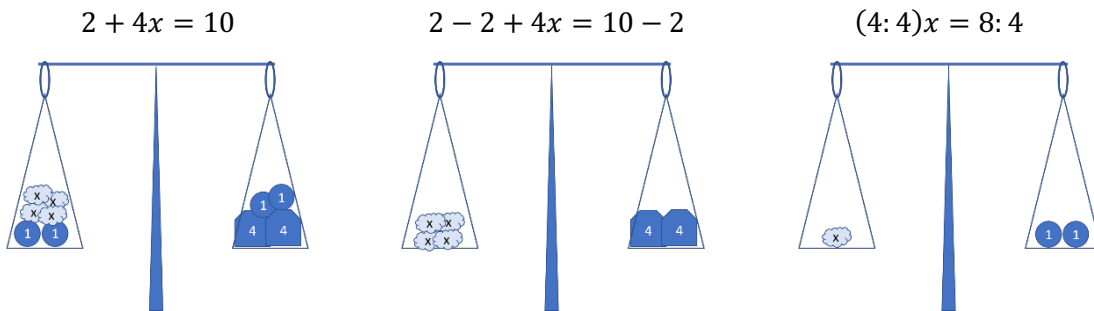**school nova.** ™

Equation

What can we do with equations to solve them?

Let's have a look at $2 + 4x = 10$.

We can add and subtract the same quantity to (from) both sides of an equation, the balance will be in place. Also, we can multiply and divide both side by the same amount, kipping the balance.

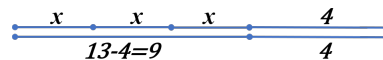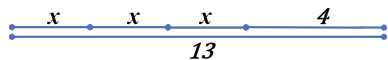| $2 + 4x = 10$ | $2 - 2 + 4x = 10 - 2$ | $(4:4)x = 8:4$ |

$2 + 4x = 10$
$4x = 10 - 2 = 8$
$x = 8:4 = 2$

The process of the solving equation can be visualized in a different way. Let solve another equation:

$3x + 4 = 13$
$3x = 13 - 4 = 9$
$x = 9:3 = 3$

| x x x 4 | | x x x 4 |
| 13 | | 13-4=9   4 |

Equations with absolute values

Let's take a look equation that involves absolute value,

$$|x| = 10$$

The solution of this equation is a number absolute value of which is 10. There are two such numbers, 10 and (-10). Thus, this equation has two roots: 10 and -10. (The word "root" can be used as the synonym for solution.).

Equations and word problems

Equations are very useful to solve word problems. In each word problem there is an **unknown quantity**, and known parameters. The equation can be created with combinations of unknowns and known parameters. For example, let's take a look on the following problem:

Problem*: There are 27 pencils in two boxes altogether. There are 5 more pencils in one box then in the other. How many pencils are there in each box?*

There are two unknown quantities in this problem, the number of pencils in the first box and the number of pencils in the second box. But these two quantities are not independent, one is 5 less than the other. If the number of pencils in one box is denoted as x, number of pencils in the second box will be $x + 5$. And we also know that the total number is 27.

$$x + x + 5 = 27$$

$$2x = 27 - 5 = 22$$

$$x = 22:2 = 11$$

Answer: there are 11 pencils in one box, and 16 in the other.

Problem*: There are candies in a box. If each kid will take 4 candies, 19 candies will be left in the box. If each kid will take 5 candies, there will be lacking 2 candies. How many candies are there in the box?*

In this problem there are also two unknown quantities, the number of kids, and number of candies in the box. If the number of kids is denoted as x, the number of candies can be calculated in to ways:

First, $5 \cdot x - 2 =$ number of candies in the box

Second, $4 \cdot x + 19 =$ number of candies in the box, so

$$5 \cdot x - 2 = 4 \cdot x + 19$$

$$5x - 4x = 19 + 2$$

$$x = 21$$

The number of kids is 21. The number of candies can be calculated from either expression:

$$5 \cdot 21 - 2 = 4 \cdot 21 + 19 = 103$$
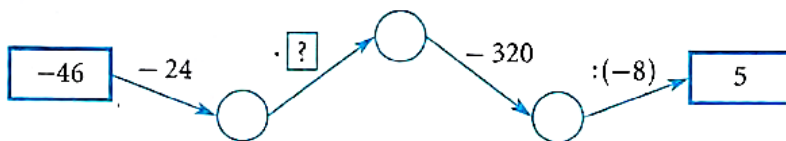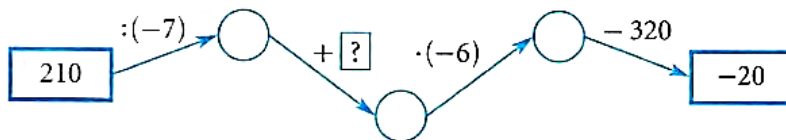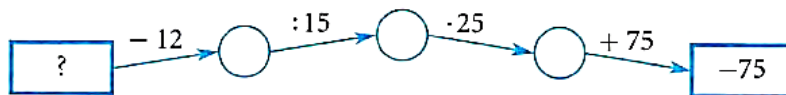
Answer: there are 103 candies in the box.

Homework

1. Write the following as mathematical expression. If this expression is an equation, solve it.

    a. Sum of the number x and 15 equals to 20.

    b. Product of y and 10.

    c. Difference between three times z and 4 is equal to 12.

    d. Half of the number b is equal to 1.5

2. Solve the equations:

    a. $5y + 3 = 13$ b. $3(2x + 3) = 27$ c. $(6x + 12) = 6$

3. The sum of three consecutive numbers is 135. What is the smallest of the three numbers?

4. A store is giving rewards to its customers at the register. Every 15th receives a free lollipop, every 24th receives a free chocolate bar. During that day 1000 customers visited the store. How many of them have received …

a) a free lollipop?
b) a free chocolate bar?
c) both?

5. 10 identical notebooks cost x dollars. Textbook costs 15 dollars more than notebook.

      a. What is the price of one notebook?
      b. What is the price of the textbook?
      c. What is the price of n notebooks?
      d. What is the price of n notebooks and m textbooks?

6. What number should be placed instead of "?" ?

$$\boxed{?} \xrightarrow{-12} \bigcirc \xrightarrow{:15} \bigcirc \xrightarrow{\cdot 25} \bigcirc \xrightarrow{+75} \boxed{-75}$$

$$\boxed{210} \xrightarrow{:(-7)} \bigcirc \xrightarrow{+\boxed{?}} \bigcirc \xrightarrow{\cdot(-6)} \bigcirc \xrightarrow{-320} \boxed{-20}$$

$$\boxed{-46} \xrightarrow{-24} \bigcirc \xrightarrow{\cdot\boxed{?}} \bigcirc \xrightarrow{-320} \bigcirc \xrightarrow{:(-8)} \boxed{5}$$

7. Create your own word problem, that can be solved with the following numeric expression:

$$40 : 5 \cdot 7$$