SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal
Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2020 **Issue:** 08 **Volume:** 88

Published: 21.08.2020 **http://T-Science.org**

QR – Issue QR – Article

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TRIANGLE AND ITS STRIKING POINTS

Abstract: *Historically, geometry began with a triangle, so for two and a half thousand years the triangle has been a symbol of geometry; but it is not only a symbol, it is an atom of geometry. Why can a triangle be considered an atom of geometry? Because the previous concepts - point, line, and angle - are vague and intangible abstracts, along with a set of theorems and problems. Therefore, school geometry today can only become interesting and meaningful, and only then can it become the geometry itself when a deep and comprehensive study of the triangle emerges in it. Surprisingly, the triangle, despite its simplicity, is something that cannot be studied - even in our time he cannot dare to say that he has learned and knows all the features of the triangle.*

Key words: *triangle, geometry, angle, radius, object, source, material, type, right angle.*

Language: *English*

Citation: Jumaniyozova, N. K. (2020). Triangle and its striking points. *ISJ Theoretical & Applied Science, 08 (88),* 50-53.

Soi: http://s-o-i.org/1.1/TAS-08-88-13 ***Doi***: https://dx.doi.org/10.15863/TAS.2020.08.88.13

Scopus ASCC: *2600.*

Introduction

Therefore the study of school geometry cannot be carried out without an in-depth study of triangular geometry; the diversity of the triangle as an object of study, and therefore as a source of different methods of studying it, it is necessary to select and develop a material for the study of the geometry of the points of interest of the triangle. In addition, the choice of this material should not be limited to the attractions noted in the school curriculum by the State Education Standard, such as the center of the inscribed circle (the point of intersection of the bisectors), the center of the circle (intersection of the middle perpendiculars) , the intersection of the medians and the intersection of the altitudes. But to delve deeper into the nature of the triangle and understand its infinity, it is necessary to have an idea of as many wonderful aspects of the triangle as possible. In addition to the fact that a triangle is inexhaustible as a geometric object, the most striking feature of a triangle should be noted as an object of study: the study of the geometry of a triangle can be started by studying any of its properties; then a methodology for studying the triangle can be constructed so that all other features of the triangle are surprising. In other words, no matter where you start learning the triangle, you can always go to the bottom of any of these amazing figures. But then - as an option - you can start exploring the triangle by exploring its amazing aspects.

The points of interest of a triangle are points that are determined by this triangle and are independent of the order in which the edges and ends of the triangle are obtained.

Theorem2. The medians of a triangle intersect at a single point and are divided by a ratio of 2: 1 at the point of intersection.

Proof.Assume that point M is the center of the AC side and point N is the center of the side BC, i.e. MA = MC, NB = NC. N point B and

Because they lie between points C, points B and C lie on opposite sides of the straight line AN. For straight lines AN and AC, point A is common, so they cannot have other common points. Therefore, point M lying on the line AC and point B lying on the line AN lie on different sides of the line. As a result, the medians AN and BM intersect at an O point.

Since M and N are the midpoints of the sides AC and BC, respectively

then MN is the midline of the cross section ΔABC and MN AB. Two mutually parallel straight lines AB and MN intersect with straight lines AN and BM. The internal alternating angles formed at that time are equal to each other: ∠BAN = ∠ANM, ∠ABM =∠BMN. Now that the two angles in ΔABO are equal to the corresponding angles of ΔMON, they are similar, i.e. ΔABO ΔMON, their corresponding sides are proportional.

Theorem 2. All the heights of the triangle intersect at one point.

Proof. From the ends A, B, C of a given triangle we draw straight lines A2C2 AC, A1B1 AB, B1C1 BC parallel to its opposite sides. The intersection of these straight lines results in the formation of A1B1C1. By construction C1B AC, C1A BC, A1C AB, BA1 AC.

Thus, the rectangles AC1BC and ABA1C are parallelograms and C1B = AC, BA1 = AC, BA1 AC. From this we get C1B = BA1, ie point B is in the middle of the intersection A1C1. Similarly, points A and C can be shown to be the midpoints of sides B1C1 and A1B1, respectively. From the end B of the triangle ABC we pass the height BN. However, in A1B1C1, the height BN is the median perpendicular to its side A1C1. Similarly, the heights CK and MA are perpendicular to the sides A1B1 and B1C1, respectively. Since the median perpendiculars intersect at a single point in any triangle, the heights MA, NB, and KC intersect at a single point O.

The bisector of a triangle is the angular cross section of the triangle that connects it with the point on the opposite side of the triangle.

Theorem Each point on the bisector of an undeveloped angle is equal to each other from its sides (i.e., an equation of straight lines containing the sides of a triangle). Conversely: every point that is equal in angle and on the sides of the angle lies in its bisector.

Let's look at some properties of the bisector of a right triangle.

Theorem 1. The points of the angle bisector lie at equal distances from the sides of the angle.

Proof. The straight line AD is the bisector of the angle BAC, ie ∠BAD = ∠DAC. Taking an arbitrary point K on the bisector AD, we draw from this point the perpendiculars KN ⊥ AC, KM ⊥ AB to the sides of the angle. In the resulting right-angled triangles AKM and AKN, the hypotenuse is common and the acute angles ∠MAK, ∠KAN are equal, so they are equal to each other: ΔKMA ΔKNA. In equal triangles, equal sides lie opposite opposite equal angles. Therefore, KM = KN. The theorem is proved.

Theorem 2. The opposite side of the bisector of the interior of a triangle is divided into parts proportional to the sides adjacent to it.

Proof. Let AD be the bisector of the interior angle ΔA = a, ie aBAD = ∠DAC. From the angles B and C of the triangle, we draw perpendiculars to the straight line AD: BE ⊥ AD, CF ⊥ AD. Then ΔABE and ΔACF are right angles and ∠BAF = ∠CAF because they are similar, i.e. ΔABE ΔACF. Hence CAC AB BE. On the other hand, since CFD and BDE are right-angled and vertical angles, the equation ∠BDE = ∠CDF is appropriate, so the triangles are similar, i.e., CFD BDE. Hence or (b). By comparing the resulting equations (a), (b), we obtain the required equation. The theorem is proved. We now give the formulas for calculating the bisectors of a triangle. Construct the bisector AD ΔABC with sides AB = c, BC = a, AC = b and express its length la by a, b, c. We get the relationship according to the property of the bisector of the interior angle of a triangle.

The gergonn point is the point of intersection of the segments connecting the ends of the triangle with the tangent points of these sides and the opposite sides to the circles inscribed on the triangle.

Let the point O be the center of the circle of triangle ABC. Connect the marked circle to the sides of the triangle BC, AC and AB at points D, E and F, respectively. The Gergonn point is the point of intersection of the AD, BE, and CF segments. Let O be the center of the circle inscribed? ABC. Connect the marked circle to the sides of the triangle BC, AC and AB at points D, E and F, respectively. The Gergonn point is called the intersection of the segments AD, BE, and CF (we rotate the triangle clockwise)), the segments intersect at one point.

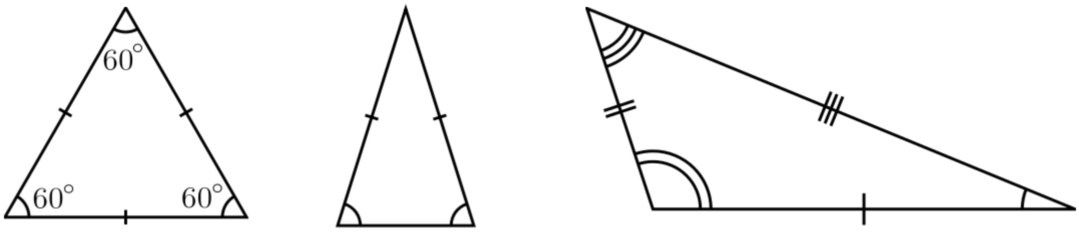
Recorded apartment features:

A circle, if it touches all its sides, is called a triangular inscription.

Given three points A, B, and C that do not lie on a straight line. By connecting these points through a series of intersections, we form a shape called a triangle and denoted by ABC. Points A, B, C are the ends of a triangle, AB, BC, CA are called its sides. The intersections AB, BC, CA form a closed broken line, and therefore the definition of a triangle can be given as follows: The part of the plane bounded by a closed broken line consisting of three joints is called a triangle. The angles ∠CAB, ∠CBA, ∠ACB are called the interior angles of the triangle ABC, which are sometimes denoted by a single letter: ∠A, ∠B, ∠C. Continue the AC side of the triangle to the right of point C. The resulting angle ∠BCD is called the exterior angle of triangle ABC.

Triangles are divided into three types: equilateral, equilateral, or regular, with different sides. A triangle with two sides equal is called equilateral. A triangle with three equal sides is called equilateral or regular. A triangle with sides of different lengths is called a triangle. There are three types of triangles. A triangle with all its interior angles is called an acute angle. A triangle with one interior angle is called an obtuse triangle. A triangle with an interior angle of 90° is called a right angle.

Depending on the length of the sides of a triangle, there are three types:



Equilateral. Equilateral Different sides

Pic.1.

Definition. The median of a right triangle is AK, which connects the end A of the triangle with the center K of the opposite side BC. By definition, ABC has three media outlets. Let AD ∠BAC in ABC be equal to two, that is, ∠BAD = ∠DAC and let AD be the point of intersection of the ray with the side BC of the triangle BC. Then the cross section AD is called the bisector of the angle A of the triangle ABC. Obviously, a triangle can have three bisectors. Draw ABC perpendicular to the straight line BC from the end A of the triangle and let F be their point of intersection. At that time AF is called the height of the intersecting triangle. There are three heights in a triangle. The midpoint of the triangle ABC is the midline of the triangle connecting the points K and N between the sides AB and AC. Three midlines can be drawn in a triangle.

Theorem 1. The center line of a triangle is parallel to its base and half the length of its base:

theorem. The sum of the interior angles of a triangle is 180 °.

Theorem 3. The exterior angle of a triangle is equal to the sum of the interior angles that are not adjacent to it:

∠BCD = ∠BAC + ∠ABC.

An equilateral triangle and its properties. Given ABC, then AB = BC, that is, let it be equilateral. This triangle has the following properties.

1. The bisector drawn from the end of an equilateral triangle to its base is both the median and the altitude. In other words, if AB = AB and BC in ABC

If ∠ABD = ∠DBC, then BD ⊥ AC and AD = DC.

2. The angles at the base of an equilateral triangle are equal to each other, if in ABC

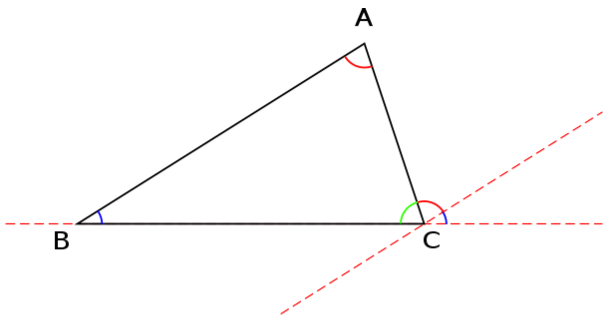
If AB = BC, then ∠A = ∠C.

Proof. In the equilateral ABC (AB = BC) we pass the bisector BD for B, that is, ∠ABD = ∠DBC. According to property 1, BD ⊥ AC and AD = DC.

Now let's turn ABD by ABC's median. Since ∠DBC = ∠DBA, when ABD is placed on top of BDC, BA goes in the direction of BC.

Since DC = DA, point A overlaps point C and sides BA and BC also overlap, BA = BC. Now that BC = BA and CD = DA, the angles between them are also equal, i.e. ∠BAD = ∠BCD. The property is proved. Moved to the sides in an equilateral triangle:

a) heights; b) medians; d) The bisectors are, respectively, equal to each other.



Pic.2.

the interior angles of a triangle are 180 ° (mutually equal in the same color)

the sum of the interior angles of a triangle is 180°;

the exterior angle of a triangle is equal to the sum of two interior angles that are not adjacent to it;

like all polygons, the sum of the exterior angles of a triangle is 360 °;

the sum of any two sides of a triangle is always greater than the third side: a + b> c, a + c> b, b + c> a

Pythagorean theorem

The Pythagorean theorem applies to a right-angled triangle, the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of its legs. A right-angled triangle with legs a and b, hypotenuse c given, then the Pythagorean theorem is represented by the formula: The main properties of a right triangle are: the sum of the acute angles of a right triangle is 90 °, they complement each other; if the legs of a right triangle are equal, the angles opposite the legs are 45 ° and the hypotenuse by Pythagorean theorem is found using the following formula: $c = \sqrt{2}a$; the hypotenuse of a right-angled triangle with angles of 30 ° and 60 ° is equal to the doubling of the catheter opposite the minor angle:; In all right-angled triangles, the median drawn to the hypotenuse is half of the hypotenuse.

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