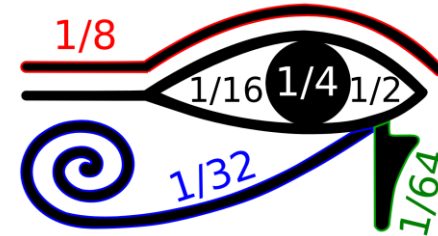




**Advanced Mathematics
Support Programme®**



Ouroboros



The eye of Horus

5000 years ago the Egyptians used fractions but could only write unit fractions, fractions where the numerator is 1.

$$\frac{1}{2} = \text{[red oval with two vertical bars below it]}$$

$$\frac{1}{3} = \text{[red oval with three vertical bars below it]}$$

$$\frac{1}{4} = \text{[red oval with four vertical bars below it]}$$

All other fractions were written as sums of unit fractions but more about that later.....



1. What is the value of $\frac{2006}{8} + \frac{6002}{8}$

2. There are 84 animals in a field
 11 are cows
 45 are sheep
 The rest are pigs

What fraction of the animals are pigs?
 Give you answer in simplest form

3. Simplify fully $\frac{x}{6} + \frac{3x}{4}$

4. Calculate $\frac{5}{6} \times \frac{3}{5}$
 give your answer in simplest form

5. What is the value of $1\frac{3}{4}$

6. How many of these calculations equal 1
 Give reasons

$$\frac{1}{2} + \frac{1}{2} \quad \frac{1}{2} - \frac{1}{2} \quad \frac{1}{2} \times \frac{1}{2} \quad \frac{1}{2} \div \frac{1}{2}$$

7. Sally has 30m of ribbon.
 She cuts lengths of $2\frac{3}{5}$ metres from the ribbon. Sally says she has enough ribbon to cut 12 lengths. Is she correct?
 You must show all workings

8. Express as a single fraction $\frac{2a}{3} - \frac{b}{4}$



Fractions 1



Solutions on the next slide....



1. What is the value of $\frac{2006}{8} + \frac{6002}{8}$ → $\frac{8008}{8} = 1001$

2. There are 84 animals in a field
 11 are cows
 45 are sheep
 The rest are pigs

→ $84 - (11 + 45) = 28$

So 28 animals are pigs

which is $\frac{28}{84} = \frac{1}{3}$

What fraction of the animals are pigs?
 Give you answer in simplest form

3. Simplify fully $\frac{x}{6} + \frac{3x}{4}$ → Need a common denominator to add fractions

e.g. $\frac{(x4)}{(x4)} \frac{x}{6} + \frac{3x}{4} \frac{(x6)}{(x6)} = \frac{4x}{24} + \frac{18x}{24} = \frac{22x}{24}$

$= \frac{11x}{12}$

4. Calculate $\frac{5}{6} \times \frac{3}{5}$ → $\frac{5}{6} \times \frac{3}{5} = \frac{5 \times 3}{6 \times 5} = \frac{15}{30} = \frac{1}{2}$

give your answer in simplest form



5. What is the value of $\frac{4}{1\frac{3}{4}}$ $\rightarrow \frac{4}{1\frac{3}{4}} = 4 \div \frac{7}{4} = 4 \times \frac{4}{7} = \frac{16}{7}$

6. How many of these calculations equal 1
Give reasons \rightarrow

| | | | |
|-----------------------------|-----------------------------|----------------------------------|--|
| $\frac{1}{2} + \frac{1}{2}$ | $\frac{1}{2} - \frac{1}{2}$ | $\frac{1}{2} \times \frac{1}{2}$ | $\frac{1}{2} \div \frac{1}{2}$ |
| | = 0 | = $\frac{1}{4}$ | = $\frac{1}{2} \times \frac{2}{1} = \frac{2}{2}$ |

7. Sally has 30m of ribbon.
She cuts lengths of $2\frac{3}{5}$ metres from the ribbon. Sally says she has enough ribbon to cut 12 lengths. Is she correct?
You must show all workings \rightarrow

Compare $12 \times 2\frac{3}{5}$ to 30 m

either: $12 \times 2\frac{3}{5} = 12 \times \frac{13}{5} = \frac{156}{5} = 31\frac{1}{5}$

or: $\frac{3}{5} \times 12 = \frac{36}{5} = 7\frac{1}{5}$, $2 \times 12 = 24$
 $24 + 7\frac{1}{5} = 31\frac{1}{5}$ No. $31\frac{1}{5} > 30$

8. Express as a single fraction $\frac{2a}{3} - \frac{b}{4} \rightarrow$

$$\frac{(x4) 2a}{3} - \frac{b (x3)}{4 (x3)} = \frac{8a}{12} - \frac{3b}{12} = \frac{8a - 3b}{12}$$



1. Calculate $2\frac{1}{7} + 1\frac{1}{5}$
Give your answer as a mixed number in simplest form

2. Simplify $\frac{4a}{5} \times \frac{7b}{3}$

3. Work out $\frac{19}{24} - \frac{3}{8}$
giving your answer in simplest form

4. Find the mean of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$
give your answer in simplest form

5. A full glass of water can hold $\frac{1}{6}$ of a bottle of water.
How many glasses can be filled by $2\frac{1}{5}$ bottles?

6. A water tank is $\frac{2}{3}$ full
40 litres of water are taken from the tank
The tank is now $\frac{1}{2}$ full
What fraction of the tank was removed ?

7. Which of these has the largest value

$$\frac{1}{2} + \frac{1}{4} \quad \frac{1}{2} - \frac{1}{4} \quad \frac{1}{2} \times \frac{1}{4} \quad \frac{1}{2} \div \frac{1}{4} \quad \frac{1}{4} \div \frac{1}{2}$$

8. Simplify $\frac{a}{b} + \frac{b}{c}$



Fractions 2



Solutions on the next slide....



1. Calculate $2\frac{1}{7} + 1\frac{1}{5}$
Give your answer as a mixed number in simplest form



$$2\frac{1}{7} + 1\frac{1}{5} = \frac{15}{7} + \frac{6}{5}$$

$$\begin{aligned} \frac{(x5) 15}{(x5) 7} + \frac{(x7) 6}{(x7) 5} &= \frac{75}{35} + \frac{42}{35} = \frac{117}{35} \\ &= 3\frac{12}{35} \end{aligned}$$

2. Simplify $\frac{4a}{5} \times \frac{7b}{3}$



$$\frac{4a}{5} \times \frac{7b}{3} = \frac{4a \times 7b}{5 \times 3} = \frac{28ab}{15}$$

3. Work out $\frac{19}{24} - \frac{3}{8}$
giving your answer in simplest form



$$\frac{19}{24} - \frac{(x3)3}{(x3)8} = \frac{19}{24} - \frac{9}{24} = \frac{10}{24} = \frac{5}{12}$$

4. Find the mean of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$
give your answer in simplest form



Add the fractions together and then divide by 4
Change all the fractions to have the denominator 12

$$\frac{6}{12} + \frac{4}{12} + \frac{3}{12} + \frac{2}{12} = \frac{15}{12} = \frac{5}{4}$$

$$\frac{5}{4} \div 4 = \frac{5}{4} \times \frac{1}{4} = \frac{5}{16}$$



5. A full glass of water can hold $\frac{1}{6}$ of a bottle of water. How many glasses can be filled by $2\frac{1}{5}$ bottles?

$$\rightarrow \frac{11}{5} \div \frac{1}{6} = \frac{11}{5} \times \frac{6}{1} = \frac{66}{5} = 13\frac{1}{5}$$

=13 glasses

Solution 

6. A water tank is $\frac{2}{3}$ full
Some water is taken from the tank
The tank is now $\frac{1}{2}$ full. What fraction of the tank was removed ?

$$\rightarrow \frac{2}{3} - \frac{1}{2} = \frac{4}{6} - \frac{3}{6} = \frac{1}{6}$$

7. Which of these has the largest value

$$\frac{1}{2} + \frac{1}{4} \quad \frac{1}{2} - \frac{1}{4} \quad \frac{1}{2} \times \frac{1}{4} \quad \frac{1}{2} \div \frac{1}{4} \quad \frac{1}{4} \div \frac{1}{2}$$

$$\rightarrow \frac{1}{2} + \frac{1}{4} \quad \frac{1}{2} - \frac{1}{4} \quad \frac{1}{2} \times \frac{1}{4} \quad \frac{1}{2} \div \frac{1}{4} \quad \frac{1}{4} \div \frac{1}{2}$$

$$= \frac{3}{4} \quad = \frac{1}{4} \quad = \frac{1}{8} \quad = \frac{4}{2} = 2 \quad = \frac{2}{4}$$

8. Simplify $\frac{a}{b} + \frac{b}{c}$

$$\rightarrow \frac{a}{b} + \frac{b}{c} = \frac{(xc)}{(xc)} \frac{a}{b} + \frac{(xb)}{(xb)} \frac{b}{c} = \frac{ac}{bc} + \frac{b^2}{bc}$$

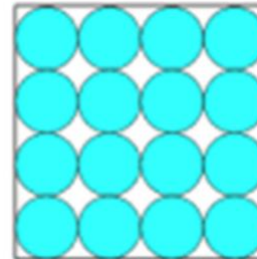
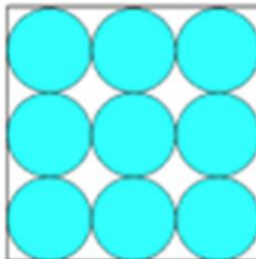
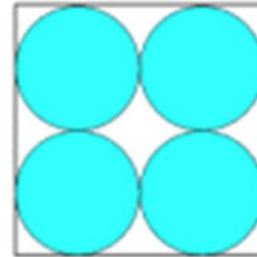
$$= \frac{ac+b^2}{bc}$$



Circles

In the images below the square has a side length of 1 unit.

Which of the images has the greatest area covered by circles?





Petrol Tank

Andrea's car has a petrol tank that holds 44 litres of petrol.

She goes to the petrol station when her tank is a quarter full and fills it up until it is two thirds full.

How many litres of petrol does she put into the car's petrol tank?



Peaches

A monkey has 75 peaches

Each day he: keeps a fraction of his peaches
 gives some away
 eats 1 peach

These are the fractions he decided to keep.

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{3}{4} \quad \frac{3}{5} \quad \frac{5}{6} \quad \frac{11}{15}$$

In what order did he use the fractions so that he was left with just one peach at the end?



Integers

What is the integer x

so that $\frac{x}{9}$

lies between $\frac{71}{7}$ and $\frac{113}{11}$?

Four Short Problems



Follow the [link](#) to the solutions



What is $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{8}{9}$ of $\frac{9}{10}$ of 1000 ?

Fractions of 1000



Follow the [link](#) to the solutions



Remember the Egyptians and their unit fractions? **Now it's time to explore this further.....**

A unit fraction is a fraction that has a numerator of 1.

Other fractions can be written as the sum of two unit fractions.

Here are some examples some of which are correct and some which are not – can you find which ones are correct?

$$\frac{1}{2} = \frac{1}{3} + \frac{1}{6} \quad \frac{1}{2} = \frac{1}{10} + \frac{1}{20} \quad \frac{1}{3} = \frac{1}{4} + \frac{1}{12} \quad \frac{1}{3} = \frac{1}{7} + \frac{1}{21} \quad \frac{1}{4} = \frac{1}{5} + \frac{1}{20}$$

What rules might have been used to generate these?

Thinking about those that are correct what rule might you suggest for generating other unit fractions from the sum of two others ?

Some unit fractions can be made in more than one way

Here are some to start you off $\frac{1}{6} = \frac{1}{7} + \frac{1}{42}$ $\frac{1}{6} = \frac{1}{8} + \frac{1}{24}$ can you find more ways to make $\frac{1}{6}$?

Can you finish this sum for $\frac{1}{8}$ and find more? $\frac{1}{8} = \frac{1}{9} + \frac{1}{\quad}$

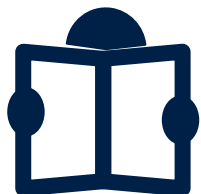
Can all unit fractions be made in this way ? Choose different unit fractions to test out your theories.



Unit Fractions



Follow the [link](#) to the solutions



Read some more about interesting fractions and how fractions are everywhere!



Discover more about fractions and series. This task explores what happens when we add fractions repeatedly.



Watch this video to find out one way that fractions connect biology and mathematics.

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