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About some methodical features of the development of creative competence of students in the process of solving research geometric problems

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ABSTRACT: this article is devoted to the use of tasks for the development of competency in the process of teaching geometry, specific instructions and recommendations are given for the development of students 'thinking on the application of research problems in order to develop students' research skills in solving geometric problems. In the process of developing students' thinking, great opportunities are provided by the following two methods: solving geometric search problems, completing tasks and exercises aimed at one learning goal. The use of these methods is considered on the example of some topics of the geometry course, and the technology of teaching students the skills to generalize is used. As you know, the solution of non-standard problems is a heuristic process, and you will have to move away from logical means. Sometimes a problem can be solved by brute force, so the student's desire to solve a problem is the basis of her creative activity. With the help of such tasks, students develop the ability to compare, find patterns, observe, put forward hypotheses, substantiate and prove them. On this basis, they have the opportunity to argue, develop companionable abilities, they master the skills to apply knowledge in new situations. The properties of a parallelogram can also be considered with the help of focused tasks and questions: the sum of the distances from the internal point to the lines on which its sides lie is a constant, the line passing through the intersection of the diagonals divides it into two equal triangles, the bisectors of the opposite angles of the parallelogram are parallel, the bisectors of the angles adjacent to one side are perpendicular, a large diagonal lies against a large angle, the angle between the heights drawn from obtuse angles is equal to the acute angle of the parallelogram. When considering the signs of a parallelogram, one can also discuss with students the problems and questions of generalizing the properties of a parallelogram.

Key words: geometry,development, competence, problems, cases, triangle, parallelogram, polygon, vertex, diagonal, lines, intersection, combinatorial problems..

Introduction

Formulation of the problem. In the process of developing students' thinking, the following two ways give great opportunities: solving search geometric problems, performing tasks and exercises aimed at one learning goal. We will consider the use of these methods on the example of some topics of the geometry course, while the technology of teaching students the ability to generalize is used [1], [2].

1) Tasks for the consideration of various cases.

1. The height divides the triangle into two equal isosceles triangles. Can you find the angles of a given triangle?

2. The median divides the triangle into two equal isosceles triangles. Can you find the angles of a given triangle?

3. The bisector divides a triangle into two equal isosceles triangles. Find the corners of a given triangle?

2) Mutually similar proof problems

4. Prove: a) intersections at right angles of bisectors of adjacent angles of a parallelogram; b) the bisectors of opposite angles are parallel or lie on one straight line.

8. Prove: a) the angle between the heights drawn from the vertices of the obtuse angles of the parallelogram is equal to the acute angle of the parallelogram;

b) the angle between the heights drawn from the vertices of the acute angles of the parallelogram is equal to the obtuse angle of the parallelogram.

3) Mutually inverse problems for the construction of non-standard structures.

1. Drawn the segments connecting the midpoints of the opposite sides of the parallelogram.

a) if the perimeter of the original parallelogram is 110 cm, then find the sums of the perimeters of all the parallelograms obtained. (Answer: 600 cm. Hint. You get 9 parallelograms (together with the original)).

b) Inverse problem. If the sum of the perimeters of all parallelograms obtained is 240 cm, then find the perimeter of the original parallelogram.

4) Oral exploration exercises.

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1. Why are all points of the circle located at the same distance from the center?
2.Can both adjacent corners be obtuse?
3. Why are all angles of an equilateral triangle equal?
4. Given two parallel lines. How many planes can you draw through these two lines?

Research results. As you know, solving non-standard problems is a heuristic process, and you will have to move away from logical means. Sometimes the problem can be solved by enumeration, construction, and therefore the student's desire to solve the problem is the basis of her creative activity. With the help of such tasks, students develop the ability to compare, find patterns, observe, put forward hypotheses, substantiate and prove them. On this basis, they have the opportunity to argue, develop communication skills, and they master the skills to apply knowledge in new situations.

5) Combinatorial problems

1. How many diagonals does a quadrilateral have? A direct check makes sure the number of diagonals is 2.

2. How many diagonals does the pentagon have? The solution is similar to the previous problem. The number of diagonals is 5.

3. How many diagonals does a hexagon have? The solution is similar to the previous problem. The number of diagonals is 9.

4 How many diagonals does a -gon have?

Decision. Let's choose one of the vertices of the -gon. Taking into account that the diagonal is a segment of two non-adjacent vertices of the polygon, we find that it is possible to draw diagonals from this vertex. Since the vertices of the polygon are equal, then taking into account that diagonals can be drawn from each vertex and in this definition of the number of diagonals each diagonal is counted twice, we will find the total number of diagonals - the triangle will be.

5. Can a polygon have: a) 10 diagonals; b) 20 diagonals; c) 30 diagonals?

Decision. Based on the results of solving the above problems, the hexagon has 9 diagonals, the heptagon - 14; octagon - 20; nine-sided - 27; decagon 35 diagonals. Obviously, a polygon with a large number of sides has more diagonals. Therefore, a polygon can have diagonals, but it cannot have 10 and 30 diagonals.

6. Is there a polygon with the number of diagonals equal to the number of sides?

Decision. Such a polygon is considered in the second problem. This is a pentagon. Let's show that he is the only one. Indeed, if the number of diagonals in the y-gon is equal to the number of sides, then the equality is true, solving it with respect to n, we find that.

The following tasks are related to the number of pairwise intersections of lines on the plane. It is known that from the axioms of planimetry it follows that two straight lines do not have more than one common point. The following questions are suggested

1. How many pairs of intersections can three lines have? Answer: 3.
2. How many pairs of intersections can four lines have? Answer: 6.
3. How many lines can have the greatest number of pairwise intersections? Answer: 10.
4. How many straight lines can have the greatest number of pairwise intersections?

Decision. The greatest number of pairwise intersections occurs if each line intersects with each line and no three lines intersect at one point.

In this case, each line has n - 1 intersection points with other lines, and we arrive at the situation that arose in Problem 4. Since the number of all lines is n and each line has n - 1 intersection points, the total number of them will be equals n (n - 1) In this case, each point is counted twice, so the number of line intersections will be $\frac{n(n-1)}{2}$.

There is one more axiom about the mutual arrangement of straight lines on a plane: a straight line divides the plane into two parts. Moreover, if two points belong to different parts, then the segment connecting these points will intersect this line; if the points belong to one part, then the segment connecting them does not intersect this line.

In this case, the following combinatorial problems can be proposed:

1. How many parts does the plane divide by two intersecting straight lines? Answer: 4.
2. How many parts does the plane divide by three intersecting lines? Answer: 6.
3. How many parts does the plane divide by three straight lines that do not intersect at one point? Answer: 7.
4. How many parts the plane divides by four straight lines, no three of them intersect at one point Answer: 11.

5. Into how many parts does the plane divide by n straight lines that do not intersect at one point? Answer: 2n.

6. Into how many parts does the plane divide in pairs of intersecting n straight lines, no three of them intersect at one point?

Decision. When a new straight line is added to this straight line, we will determine how much the number of plane parts will change. This addition is connected with the separation of some parts of the plane by a new straight line. For example, if there are two intersecting straight lines, then when adding the third, three parts from the existing four parts are divided into two parts and the total number of parts obtained will be equal to 7 = 4 + 3. The number of parts of the plane connected by the division of the new straight line is equal to m by the division and points of existing straight lines and the number of parts that the new line will divide. Each such part of a new straight line divides the corresponding part into two parts. Since the n-line intersects with n - 1 lines, it is divided into parts wa, so the number of parts of the plane will increase by n. Thus, the total number of parts of the plane that divides n straight lines is 4 + 3 + ... + n. From the formula

$$1+2+...+n=\frac{(n+1)^2-(n+1)}{2}=\frac{(n+1)n}{2}.$$

find the required number of parts

$$4+3+\ldots+n=\frac{(n+1)n}{2}+1.$$

When studying the topic "Signs of parallelism of straight lines" in the 7th grade, based on the solution of the following search problems, the theoretical concepts of this topic are presented and they will generalize the knowledge gained. At the same time, the following generalization issues are discussed:

1. Angle ABC is equal to 800, and angle of VSD is equal to 1200. Can straight lines AB and CD be parallel? Prove the answer.

2. Will lines AB and CD always be parallel? What cases should be considered?

3. Angle ABC is equal to 800, and angle of VVD is equal to 1000. Can lines AB and CD be parallel?

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From this it is clear that when considering each case, a general conclusion is drawn, i.e. the sequence of theoretical questions, takes into account the generalization of the studied concept. [6], [7], [8], [9]

The use of purposeful tasks in geometry lessons allows to form students' skills to generalize the knowledge gained and draw independent conclusions.

When studying the topic "Parallelogram", students are offered the following tasks aimed at developing the ability to generalize the properties of the studied geometric figure [3], [4]: Prove the following properties:

1. The diagonal of the parallelogram divides it into two equal triangles.
2.The diagonal of the parallelogram at the point of intersection is halved
3. In a parallelogram, opposite angles and opposite sides are equal.
4. The angles adjacent to either side add up to 1800.
5. The bisector of any angle of the parallelogram separates two isosceles triangles from it.

Conclusions.

In general, it can be considered with the help of purposeful tasks and questions describing the following properties of a parallelogram: the sum of the distances from the inner point to the straight lines in which its sides lie is a constant value, the straight line passing through the intersection point of the diagonals divides it into two equal triangles, the bisectors of opposite the angles of the parallelogram are parallel, the bisectors of the angles adjacent to one side are perpendicular, a large diagonal lies against the large angle, the angle between the heights drawn from obtuse angles is equal to the acute angle of the parallelogram [5], [10], [11], [12], [9]

When considering the signs of a parallelogram, you can also discuss tasks and questions on generalizing the properties of a parallelogram:

1. If the opposite sides of a quadrilateral are pairwise parallel, then this quadrilateral is a parallelogram.

2. If in a quadrilateral opposite sides are pairwise equal, then this quadrilateral is a parallelogram.

3. If in a quadrilateral two opposite sides are equal and parallel, then this quadrilateral is a parallelogram.

4. If in a quadrilateral diagonals, intersecting, the intersection point is divided in half, then this quadrilateral is a parallelogram.

5. The midpoints of the sides of an arbitrary quadrilateral are the vertices of the Varignon parallelogram

6. The sides of this parallelogram are parallel to the corresponding diagonals of the quadrilateral ABCD. The perimeter of the Varignon parallelogram is equal to the sum of the lengths of the diagonals of the original quadrilateral, and the area of the Varignon parallelogram is half the area of the original quadrangle [5], [6], [7], [12], [13].

The use of research tasks of a purposeful nature in the geometry lessons for the development of creative competence allows the formation of students' skills to generalize the knowledge gained and draw independent conclusions.

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