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METHODS OF SOLVING COMPLEX PROBLEMS

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Abstract: In the methodological literature, it is recommended to include all these three types of problems in one lesson by turning the given problem into reverse problems. It is necessary to start the work with the problem of finding the distance, for example, such a problem: "Two pedestrians set out from two villages at the same time towards each other and met after 3 hours. The first pedestrian walked at 4 km per hour, the second at 5 km per hour. Find the distance between the villages.It is useful to make a poster to better understand the problem and its solution. In this poster, the road, speed, etc. are shown with cuts, and two cardboard figures of pedestrians should be placed on it. These shapes should be able to slide smoothly over the poster and on the string attached to the classroom board.

Key words: Distance, speed, average speed.

Solving problems on finding distance, speed, average speed

Action matters. "Motion" issues can be defined as issues that include quantities characterizing movement, i.e., speed, time, and distance.

a) all simple and complex problems related to the movement of one body (in these problems, one of the quantities - speed, time or distance - is involved depending on the other two);

b) issues related to meeting;

c) issues related to the movement of two bodies in opposite directions;

g) problems related to the movement of two bodies in one direction (this type of problems is not considered in elementary school).

Solving simple motion problems should begin with the introduction of a new quantity-speed and clarification of how to understand the following sentences: "The cyclist traveled at a speed of 14 km per hour", "The pedestrian traveled at 4 km per hour". After that, work begins on opening the links between speed, time, distance.

I. a) Problems on finding speed for a given distance and time of movement. We will reveal the essence of working on these types of problems on the example of solving this problem: "If it is known that a pedestrian walks 12 km in 3 hours, walking every hour, at what speed did he walk?"

Students learn to write the problem on the table while analyzing the condition of the problem with the help of the teacher.

- What is known about the issue? (The pedestrian was on the road for 3 hours.)

— 3 hours, the teacher explains, is the time a person walks on foot.

- What else is known about the matter? (A pedestrian covered 12 km in 3 hours.)

— 12 km - the teacher explains the path or distance traveled on foot.

- What is required to know in the matter? (How much a pedestrian travels in one hour.)

During the analysis of the problem, the teacher shows how the conditions of the problem are written in the table:

Speed – ?

Time - 3 hours

The distance is 12 km

When the students begin to analyze the problem under the guidance of the teacher (make a solution plan), they discuss as follows: If it is known that a pedestrian walks 12 km in 3 hours, then it is known that he walks 3 times less than that in one hour , therefore, to find out how many kilometers per hour the pedestrian travels, you need to divide: 12:3 = 4 km/h.

- 4 km per hour - explains the teacher - this is the distance traveled by a pedestrian every hour. This quantity is called speed.

— So, what amounts are given in this matter? (Motion, time and distance.)

- What amount of food are you looking for? (Speed.)

— How did we find the speed according to the time and distance of movement? (We divided the distance by the time.)

After that, it would be appropriate to offer the students to create problems similar to the problems considered above, about finding the speed for a certain distance and time. (Children can get more information from the textbook appendix.)

Such a conclusion is drawn: if the distance and time of movement are known, the speed can be found. Speed is distance divided by time.

We would like to emphasize that short records of all simple and complex motion problems of this type, as well as other types, can be formalized not only in tables, but also with the help of drawings. For example, the content of the problem discussed above can be illustrated using a section divided into three equal parts (Fig. 74).

b) Problems of finding the distance according to the known speed and time of movement. For example, let's look at the solution of such a problem: "A pedestrian traveled for 3 hours at a speed of 6 km per hour. How far did the pedestrian walk?'

During the analysis of the problem, a short note of the condition of the problem appears on the board and in the student's notebook:

Speed - 6 km per hour

Time - 3 hours

Distance – ?

The condition of the problem can also be represented by drawing.

If a walker covered 6 km in one hour, then the distance covered in 2 hours will definitely be more, and children will cover more distance if 3 hours is greater than 1 hour. comes to the following conclusion: to find the distance, you need to multiply the speed (6 km per hour) by the time (3 hours).

The solution is written like this: 6·3= 18 (km).

As a result of solving a series of similar problems, students come to the following conclusion: if the speed and time of movement are known, then the distance can be found. Distance is equal to velocity multiplied by time.

Looking at a number of issues related to finding the time of movement according to the known speed and distance, they come to the following conclusion: if the speed and distance are known, then it is possible to find the time of movement. Time is distance divided by speed.

An important step in working on motion problems is children's conscious understanding that the problems of finding speed, time, and distance are mutually inverse problems.

In order to understand that simple motion problems are inverse problems, it is necessary to formulate and solve three problems according to this table:

The solution to the problems will look like this in the students' notebooks:

Issue 1. 60-2 = 120 (km)

Issue 2. 120:60 = 2 (hours)

Issue 3. 120:2 = 60 (km/h)

After that, the solutions of the problems are compared and their similarities and differences are identified.

Now let's look at typical problems of movement.

II. Issues related to meeting motion. In order to solve the problems related to the meeting movement, the following preparation problems, which are to be solved orally, are considered first, in which indicativeity is used.

1. Two children are running towards each other. Before the meeting, the first boy ran 48 m, the second 37 m. How many meters did both children run together?

2. The length of the avenue is 80 m. From the end of the alley, two children started walking toward each other. A boy walked 50 m before meeting. How many meters did the second child walk?

After that, the teacher should explain to the children what the word "at the same time" means in typical motion problems, and what conclusions should be drawn from this about the time of the two moving bodies on the road. Questions similar to the following question can be oral preparation questions:

1. Two cyclists set off at the same time towards each other and met. What about the time on the road before each cyclist meets?

2. Two buses left Tashkent and Almalik at the same time towards each other and met after 2 hours. How long were each of these buses on the road before they met?

As a result of solving these and similar problems, it is explained that two bodies, when they start moving at the same time, are on the road for the same amount of time when they meet, and that they have traveled the entire distance between the points.

In order to make it more understandable, students should be given a problem about meeting motion, in one of which the action does not start at the same time, and in the other, the action starts at the same time. For example:

1. Two trains left each other from two cities, one of them left at 7 o'clock and the other at 9 o'clock. They met at 11 o'clock. How long did each train travel before they met?

2. Two trains left the two cities at the same time - at 8 o'clock towards each other. They met at 10 o'clock. How long was each train on the road before they met?

We remind you that in order to successfully solve the problems related to the meeting movement, children need to imagine and understand the meeting movement itself. To do this, the teacher takes the students to the school yard, where the students can see the movements of pedestrians and vehicles on the street (if this is not possible, the teacher makes two students look at each other can act). After that, the teacher draws the students' attention to the process of movement of bodies meeting and the reduction of the distance between them.

In the primary classes, problems related to the motion of the meeting are given, in which the bodies start moving and stop moving at the same time. In these problems, four interrelated quantities are discussed: s, v1 v2, t; where s is the distance between the starting points of the movement s, v1 v2 are the speeds of the moving bodies t is the time of movement. It follows that this group includes four different issues. But finding the velocities of the first and second bodies requires the same solution, so it is accepted to include three different problems in this group of problems,

1. Problems of finding the distance according to the speed and time of movement of the given bodies.

2. Problems of finding time according to the known speed and distance of any body.

3. Issues related to finding the speed of one of the moving bodies according to the given distance, time of movement and the speed of the other body.

In the methodological literature, it is recommended to include all these three types of problems in one lesson by turning the given problem into reverse problems. It is necessary to start the work with the problem of finding the distance, for example, such a problem: "Two pedestrians set out from two villages at the same time towards each other and met after 3 hours. The first pedestrian walked at 4 km per hour, the second at 5 km per hour. Find the distance between the villages.

It is useful to make a poster to better understand the problem and its solution. In this poster, the road, speed, etc. are shown with cuts, and two cardboard figures of pedestrians should be placed on it. These shapes should be able to slide smoothly over the poster and on the string attached to the classroom board.

In addition to the use of such a moving guide, children should be taught to independently make a graphic representation of the condition of the problem during the analysis of the problem. For example, the starting points of pedestrians are marked with letters A and B. The direction of pedestrian movement is indicated by an arrow, and the meeting point is indicated by a dash or flag. In the schematic representation of the condition of this problem (and other problems related to motion) "with sections", they follow the approximate proportions of their lengths according to the distance traveled (in particular, the distance traveled until they meet) and speeds, that is, a large section should be described with Of the two arrows indicating the direction of movement, the larger number is written on it (Fig. 76).

Then the content of the problem is told according to the drawing: "Where did each pedestrian start to move?" How fast was each going? Why is their meeting place marked closer to the starting point of one of the pedestrians? The meeting point is marked near the exit of which of them? In this case, one can ask: "In what case is the flag placed exactly at half-way?" What do the divisions to the right and left of the flag mean? Why are these different lengths? What do the numbers on the arrows mean?' Such a perfect vision teaches students to "read" schematically.

The problem can be solved in two different ways. Solving the problem by selecting the problem on a drawing or poster, the first method shows the movement of the pedestrians meeting, then it is determined what the problem requires to know and what information is needed to calculate the total distance traveled by both pedestrians. By answering these questions, students will find the first way to solve:

4 3+5 3 = 27 (km).

The problem should be found by referring to the instruction manuals or drawing (pedestrians will come closer in 1 hour as many kilometers as the first and second walker walked together in one hour; i.e. (4+5) km will come closer). Then there is an approximate discussion: "If pedestrians walk 4+5 (km) in 1 hour, then they walk 3 times as much distance in 3 hours."

Solution: (4+5) · 3 = 27 (km).

Comparing the methods of solving, the students find out that when solving the problem by the second method, the sum is multiplied by a number, and when solving the problem by the first method, each of the addends of the sum is multiplied by this number and the sum of the results is found.

After solving the problem, it is useful to ask students such questions:

1. How far did each of the pedestrians travel before they met?

2. Why did the pedestrians travel different distances before they met?

3. Do pedestrians meet in the middle of the road or not? Why don't they meet in the middle?

These questions bring great insight into the nature of the problem and its solution. After solving this problem, the teacher changes its condition and creates an opposite problem, that is, the unknown distance (27 km) is known, the known time of movement is unknown introduces the issue to the students: "Two pedestrians set out from two villages at a distance of 27 km from each other at the same time. The speed of the first pedestrian is 4 km per hour, and the speed of the second pedestrian is 5 km per hour. After how many hours did the pedestrians meet?'

In the process of analysis, a graphic representation of the problem condition is made: a section is made, the points where the pedestrians come out are marked with the letters A and B, the direction of movement is marked with arrows, and the meeting place is marked with a flag. Since the second pawn is moving faster, the flag is placed closer to point L.

Based on the graph, the problem is analyzed as follows: "To meet, pedestrians must cover the entire distance between the villages (27 km), where the first pedestrian will cover the distances from point A to the meeting place, and the second pedestrian will cover the distances from point

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B to the meeting place. How many hours will it take for them to meet, that is, how many hours will it take for them to travel the whole distance?'

Pedestrians approach (4+5) km after one hour (illustrated in graphical model). After the second hour, they move closer (4+5) km (represented in the graphical model) and so on. How many hours will the pedestrians have to walk to cover a distance of 27 km? It is clear that they have to walk as many hours as there are in 27 km from (4+5) (km). The solution is written like this: 27: (4+5) = 3 (hours).

The solution of the problem can be given by writing down the actions separately (with explanations).

1) 4+5 = 9 (km)-pedestrian approach per hour;

2) 27: 9 = 3 (hours)-time elapsed until meeting.

The condition of the problem is changed once again in such a way that it is required to find the speed of one of the pedestrians: then met. The first pedestrian walked at a speed of 4 km per hour. How fast was the second pedestrian walking per hour?"

This problem can be analyzed by looking at its graphic representation as follows: "It is necessary to know how many kilometers per hour two pedestrians walk. For this, it is necessary to know the time he was on the road and the distance traveled before meeting. The time on the road is known. (3 hours). The distance traveled by each walker is unknown, but they can be found: the total distance is 27 km, the distance traveled by the first walker is found from the given time and the given speed (4-3 (km)), the distance traveled by the second walker is found by o 'tgan (27-4-3 (km)). '

Before solving this problem, it is better to write with explanations about actions:

1) 4*3 = 12 (km)—the distance traveled until the first pedestrian meets;

2) 27-12 = 15 (km) - the distance traveled until the second pedestrian meets;

3) 15:3 = 5 (km per hour) - the speed of the second pedestrian.

It is then useful to write the solution as an expression:

(27-4*3) : 3 = (27-12) : 3 = 5 (km per hour).

The problem can be solved in another way:

1) 27 : 3 = 9 (km) - the distance traveled by both pedestrians in one hour;

2) 9-4 = 5 (km/h) is the speed of the second pedestrian.

Answer: The speed of the second pedestrian is 5 km per hour.

After that, in solving similar problems, it is possible to use some writing of actions, and to create an expression or equation.

After solving the problem in three different ways, it is possible to roughly summarize it as follows: "All the solved problems are about the meeting action of two bodies. In this, the objects are one quantity - distance, time, speed. In the same problems, the velocities of the bodies and the time are known, and it is required to find the distance; in the second type of problems, the distance and the speed of the objects are known, and it is required to find the time; and in three different problems, the distance and time are known, and it is required to find the speed of one of the bodies.

Work on the problems of the motion of two bodies in opposite directions is built on the same plan as the plan of work on the problems of the meeting motion.

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