liber Abaci*. The sequence starts with two numbers 0 and 1. To find the next number of the sequence, we add the two previous numbers: in this case, 0 + 1 = 1. Now we have the sequence 0, 1, 1. To find the next number of the sequence, we repeat the procedure, forming 1 + 1 = 2. So now we have the sequence 0, 1, 1, 2. Continuous repetition of the this procedure yields a sequence that continues forever to, what mathematicians call, infinity. The Fibonacci sequence has attracted attention because its numbers show up in the form of spirals, in such things as sunflowers and shells.

Fill in the empty boxes of the Fibonacci sequence below:



$\frac{C}{B}$ = **1/1 = 1** (divide)

$\frac{D}{C}$ = **1/1 = 2** (divide)

$\frac{E}{D}$ = **3/2 = 1.5** (divide)

$\frac{F}{E}$ = **5/3 = 1.67** (divide)

$\frac{G}{F}$ = **8/5 = 1.6** (divide)

$\frac{H}{G}$ = **13/8 = 1.63** (divide)

$\frac{I}{H}$ = **21/13 = 1.62** (divide)

$\frac{J}{I}$ = **34/21 = 1.62** (divide)

Next, try to put the pieces of the Fibonacci squares puzzle together.
Question: Have you seen the shape of the dotted line in nature?

Possible answer: It is similar to the Fibonacci spiral seen in, for example, the nautilus shell.