

The importance of inverse problems in optimizing the mathematical knowledge of elementary school students

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Abstract

Inverse problems are of particular importance in increasing elementary school students' interest in mathematics, developing logical thinking and cognitive activity. In the process of solving inverse problems, students learn to think creatively, make judgments, and justify their ideas.

The comparison method should be widely used in the process of solving arithmetic problems in elementary grades, because this method is of great importance in optimizing mathematical knowledge, including understanding the dependencies between quantities .

Keywords: student, training, reverse issue, geometric problem, optimization.

Let's explain the role of geometry and inverse problems in optimizing the teaching of table cases of multiplication and division, as well as theoretical material related to some elements and concepts of geometry .

Problem: Compare the areas of rectangles ABCD and EFKD (figure 1).

1) $ED = 4$ cm, so $AD = 2 + 4 = 6$ cm, hence $S_{ABCD} = 24$ sq.cm.

The area of rectangle EFKD is found analogously.

2) The rectangle ABCD consists of the square CD and the rectangle ABOE, and the rectangle EFKD consists of the square EOCD and the rectangle OFKC.

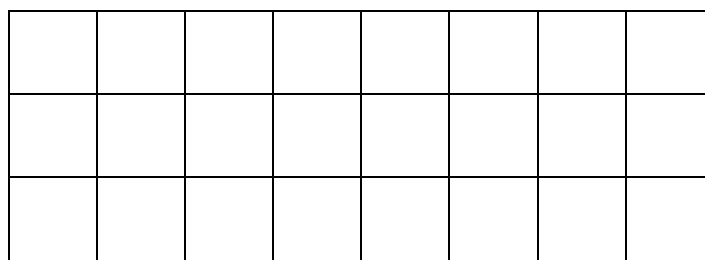
$$S_{ABOE} = S_{OFKC}$$

Therefore, $S_{ABCD} = S_{EFKD}$.

(Figure 1)

Problem. There are 3 squares in the width of a rectangle and 8 squares in the length (Figure 2) . 1) How many squares are there in this rectangle ? 2) What is the area of the rectangle?

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(picture 2)

~~$$8+8+8+8+3+2$$~~

$$3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 24$$

$$8 \cdot 3 = 24 \text{ sq.m.}$$

Problems formulated in this way and their solutions closely contribute to both the assimilation of theoretical material and interdisciplinary connections.

straight problem , we consider problems that require calculating the area when the length and width are known.

The direct problem also has two inverse problems:

1. Finding the width of a rectangle given the length and area.
2. Finding the length of a rectangle given its width and area.

Solving inverse problems not only develops logical thinking in students, but also forces them to think, or rather, to make judgments. On the other hand, studying the solutions to these problems also increases students' interest in mathematics. This leads to rapid assimilation of the material, that is, learning is optimized.

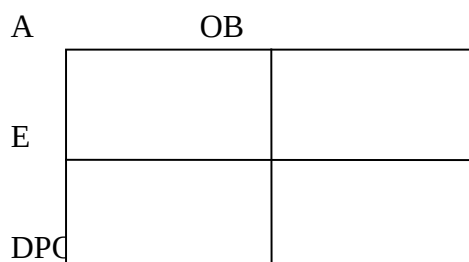
In general, learning how to solve inverse problems is very important for elementary school students, as solving such problems has a positive effect on students' more conscious understanding of the functional dependence between quantities.

PMerdniev's book notes that special attention is paid to solving reciprocal inverse operations, as well as direct and inverse problems [5]. It is clear that students can consciously master inverse operations along with these direct operations. Also, while solving such problems, students can learn the correct spelling of names in addition to numbers. Unfortunately, the situation in our schools in the study of inverse problems related to the teaching of areas is not so satisfactory. The lack of due attention to such problems cannot but have a negative impact on the mastery of inverse operations from arithmetic. Therefore, special attention should be paid to the solution of inverse problems on the topic "Calculation of Areas".

Teaching the solution of direct and inverse problems in a comparative manner also creates a broad opportunity for students to learn difficult concepts related to arithmetic and geometry in an easier way.

The segments $EF = 6\text{cm}$ and $OP = 3\text{cm}$ are drawn through the midpoints of the sides of rectangle ABCD (Figure 3). What is the perimeter of rectangle ABCD?

$$P = 2(AB + AD) = 2(6 + 3) = 18 \text{ cm}$$



(Figure 3)

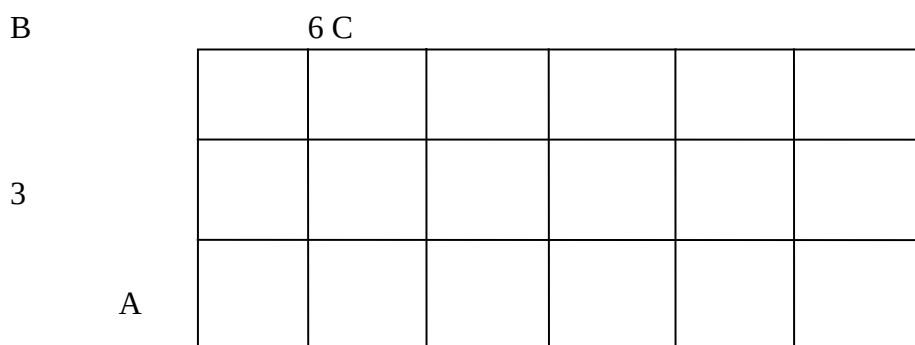
In the converse problem, $P = 18 \text{ cm}$. What is the sum of the sides of the given rectangle?

$$AB + AD = P : 2$$

$$AB + AD = 18 : 2$$

$$AB + AD = 9 \text{ cm}$$

Let's focus on solving the problem further. The area of the rectangle is 18 sq.cm . Its length is 6 cm (Figure 4) . Find the width of this rectangle.



(Figure 4)

The area of a rectangle is the product of its length a and its width b . That is, $S = a \cdot b$ it is .

In the condition of the problem, the product is 18 and one of the multipliers, i.e. the multiplicand (6), is known. The other multiplier, i.e. the numerator (x), is unknown. To find x , we need to divide 18 by 6.

$$x = 18 : 6 = 3 \text{ cm}$$

$$x = 3 \text{ cm.}$$

The width of the rectangle is 3 cm .

In the second type of inverse problem, the width and area of the rectangle are given. The length is required to be found.

$$x \cdot b = S ; x = S : b \quad \text{It happens.}$$

That is, to find the product x , we need to divide the product (S) by the multiplier (b).

It is known that in a direct problem, multiplication is performed. In a check, division is performed.

However, in solving inverse problems, division is performed. In checking, multiplication is performed. As can be seen, in solving direct and inverse problems, students are able to consciously understand the relationship between length, width, and area in accordance with the multiplicand, multiplier, and product.

There is also a problem that is the opposite of the problem of calculating the area of a square given its side. It is the calculation of the side of a square given its area. For example, let's say the area of a square is 25 sq.cm. We need to calculate its definition.

To solve the problem, it is necessary to make such a judgment. The area of the square is 25 sq.cm, that is, 25 squares of 1 sq.cm each are located in the area of the square. This means that the figure is divided into 5 equal parts with both length and width equal to each other. Each of them has 5 strips of 5 sq.cm. In order for each strip to accommodate 5 sq.cm, its length should be 5 cm.

The writing is like this: $25 : 5 = 5$ cm.

So, the side of the square is 5 cm. We can also make another judgment: $25 = a \cdot a$ let's pay attention to the formula. As you can see, 25 is equal to the product of two equal products. That is $25 = 5 \cdot 5$, it turns out. So, the side of the square will be 5 cm.

The straightforward problem of calculating the perimeter of a rectangle given its length and width has two inverse problems.

Inverse problem. 1) Calculate the width of a rectangle given its perimeter and length,

1) Calculate the length of a rectangle given its perimeter and width.

Let's solve this problem: The perimeter of a rectangle is 12 cm and the width is 1 cm. We need to find the length of the rectangle.

There are 4 cases in solving this problem.

Case I: The perimeter of the rectangle is 12 cm. Half of the perimeter is $12 : 2 = 6$ cm.

Here 6 cm is the sum of the length and width of the rectangle. Since the width of the rectangle is 1 cm, its length will be $6 - 1 = 5$ cm.

Case II: Since the side (width) of the rectangle is 1 cm, the other opposite side will also be 1 cm. The sum of the two sides is $1 + 1 = 2$ cm. The sum of the two lengths of the rectangle is $12 - 2 = 10$ cm. Then the length of the rectangle is $10 : 2 = 5$ cm.

Case III: The sum of all sides of the rectangle is $x + 1\text{cm} + x + 1\text{cm} = 12\text{cm}$.

We write based on the law of permutation and grouping.

$$(x + x) + (1 + 1) = 12$$

$$2x + 2 = 12$$

$$2x = 12 - 2$$

$$2x = 10$$

$$x = 5 \text{ cm.}$$

The length of the rectangle is 5 cm.

Case IV: The general solution to the problem is:

Let's write it using the formula $P = 2(a + b)$.

$$12 = 2(a + 1)$$

$$12 = 2a + 2$$

$$2a = 10$$

$$a = 5 \text{ cm.}$$

The inverse problem we showed above, which concerns calculating the length of a rectangle given its perimeter and width, should also be taught to students in the same way. As students solve such problems, their knowledge of arithmetic deepens and strengthens. Geometry material is more easily mastered.

After the research we conducted above, we can conclude that problem solving in elementary grades optimizes the reinforcement of theoretical knowledge and the teaching of mathematics as a means of imparting new theoretical knowledge. That is, problem solving:

- 1) understanding the concept of natural numbers and teaching operations and properties on them,
- 2) to explain the meaning of the concepts of part, fraction, equality, inequality, equation, and variable,
- 3) providing functional concepts,
- 4) calculate the dimensions of the simplest geometric figures and visually demonstrate some algebraic concepts with the help of figures,
- 5) creates and serves the conditions for connecting learning with life, the formation of new concepts, the acquisition of knowledge by students, and independent thinking.

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