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BASIC ELEMENTS OF A TRIANGLE: BISECTOR, ALTITUDE, MEDIAN

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Abstract

Issues of teaching mathematics are related to the search for innovative approaches to teaching, both in secondary school and at university. The volume of knowledge is constantly growing, and therefore the possibilities for interactive learning are expanding. This article provides an example of conducting an interactive lesson in geometry in a high school. All stages of the interactive lesson are considered and the results of the lesson are summed up.

Keywords: *mathematics, motivation, worksheets, research question, conclusions*

1. Introduction

The 21st century is marked by significant changes in people's lives. These changes in one way or another affect our daily lives, careers, our thinking and changes in attitude toward certain issues. Adaptation to these changes poses a number of problems for a person. This series includes concepts such as lifelong education, critical thinking, teamwork, tolerance, active use of telecommunications and modern technologies, etc.

Considering the exceptional importance of education, it should be noted that every teacher must constantly work on himself. Taking into account the needs of children, it is no longer possible to teach children using old methods and approaches. Therefore, along with traditional lessons, students' need for interactive learning is growing.

This article presents a detailed geometry lesson that meets all the requirements of an interactive lesson.

2. Main part (lesson progress)

Motivation. Guys, today we will learn the main elements of one of the most important figures of planimetry, the name of which is encrypted in the crossword puzzle. To do this you must solve the crossword puzzle.

1) The science of geometric shapes and properties. (Geometry).

2) Angles that have a common vertex and whose sides continue each other are called? (Vertical).

[1]G	E	O	M	E	T	R	Y			
			[2]V	E	R	T	I	C	A	L
					I					
				[3]R	A	Y				
				[4]A	N	G	L	E		
			[5]D	E	G	R	E	E		
					L					
[6]A	D	J	A	C	E	N	T			

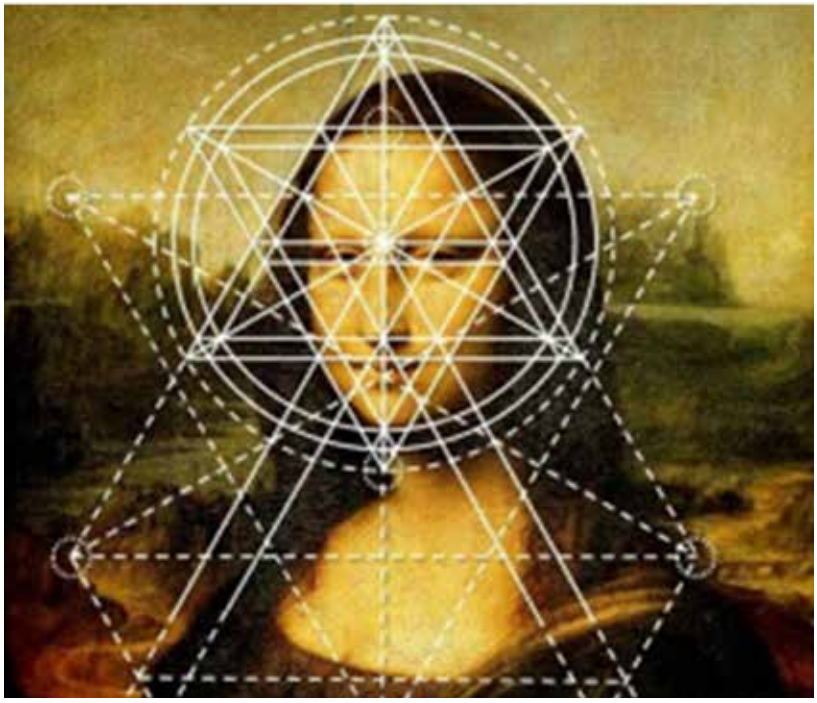
3) A point divides a line into parts, each of which is called? (Ray)

4) The part of the plane bounded by two rays from the common beginning is called... (Angle)

5) Unit of measurement of angles? (Degree)

6) Two angles into which the unfolded angle is divided its angle is called an internal ray? (Adjacent)

Figure 1.



So, today we will go through the main elements of the triangle.

In general, the triangle has a special place not only in mathematics but also in art.

For example, in the painting "Mona Lisa" (Gioconda) by the famous artist Leonardo da Vinci, the outlines of the figures form a triangle.

There is also the Bermuda Triangle, which you may have heard of. The brightest minds are trying to explain the mysterious phenomena occurring here. The Bermuda Triangle is a small area located in the Atlantic Ocean, in which disappearances seem to occur, covered in the secrets of the sea and air layers.

And that's not all, of course; triangles are found in many other areas of science.

Formulation of the problem. Our task is to determine the location of the bisectors, medians, altitudes of the triangle and determine their points of intersection, namely the points of intersection of heights.

Research question: How are the main elements of the triangle located? what properties do they have?

Standards (headings):

- Understands the relationship between the bisectors of a triangle and depicts them geometrically;
- Understands the property of medians of a triangle and depicts them geometrically;
- Understands the property of the altitude of a triangle and depicts it geometrically.

Guys, today I will divide you into 3 groups and give you worksheets.

After reviewing the solution to the problem in the sample, each group will have to solve the problems on their worksheet.

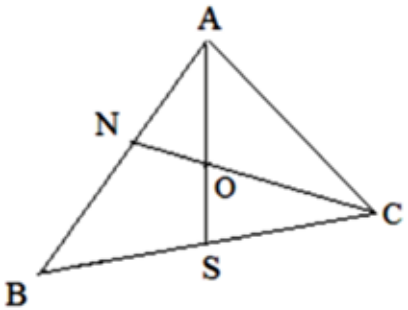
Group Worksheet № 1
Topic: Bisector of a triangle

1. The bisector BM is drawn in triangle ABD. Find ABM if angle B is 124 degrees.

2. Find the angle between any bisector of an equilateral triangle and the opposite side.

3. In triangle ABC, bisectors AS and CN are drawn. If $B = 40°$ find $\angle AOC$.

Fiqure 1. *Triangle ABC with the bisectors AS and CN*



A) $100°$; B) $110°$ C) $120°$ D) $100°$

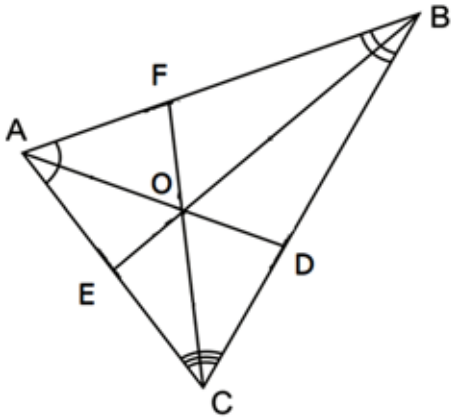
Sample.

Definition. An angle bisector is a ray emanating from the vertex of an angle and dividing this angle into two equal angles.

The three bisectors of a triangle always intersect at one point, always inside the triangle

Task. In triangle ABC $\angle A = 60°$, $< B = 82°$. AD, BE and CF are bisectors intersecting at point O. Find $\angle AOC$.

Fiqure 2. *Triangle ABC with the given bisectors*



Solution. Let's find angle C. It is equal to $180° - 60° - 82° = 38°$.

Note that in triangle AOC the acute angles are equal to the halves of angles CAB and ACB, that is $30°$ and $19°$

In triangle AOC, the sum of angles is:

$\angle OAC + \angle ACO + \angle AOC = 180°$

$30 + 19 + \angle AOC = 180°, \angle AOC = 131°$.

Answer: $\angle AOC = 131°$.

Group Worksheet № 2
Topic: Median of a triangle

1. In triangle ABC, median CN is drawn to side $AB = 16,4$ *sm*. Find AN.

2. AM, BN and CK are the medians of triangle ABC with a perimeter of 48,12 *sm*.
$AN + VK + SM = ?$

3. In an isosceles triangle ABC with base AC, the medians AQM and BN are drawn. Find the perimeter of triangle ABC if $AN = 6,8$ *sm* and $BM = 5,3$ *sm*.

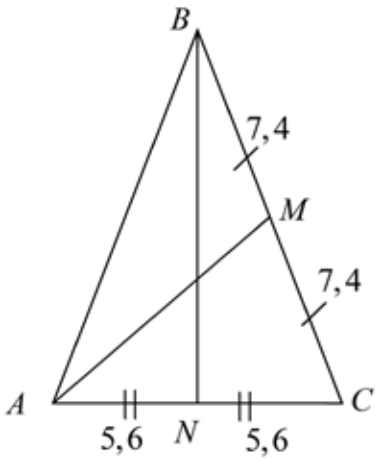
A) 20,4 *sm* B) 31,8 *sm*
C) 34,8 *sm* D) 37,8 *sm*

Sample.

Definition. Median is a line connecting the vertex of a triangle to the middle of the opposite side.
Three medians intersect at one point, always inside a triangle.

Task. In an isosceles triangle ABC with base AC, the medians AM and BN are drawn. Find the perimeter of triangle ABC if $AN = 5,6$ in. and $BM = 7,4$ in.

Figure 3. *Triangle ABC with the medians AM and BN*



Solution. BN is the median, which means it divides AC in half, i.e. $AN = NC$. Then
$AC = AN + NC = 2 \cdot AN = 2 \cdot 5,6 = 11,2$ *sm*
AM is the median, which means it divides BC in half, i.e. $BM = MC$. Then
$BC = BM + MC = 2 \cdot BM = 2 \cdot 7,4 = 14,8$ *sm*

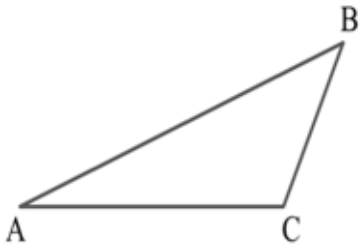
Considering that ABC is isosceles, i.e. $AB = BC$, the perimeter of triangle ABC is
$P(ABC) = AB + BC + AC =$
$= 2BC + AC = 2 \cdot 14,8 + 11,2 = 40,8$ *sm*.

Answer: 40,8 *sm*

Group Worksheet № 3
Topic: Height of a triangle

1. From vertex B of triangle ABC draw the altitude to side AC and write down the result.

Figure 4. *Triangle ABC with the given sides*



2. In equilateral triangle ABC, height BD is lowered to side AC. Find angle ABD.

3. In triangle ABC $\angle A = 60°$, $\angle C = 80°$, AD and CE altitudes intersect at point F. Find $\angle EFD$.

A) $140°$, B) $120°$, C) $70°$, D) $125°$.

Sample.

Definition. The altitude of a triangle is the perpendicular drawn from the vertex of the triangle to the opposite side.

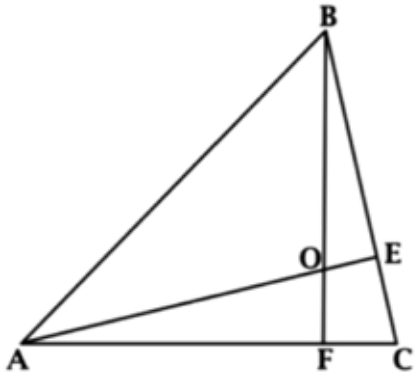
1. If the triangle is obtuse, then the altitude from the obtuse angle will lie inside the triangle, the altitudes drawn from the acute angles will lie outside the triangle, or rather, they are dropped onto the extensions of the sides of the triangle. At point, it is not the heights that intersect, but the continuations of the heights

2. In an acute triangle, all three altitudes and their intersection point lie inside the triangle.

3. In a right triangle, the legs (two smaller sides) serve as altitudes. The third height descends from the top at an acute angle. It is this peak that will be the point of intersection of the heights.

Task. In triangle ABC AE and BF the altitudes intersect at point O, $\angle FBC = 19°$. Find $\angle FOE$. Answer given in degrees.

Fiqure 5. *Triangle ABC with the given altitudes*



Solution. Triangle BOE – right angle, $\angle ABE = 19°$, then $\angle BOE = 90° - 19° = 71°$, $\angle FOE$ is adjacent to $\angle BOE$, then their sum is $180°$ and hence $\angle FOE = 109°$.

Answer: $\angle FOE = 109°$.

Now there will be a presentation of the work of each group on the blackboard.

At the same time, do not forget that first of all you need to introduce yourself and stand facing the class – this applies to all group

members. Each group must choose who will present the work (i.e., explain the sample and solve the problems) on behalf of their group.

Now participants of group № 1, and then group's № 2 and № 3 will come up to the board.

Groups / Criteria	Group № 1	Group № 2	Group № 3
Compliance with rubrics	10	10	10
Regulations	10	10	10
Cooperation	10	10	10
Listening skills	10	10	10
Result	10	10	10

3. Conclusion

This article provides a sample of conducting an interactive lesson in accordance with all the requirements of active learning, taking into account the age characteristics of students at this stage of education. All stages of the lesson are followed and covered with detailed solutions on the worksheets. And this sample can be used when teaching a lesson on the topic "Basic elements of a triangle: bisector, altitude and median of a triangle."

Homework:

Construct bisectors, medians, heights in obtuse, acute, and right triangles to determine where their intersection points are in each case, namely, pay attention to the location of the point of intersection of the heights.

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