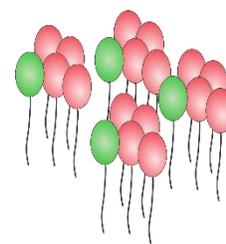




**Example1:** Ratio of the green balloon to the red balloons is  $\frac{1}{4}$  (1 to 4). On both pictures there are four red balloons for each green balloon. The number of green balloons is a quarter of the number of red balloons. (Or, the number of RB is 4 times greater than number of GB).

$$\frac{1}{4} = \frac{4}{16}$$



There are 1165 red and green balloons in the store. The ratio of GB to RB is 1 to 4. How many green and red balloons are in the store? We can solve the problem by methods:

1. Because there are 4 RB for each green one, all balloons can be divided into groups of 5 – 1 green and 4 red.  $1165:5 = 233$ . So, there are 233 green balloons and  $4 \cdot 233 = 932$  red balloons.
2.  $\frac{1}{5}$  part of all balloons will be green balloons.  $4 + 1 = 5$ , and  $\frac{4}{5}$  will be red.  $\frac{1}{5} \cdot 1165 = 233$

Also we can say that the ratio of green balloons to all balloons is  $\frac{1}{5}$ , or 1 to 5, in other words, one out of 5 balloons is green (and therefore 4 are red)

The ratio of two numbers indicates how many times one number is larger than another or which part of one number the other number is.

**Example2:** To make a jam I use sugar and cherries in the ratio 2:3. For each 2 pound of sugar I need to use 3 pounds of cherries. How many pounds of sugar and cherries I need to use to make 5 lb of jam? 7.5 lb of jam?

**Example3:** Three brothers, 5, 7, and 9 years old went to trick-o-treat. They got 84 sweets altogether. They decided to divide the candies in the ratio of their age 9:7:5. How many candies each of them should get?

To divide all candies between the brothers we need to find the “unit” part of the total amount of candies. The oldest brother should get 9 of such units, the middle one should get 7, and the youngest brother will get 5. Total amount of units is  $9 + 7 + 5 = 21$ . The number of candies is 84, so the “unit” contains  $84:21 = 4$  candies.

So, the first brother will get  $4 \cdot 9 = 36$  candies, the second will get  $4 \cdot 7 = 28$ , and the third will get  $4 \cdot 5 = 20$ .  $36 + 28 + 20 = 84$

The ratio is very similar to fraction: in the mixture of dried fruits the ratio of dried apricot and prunes are 4 to 5. For each 4 weight units (for example 100g or 1 kg) of dried apricots there are 5 such units of prunes (or  $\frac{4}{5}$  weight unit of dry apricot for each 1 weight unit of prunes). What is the weight of prunes and apricots in the 1800g. of mixture? Another fruit mix of apricot and prunes has the ratio 3 to 4 (or  $\frac{3}{4}$ ). How much apricots and prunes are in 1400g of mixture? What will be the ratio of dried apricots and prunes if we will mix these two mixtures?

Can we just add two fractions  $\frac{4}{5}$  and  $\frac{3}{4}$ ?

Solve the problem for 2430g of first mixture and 3570 g of second?

Let's go back to the first example, with red and green balloons. The ratio of green balloons to all balloons is 1 to 5.

$$\frac{1}{5} = \frac{20}{100}$$

As you can see, for 100 balloons in total, 20 will be green. The ratio of a number to 100 is a percentage, so 20% of balloons in our store is green.

1 percent of quantity is a  $\frac{1}{100}$  th part of it.

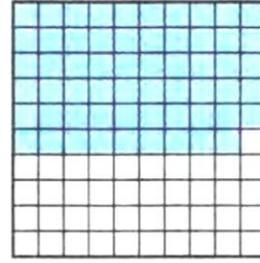
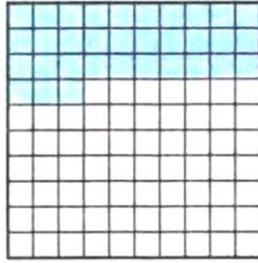
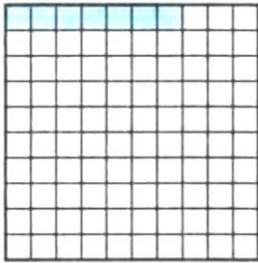
1. One percent (**1%**) means 1 per 100.



**1%** of this line is shaded green: it is very small isn't it?

2. How many squares we have to shade to shade 10% of the line, 15%, 20%, 25%?
3. There are 200 pencils in the box. 3% of the pencils are red, 26% are yellow, and the rest are blue. How many red pencils are in the box?
4. 15% of the participant of math Olympiad solved 1 problem, 25% of the participant solved 2 problems, and the rest 24 students solved all three problems. How many students did participate in the math Olympiad?

5. 15% of the participant of math Olympiad solved 1 problem, 25% of the participant solved 2 problems, and the rest 24 students solved all three problems. How many students did participate in the math Olympiad?
6. What percent of each square is shaded on the picture below?



7. There are 40000 books in a library. 75% of all books are in English, 10% of all books are in Spanish and the rest of the books are in French and German. How many books are there in the library in English and in Spanish?
8. Grapes were dried to raisin. During the process, the weight of grapes was reduced by 70%. How many kilograms of raisin was produced from 200 kg of grapes? How many kilograms of grapes were dried if the weight of obtained raisin is 15 kg?

## Geometry.

Rigid Motion:

Any way of moving all the points in the plane such that

- a) the relative distance between points stays the same and
- b) the relative position of the points stays the same.

There are four types of rigid motions that we will consider: translation, rotation, reflection, and glide reflection.

