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METHODOLOGY FOR GROWING MATHEMATICAL COMPETENCE BY CONSTRUCTING EQUATIONS

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Annotation
The article explains how to correctly compose and solve equations when solving problems –to cultivate creative thinking, develop the level of mathematical competence, deeply understand the ideas of functional bonding, create favorable conditions for the growth of computing culture and make it possible to content the skills of modeling objects and phenomena.

Keywords: matter, object, functional bonding, computational culture, mathematical competence, amount of heat, distance, equation.

The correct compilation and solution of equations in solving text problems creates favorable conditions for the development of creative thinking of students, the development of the level of mathematical competence, a deep understanding of the ideas of functional bonding, the growth of computing culture. As a result of solving such issues, students will find content and develop these skills in the modeling of real objects and phenomena.

Taking into account the content of the issue, it is necessary to determine the relationship between the responsible and the unknown. For example,

a) let the number of students in one school be equal to x, and let the number of students in two schools be (x+60), and the number of students in the third school is equal to (x-45). What is the number of students in all three schools?

b) the first day the store sold X wg of flour, the second day 2x wg, the third day (2x-40) wg of flour. How to proceed with the issue? (How much flour was sold in three days?)

c) Kater swam across the stream and against the stream $14\frac{1}{2}$ clock. Continue the matter? (Compare the time a motor boat swims along a stream and the time it swims against a stream).

d) the inner corners of the Triangle $x, x-20^0, 2x$. Continue the issue (find the inner corners of the Triangle).

2. They are equal if two quantities express the same thing (for example, if the steamer goes from one pristan to the 2nd pristan, then the distance between the 2nd pristan is equal.).

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Task 1. The machine-making plant had planned to complete the assignment in 15 days. However, the plant fulfilled the plan 2 days earlier and produced 6 cars unscheduled. How many cars did the plant produce in total?
Together with the readers to green up the issue, we think:
1) according to the plan, a total of x machines had to be produced at the plant.
2) according to the plan, in one day the plant $\frac{x}{15}$ had to produce a car.
3) in fact, the plant produced a machine in one day $\frac{x+6}{13}$.Under the condition of the issue, the plant produces two unscheduled cars every day. Therefore, the following three different equations can be formulated:

$$\frac{x+6}{13}-\frac{x}{15}=2; \quad \frac{x+6}{13}-2=\frac{x}{15}; \quad \frac{x}{15}+2=\frac{x+6}{13}.$$

After the equation is formulated, it is necessary to solve the equation. After solving the equations, readers will see that all the answers are the same (x=150).
However, readers make mistakes when compiling an equation, separating the concepts "more times" and "more than". To avoid such errors, exercises must be performed. For example, if the number m is expressed as 6 times more than the number n $\left(\frac{m}{n}=6\right)$ or $\left(\frac{m}{6}=n; \quad m=6n\right)$, then the number m is represented by equations such as m − n = 6; m = n + 6 ; m − 6 = n, while 6 is more than the number N.
Students are given such issues for independent solution. For example:
Task 2. One bag contains 60 kg of sugar, and the other-80 kg. 3 times more sugar was obtained from the second bag than the first, and 2 times more sugar remained in the first bag than in the second. How many kilograms of sugar were taken from each bag?
It is known how much sugar is in each bag, but it is not known how much is obtained from each bag.
If we say X wg of sugar from the first bag, then the sugar from the second bag will be 3x wg. Then the sugar in the first bag (60-x) wg is left, and in the second (80-3x) wg of sugar.
Under the condition of the matter, since the sugar in the first bag is 2 times more than in the second, we form the following equation:

$$60-x= 2 (80-3x)$$

Task 3. The combined weight of iron and copper is 373 g, and the volume of iron is more than the volume of copper 5 sm^3. The specific weight of iron is 7.8 g/ sm^3, the specific weight of copper is 8.9 g/ sm^3. Find the size of each piece.

As you know, p = dV. Since the specific weight of iron and copper is known in the matter, their size is determined by x, and their weight is expressed as follows.

	Size (sm^3)	Weight (gramm)
One piece of iron	x	7,8x
One piece of copper	x-5	8,9 (x-5)

Since the two parts together weigh 373 grams, we form the following equation:
7,8x+8,9 (x-5) = 373.
Task 4. There was a large ice on the surface of the sea water. What is the size of the ice if the volume of its part on the surface of the water is 2000 m^3, the specific weight of sea water is 1.03 g/c m^3, and the specific weight of the ice is 0.9 g/c m^3?
If we say the volume of all ice X m^3, then the volume of ice inside (the invisible part) of water (x-2000) m^3, the weight (x-2000)*1.03, and the weight of all ice is x*0.9.
According to Archimedes ' law: a body sewn into a liquid removes an amount of bone equal to its specific weight from the container. Therefore, we form the following equation:
$(x-2000)\cdot 1{,}03 = 0{,}9x$
Task 5. The two containers contain water of different temperatures. If you take 240 grams of water from the first container and 260 grams of water from the second container and mix, the temperature of the mixture will be 52^0. If 180 grams are taken from the first container and 120 grams of water from the second container are mixed, its temperature will be 46^0. Find the temperature of the water in each container.
In quantities that are encountered in such matters, water is considered in liters, weight (m), temperature (T) and amount of heat (Q). From physics it is known that their relationship is expressed by the formula Q=mt, and the specific heat of water is equal to 1. We enter the following designations:
x^0-the temperature of the water in the first container;
y^0-the temperature of the water in the second tank;
240X Cal-the amount of heat of the water in the first container;
260y Cal-the amount of heat of water in the second container;
(240 + 260) 52 lakes. - the amount of heat in the mixture.
Thus, the first equation would be:

$$240x+260y= 500\cdot 52.$$

Now we draw up the second equation of the system:
180x Cal-the heat content of the water in the tank in the first tank;
120Y Cal - the heat content of the water in the tank in the second tank;

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(180 + 120)*46 lakes. - the amount of heat in the mixture.

The second equation will be:

180x+120y= 300*46

and we compose a system of equations:

$$\begin{cases} 240x + 260y = 26000, \\ 180x + 120y = 13800. \end{cases}$$

Let's look at another issue.

Task 6. The front wheel of the cart rotates 15 times more than the rear wheel. The usunity of the front wheel is 2.5 m, and the usunity of the rear wheel is 4 m. How many times does each wheel rotate and how far does the cart travel?

In this case, the values found in the calculations are: the walking distance of the cart (S), the wheel length (C) and the number of revolutions (n). Their relationship is expressed by the following formula:

$$S = C\cdot n, \text{ that is } C = \frac{S}{n}, \quad n = \frac{S}{C}.$$

Since there are two questions in the matter, there are two different ways to define and two different equations are formulated.

a) if the front wheel determines the number of revolutions in x:

1) the number of revolutions of the rear wheel is – x-15.

2) the distance covered by the front wheel is 2.5 x km.

3) the distance traveled by the rear wheel – (x-15)*4 km.

Since the paths traveled by the front and rear wheels are equal, we form the following equation:

$$2{,}5x = (x-15)\cdot 4$$

We draw up an equation with the second method:

b) if we mark the path with x:

X is the distance traveled by the cart.

$\frac{x}{2{,}5}$ - number of front wheel rotations.

$\frac{x}{4}$ - number of rear wheel rotations.

Under the condition of the issue that the number of revolutions of the front wheel is more than 15 of the number of rotations of the rear wheel, we form the following equation:

$$\frac{x}{2{,}5} - \frac{x}{4} = 15$$

Task 7. The car moved between the city and the village at a speed of 60 km / h. On his way back, he walked 75% of the road with this speed and on the rest of the road at a speed of 40 km / h. On the way back, he spent 10 minutes longer than going from city to village. Find the distance between the city and the village.

In this matter, the account is talking about the car, time and speed. At the same time, since there is interest in the matter, it is necessary to remind students to repeat the main issues of interest and find the percentage of the given number.

For example, to determine p% of a number, you first need to find 1% of it, and then find p%. The following are known:

X km is the distance from the city to the village;

$\frac{x}{60}$ – this is the time to cover the distance.

$\frac{x \cdot 75}{100} = \frac{3x}{4}$ км – the way back.

$\frac{\frac{3x}{4}}{60} = \frac{3x}{240}$ – this time.

$x - \frac{3x}{4} = \frac{x}{4}$ km – the remaining path.

$\frac{\frac{x}{4}}{40} = \frac{x}{160}$ - time that went to the rest of the way.

When the car returns (since the time from the village to the city is 10 minutes= $\frac{1}{6}$ hours):

$\frac{3x}{240} + \frac{x}{160} - \frac{x}{60} = \frac{1}{6}$

Here it is necessary to draw the attention of readers to the fact that the speed of the car is given in hours, and the time difference in minutes. In this case, they should be known to readers that both should be expressed in the same measure. As you know, in such a case, readers make mistakes without noticing that they are given by different measurements.

Among the issues related to the construction of a system of First-Order equations, there are a number of issues that can be introduced without additional information. From the experience of teaching mathematics at school, it is known that students have difficulty solving these issues and sometimes cannot solve them. So we'll show you how to get rid of these mistakes.

When compiling an equation, it is necessary to draw the attention of readers to the information used in the statement of the issue. It is necessary to pay special attention to the fact that unnecessary information is not provided in any matter, if information is not used, it is not provided in the condition of the issue, and if it is given in the condition of the issue, it must be used.

As a rule, issues related to the construction of equations are checked in the class depending on their conditions. This, of course, is news for readers.

Task 8. Every day at 12 o'clock, the kater ship passes on the river from pristan A to pristan B. Kater walked from pristan A to pristan at a speed of 12 km / h. It stops in front of pristan B for 2.5 hours and then goes back, without stopping it goes all the way at a speed of 15 km / h and arrives at pristan A at 1900 on the same day. Find the distance from A to B.

Solution: if we say the distance between two Pristas x, the ship's swimming time from A to B is $\frac{x}{12}$ hours, and the return time is $\frac{x}{15}$ hours.

From the fact that the ship spent 4.5 hours on the road (19 hours-12 hours-2.5 hours = 4.5 hours), the following equation can be formulated:

$$\frac{x}{12}+\frac{x}{15}=4{,}5; \; x=30\,.$$

The work is carried out orally. The path can be an integer or a fractional (mixed) number, but according to calculations, it must be a positive number. Therefore, the answer satisfies the condition of the issue.

Check. If the distance between two Pristas is 30 km, then the travel time from A to B is 2.5 hours (30:12 = 2.5), and The Walking time is 2 hours (30:15=2). Then the time that went to the road

2.5 hours + 2 hours = 4.5 hours.

Therefore (30 km) the result fully corresponds to the conditions of the issue.

Answer: the distance between the two pristans was 30 km.

While students can give examples of equations when solving text issues, they can bring fewer text issues, and most teachers do not pay proper attention to solving letter-text issues. The above issues provide a sufficient opportunity for teachers to grow their creative thinking and mathematical competence.

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