Egyptian Division

- Demonstrate Egyptian division by dividing:
  - 9/4
  - 13/7

  Try these using the same sort of "doubling/halving" table that we use for multiplication.
- Demonstrate Egyptian division by dividing:
  - 4/9
  - 7/13

  Try these using the unit fractions table method, and Fraudini's trick (writing a number as a sum of distinct powers of 2).

9/4:

1	4	
2	8	*
1/2	2	
1/4	1	*

$9 = 8+1$

$9/4 = 2+1/4$

of course!

By the Fraudini method:

$$\frac{9}{4} = \frac{8+1}{4} = \frac{8}{4} + \frac{1}{4} = 2+\frac{1}{4}$$

13/7:

1	7	*
1/2	3+1/2	*
1/4	1+1/2+1/4	*
1/7	1	
1/14	1/2	*
1/28	1/4	*

switch gears to get to 1:

13

17 6

3+1/2 2+1/2

1+1/2+1/4 1/2+1/4

done!

need 1/2 of 1/4 easy!

Check:

$13 = 7 + (3 + \frac{1}{2}) + (1 + \frac{1}{2} + \frac{1}{4}) + \frac{1}{2} + \frac{1}{4}$ ✓

So $\frac{13}{7} = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{14} + \frac{1}{28}$

Check with calculator

1,857... 1,857... ✓

Faster by Fraudini?

$$\frac{13}{7} = \frac{7+6}{7} = 1 + \frac{6}{7} = 1 + \frac{4+2}{7} = 1 + \frac{4}{7} + \frac{2}{7}$$

$$= 1 + 2\left(\frac{2}{7}\right) + \frac{2}{7}$$

$$= 1 + 2\left(\frac{1}{4} + \frac{1}{28}\right) + \left(\frac{1}{4} + \frac{1}{28}\right)$$

$$= 1 + \frac{2}{4} + \frac{2}{28} + \frac{1}{4} + \frac{1}{28}$$

same

$$= 1 + \frac{1}{2} + \frac{1}{14} + \frac{1}{4} + \frac{1}{28}$$

- Demonstrate Egyptian division by dividing:
  - 9/4
  - 13/7

  Try these using the same sort of "doubling/halving" table that we use for multiplication.
- Demonstrate Egyptian division by dividing:
  - 4/9
  - 7/13

  Try these using the unit fractions table method, and Fraudini's trick (writing a number as a sum of distinct powers of 2).

Now using the Fraudini approach.

$\frac{4}{9}$ ← already a power of 2!

$= 2\left(\frac{2}{9}\right)$

$= 2\left(\frac{1}{6}+\frac{1}{18}\right)$

$= \frac{2}{6}+\frac{2}{18}$

$\boxed{\frac{4}{9} = \frac{1}{3}+\frac{1}{9}}$ of course!

$\frac{7}{13} = \frac{4+2+1}{13} = \frac{4}{13}+\frac{2}{13}+\frac{1}{13}$

$= 2\left(\frac{2}{13}\right)+\frac{2}{13}+\frac{1}{13}$

$= 2\left(\frac{1}{8}+\frac{1}{52}+\frac{1}{104}\right)+\left(\frac{1}{8}+\frac{1}{52}+\frac{1}{104}\right)+\frac{1}{13}$

$= \frac{2}{8}+\frac{2}{52}+\frac{2}{104}+\frac{1}{8}+\frac{1}{52}+\frac{1}{104}+\frac{1}{13}$

$= 1/4 + 1/26 + 1/52 + 1/8 + 1/52 + 1/104 + 1/13$

can't repeat fractions
so combine into $2/52$
$= 1/26$

$= 1/4 + 1/26 + 1/26 + 1/8 + 1/104 + 1/13$

repeated $\quad 1/26 + 1/26 = 2/26 = 1/13$

$= 1/4 + 1/13 + 1/8 + 1/104 + 1/13$

$2/13 = 1/8 + 1/52 + 1/104$

$= 1/4 + 1/8 + 1/52 + 1/104 + 1/8 + 1/104$

$= 1/4 + 2/8 + 1/52 + 2/104$

$= 1/4 + 1/4 + 1/52 + 1/52$

$= 2/4 + 2/52$

$F_{13} = 1/2 + 1/26$

yikes!

1	13	
½	6+½	*
1/13	1	
1/26	½	*

$\frac{7}{13} = \frac{1}{2} + \frac{1}{26}$

7 = 6+½ + ½

Wow! Lots easier by the doubling/halving table....

Evan find a better way:

$$\frac{7}{13} = \frac{14}{26} = \frac{13+1}{26}$$

$$= \frac{13}{26} + \frac{1}{26}$$

$$= \frac{1}{2} + \frac{1}{26}$$

Nice!