Rhind Papyrus (Egyptian Unit Fractions)/Compass Creating Circles/Protractors Measuring Degrees of Unit Fractions

We had a very busy week. First, the children read the oldest known mathematical document called the Rhind Papyrus written in Egyptian hieroglyphs. The scribe was Ahmes, the Egyptian who wrote the papyrus. It is dated to 1650 BC, over 3650 years ago. It is more than 1500 years older than the Rosetta Stone.

It was found in a tomb in Thebes, Egypt and sold to a Scotsman named Rhind in Luxor in 1858. I was fortunate enough to see it in the British Museum. The Rosetta Stone, also in the British Museum, is probably the reason that we are able to decipher the Rhind Papyrus..

The oldest mathematical document speaks of Unit Fractions (fractions with only one in the numerator). The children explored the Egyptian formula for splitting unit fractions into two or more other unit fractions with different denominators (Egyptian mathematics would not allow numerators to have numbers other than one and would not allow an equation to repeat a denominator such as $1/2 = \frac{1}{4} + \frac{1}{4}$).
The formula is $1/a = 1/(a+1) + 1/(a \times (a+1))$. This yields fraction equations such as on the following page:

CAN YOU FIND THE FIRST TWELVE UNIT FRACTIONS?

(EGYPTIAN FRACTIONS)

$$\frac{1}{A} = \frac{1}{A+1} + \frac{1}{A \times (A+1)}$$

FOR EXAMPLE: $\frac{1}{2} = \frac{1}{2+1} + \frac{1}{2 \times (2+1)}$

$\frac{1}{2} = \frac{1}{3} + \frac{1}{6}$

$\frac{1}{2} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{3} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{4} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{5} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{6} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{7} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{8} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{9} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{10} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{11} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{12} = \frac{1}{\ } + \frac{1}{\ }$

$\frac{1}{13} = \frac{1}{\ } + \frac{1}{\ }$

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$$\frac{1}{2} = \frac{1}{3} + \frac{1}{6} \qquad \frac{1}{8} = \frac{1}{9} + \frac{1}{72}$$

$$\frac{1}{3} = \frac{1}{4} + \frac{1}{12} \qquad \frac{1}{9} = \frac{1}{10} + \frac{1}{90}$$

$$\frac{1}{4} = \frac{1}{5} + \frac{1}{20} \qquad \frac{1}{10} = \frac{1}{11} + \frac{1}{110}$$

$$\frac{1}{5} = \frac{1}{6} + \frac{1}{30} \qquad \frac{1}{11} = \frac{1}{12} + \frac{1}{132}$$

$$\frac{1}{6} = \frac{1}{7} + \frac{1}{42} \qquad \frac{1}{12} = \frac{1}{13} + \frac{1}{156}$$

$$\frac{1}{7} = \frac{1}{8} + \frac{1}{56} \qquad \frac{1}{13} = \frac{1}{14} + \frac{1}{182}$$

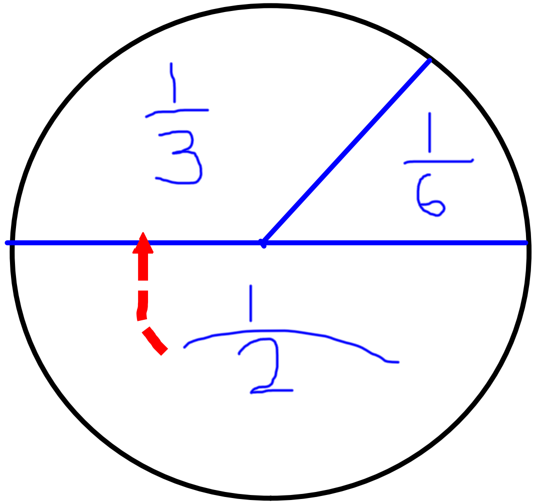
$$\frac{1}{2} = \frac{1}{3} + \frac{1}{6}$$

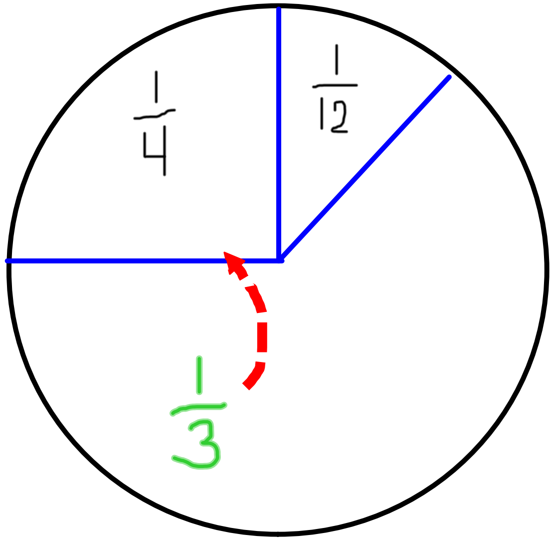
$$\frac{1}{2} = \frac{1}{4} + \frac{1}{12} + \frac{1}{7} + \frac{1}{42}$$

we could keep going to infinity, making the equivalent of 1/4, and 1/12, and so forth. I did this to 64 unit fractions the sum of which equals 1/2.

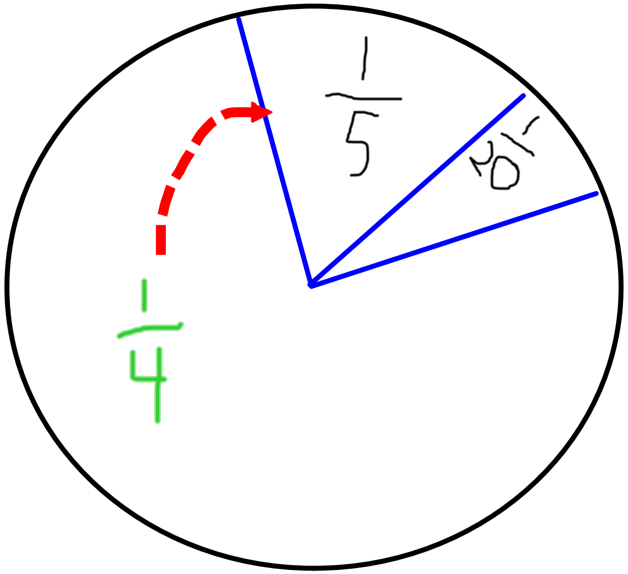
Can you create an equation of unit fractions that uses 128 unit fractions.

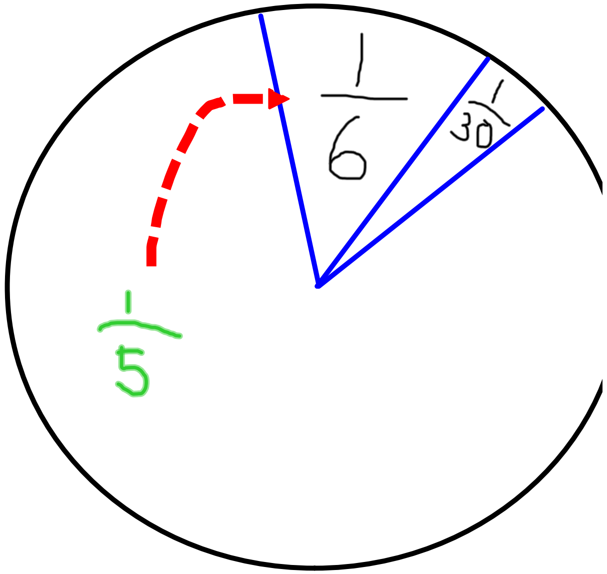
After the children discovered this formula on their own, I had them use a compass (safe compass without the sharp point) to draw circles. Then we used a protractor to measure the degree angles of the Egyptian unit fractions. I also introduced the graphing calculator to them so they could easily divide 360 degrees by the denominator of their unit fractions. For example, if the children chose 1/6 = 1/7 + 1/42, I had them first divide 360/6 = 60 degrees, then 360/7 = 51.4 degrees, and finally 360/42 = 8.6 degrees. The children used the protractor to create unit sectors within their circles with these degree measurements.





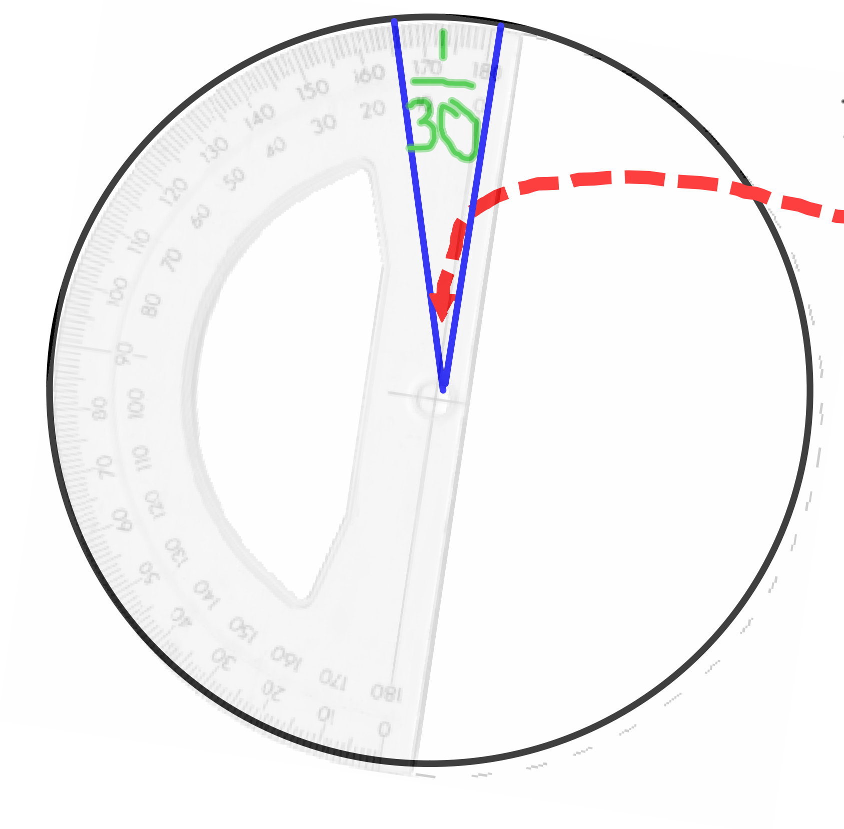
NOW CHECK TO SEE IF YOUR SOLUTIONS WORK





HOW DO WE CREATE THESE SECTORS?

SINCE A CIRCLE HAS 360 DEGREES, DIVIDE 360 BY THE DENOMINATOR OF THE UNIT FRACTION AND USE THAT DEGREES TO CREATE THE SECTOR.



$$\frac{1}{30} = \frac{360}{30} \text{ Degrees}$$

$$12^\circ$$