Day 14, MAT115

Last Time   Next Time

- Announcements:
  - I'm sorry that I've not gotten your homework's graded yet. I've got a key here, in case you want to make sure that you're doing them right, however.
  - Materials for today:
    1. Here is a video covering today's topic of symmetry (with some practice Egyptian Division). Here's the pdf containing the work that was done during the video.
- Last time we checked out Egyptian division. Since most of you probably don't care too much for our own division, that's probably not something you're excited about studying! What makes it interesting to me is what we discover culturally: e.g.
  1. That Egyptians, although they were "base 10" people, probably also gravitated toward the powers of 2 (they liked doubling and halving).
  2. That "fair divisions" -- making portions look fair to their enslaved populations -- may have had important ramifications socially. The Family Circus comic makes this plain: Dolly things that her sandwich, cut into two pieces, is somehow less than PJ's sandwich, because it's been cut into four pieces.....

- We'll begin with a little review of Egyptian division. Then on to a completely new topic: symmetry.
  - We started last time with some simple examples, and we should do a warmup, that sounds like a hard one (but it's easy, because it divides evenly -- I want to show that it's basically just multiplication backwards): what's 14941/223 = ?

1	223	*
2	446	*
4	892	
8	1784	
16	3568	
32	7136	
64	14272	*

? = 64 + 2 + 1 = 67 ✓

14941 = 14272 + 669 (446 + 223)

On the right we build the "missing part" of the quotient -- 14941 -- and on the left we build up our answer, using the powers of 2 corresponding to the "useful" doubles of 223.

The divisor is the thing that gets doubled. In this case we get lucky, and it divides evenly.

  - Let's try this one: 31 divide by 13? This is about as tricky as it gets! We'll do it in two ways: as "multiplication backwards", and using the Unit Fraction Table: Egyptians had this fascination with fraction that had a numerator of 1. The only fraction (other than the the unit fractions) they used was 2/3. Nonetheless, just FYI, 2/3 can be written as

$\frac{31}{13} = 2 + \frac{1}{4} + \frac{1}{13} + \frac{1}{26} + \frac{1}{52}$

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

1	13	
2	26	*
1/2	6 + 1/2	
1/4	3 + 1/4	*
1/13	1	*
1/26	1/2	*
1/52	1/4	*

31 = 26 + 5; 5 = 3 + 1/4 + 1 + 1/2 + 1/4

31 = 26 + 3 + 1/4 + 1 + 1/2 + 1/4

- Now today we're starting a new topic, one which I think is beautiful. Let's talk about **symmetry**:

> Symmetry, as wide or as narrow as you define its meaning, is one idea by which man through the ages has tried to comprehend and create order, beauty and perfection.

Hermann Weyl (German Mathematician; 1885 - 1955)

  - Where have we used symmetry already?
    - Yanghui's triangle had an error in it....
    - There's a certain symmetry between Egyptian multiplication and division.
    - There's a type of symmetry in the golden rectangle: within a golden rectangle is found a perfect scale copy of itself.

    Where else does symmetry appear, and how do we use it?

    Are humans symmetric? Turns out that we're purported to have a "good side" and an "evil side"!
  - Symmetry can be used in two different ways:
    - to simplify, and
    - to complexify!

    We can use symmetry to solve some problems, and we can use symmetry to make things more interesting. Let's start with the latter:
    - Contradancing
    - Haeckel and the radiolaria: On the Discovery Docket: Proteus
  - Now to help us break down some of the most important elements of these topics, I want to distribute this worthy handout, or four pages of it at any rate.

    It covers two kinds of symmetry that are very important: rotational and reflective.

    So let's take a look at the definitions.

    Your homework: to do the problems on the first **three** pages of this symmetry handout (see the assignments page).
  - In the plane of 2-Dimensions,
    - What is the most symmetric rectangle?
    - What are regular polygons?
    - How many regular polygons are there?
    - What kinds of symmetry do they possess?
    - Which regular polygons can be used exclusively to "tile" the plane, like a bathroom floor?
- **Links**:
  - Unit Fraction Table

Website maintained by Andy Long. Comments appreciated.
Updated on 03/04/2021 00:37:52