

# MATHEMATICS



## Fractions

### SEQUENCE 1

|                                |                        |
|--------------------------------|------------------------|
| Age group                      | 10-12 y.o              |
| Prior knowledge                | Divisions              |
| Material needed                | The Fractions box      |
| Subjects                       | Mathematics            |
| Skills involved                | Counting and reasoning |
| Time to carry out the sequence | 1 hour                 |

#### Step 1: Test with the box

Use the box with your pupils to illustrate the concept of fractions. The goal of the box and the storytelling resource is to anchor the concept of fractions into reality.

Start by showing your pupils the cake from the storytelling resource (along with the story) to show them how fractions work: at first, the cake was whole, and then only half of it remained, and half of that half, etc.

#### Step 2: What is a fraction?

Guide your pupils to phrasing “A fraction is a part of something”.

A fraction is made of two numbers and is represented as follows:  $\frac{1}{2}$

The bottom number is the denominator: this is the number of equal parts in which the item has been divided.

The top number is the numerator: this is the number of parts we take into account.

In a fraction, we do not care so much about the object we study as what part of it we want. It does not matter if we speak of apples or pizza; one half remains one half.



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Look back at what you did with the box: how would you represent  $\frac{3}{4}$  of an hour? Have your pupils draw a picture of a clock and colour  $\frac{3}{4}$  of it.

Next, use the coloured cubes to represent other fractions, such as:

$$\frac{2}{6}; \frac{4}{7}; \frac{5}{8}; \frac{3}{9}; \frac{7}{10}.$$

## Step 3: Compare the fractions

Sometimes, we can be led to face complex fractions with big numbers: those can be scary for pupils!

In order to make the fractions less threatening, when it is possible, we can divide both the numerator and the denominator by the same number. The fraction is still worth the same proportion, but the numbers are easier to deal with.

For example, consider the fraction  $\frac{16}{20}$ . It is quite hard to know how much this is worth!

However, both 16 and 20 can be divided by 2. The resulting fraction is  $\frac{8}{10}$ . It is better, but we can go even further: both 8 and 10 can be divided by 2. The resulting fraction is  $\frac{4}{5}$ . 4 and 5 cannot be divided by a common number, so we can leave the fraction as it is.

Using the cubes, have the pupils do the same with the fractions they recreated in the second step of this sequence:  $\frac{2}{6}; \frac{4}{7}; \frac{5}{8}; \frac{3}{9}; \frac{7}{10}$ .

What can they notice? Indeed, two of these fractions are equal:  $\frac{2}{6}$  and  $\frac{3}{9}$ , which are both equal to  $\frac{1}{3}$ .

In order to compare two fractions, you need to make sure that they are using the same denominator. If they are not, multiply both numbers of one fraction by the denominator of the other, and repeat with the other fraction.



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If we use the fractions from the step 2 examples, let's compare  $\frac{4}{7}$ ;  $\frac{5}{8}$  to know which one is bigger. We multiply 4 and 7 by the denominator of the other fraction, which is 8: the resulting fraction is  $\frac{32}{56}$ . Next, we multiply 5 and 8 by the denominator of the other fraction, which is 7: the resulting fraction is  $\frac{35}{56}$ . Both fractions have a common denominator, which is 56. Now, all we have to do is compare the numerators:  $32 < 35$ , so  $\frac{4}{7} < \frac{5}{8}$ .

Now compare all the fractions between themselves and rank them from the biggest to the smallest!



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## SEQUENCE 2

|                                |                                  |
|--------------------------------|----------------------------------|
| Age group                      | 10-12 y.o                        |
| Prior knowledge                | Basic knowledge of the fractions |
| Material needed                | The Fractions box                |
| Subjects                       | Mathematics                      |
| Skills involved                | Counting and reasoning           |
| Time to carry out the sequence | 1 hour                           |

### Step 1: Test with the box

In this sequence, use the box as a means to represent the various operations. Use the squares of a single colour to add and subtract: if you painted the 6 cubes yellow, ask your pupils to pick 1 cube and add 2 more for example. If you want them to subtract, give them all the yellow cubes and ask them to remove 4 of them. The same method applies for multiplication and division: give them 1 of the yellow cubes and ask them to multiply by 5, or give them 4 and ask them to divide by 2.

Next, for more tricky operations, ask your pupils to roll the dice: the smallest number is the numerator, and the biggest is the denominator. Ask your pupils to roll four dice in total to create two fractions. They will have to add, subtract, multiply, and divide the numbers they rolled. Keep this activity for higher-level pupils, since multiplying and dividing with a fraction can be tricky for younger pupils.

### Step 2: Calculate and compare

The experiments with the box should give your pupils the tools to complete basic operations with fractions.



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The first lesson to remember is the fact that you can only add and subtract fractions that have the same denominator. At this stage, your pupils should know how to put two fractions on the same denominator. If not, go back to the third step of the first sequence!

When adding or subtracting two fractions with the same denominator, all you have to do is to add or subtract the numerators, and leave the denominator unchanged: when pupils added or removed painted cubes, they always kept ones of the same colour. Using the example from the first step of this sequence, you may show your pupils that they added  $\frac{2}{6}$  to the  $\frac{1}{6}$  they already had. After adding, they had  $\frac{3}{6}$  of the yellow cubes, which is half of the yellow cubes. In the same fashion, they started the subtraction experiment with  $\frac{6}{6}$  yellow cubes and removed  $\frac{4}{6}$  of the cubes: they were left with  $\frac{2}{6}$  of the cubes.

Multiplying two fractions is easier: all you have to do is multiply the numerators between themselves and do the same with the denominators. To multiply  $\frac{1}{3}$  and  $\frac{2}{5}$ , you may write the following:  $\frac{1 \times 2}{3 \times 5}$ , which equals  $\frac{2}{15}$ .

Dividing two fractions is a bit more tricky: you need to multiply the divided fraction by the opposite of the dividing one. For example, let's divide  $\frac{1}{2}$  by  $\frac{3}{4}$ . The resulting operation will be:  $\frac{1}{2} \times \frac{4}{3}$ , which is  $\frac{1 \times 4}{2 \times 3}$  which equals  $\frac{4}{6}$  or  $\frac{2}{3}$ .

## Step 3: What happens with whole numbers?

A whole number can be represented as a fraction with 1 as a denominator. 1, for example, can be represented as  $\frac{1}{1}$ . In the same fashion, 3 can be represented as  $\frac{3}{1}$ , and the same goes for every whole number.



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This needs to be taken into account when writing operations with whole numbers: represent the whole number as a fraction, and follow the rules listed above. As it turns out, your pupils already manipulated whole numbers in the first step of this sequence, when they were asked to multiply the  $\frac{1}{6}$  cube they had by 5, or  $\frac{5}{1}$ . Therefore, this could be represented as follows:  $\frac{1 \times 5}{6 \times 1}$  or  $\frac{5}{6}$ , which is what they had already found!

To go further, the numerator of a fraction can be higher than the denominator. In that case, it means that we need more than what we already have. You may illustrate this with the boxes, by asking pupils to fetch more cubes of a colour than what they have. To represent this, they will have to ask other pupils to lend them some of the cubes, and to possibly exchange them for some of another colour that the other group needs. Keep in mind to ask all groups to get cubes of a different colour to avoid any incidents!



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