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Methodology Of The Topic ”Rectangle And Its Types”

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ABSTRACT

The article formulates a methodology for teachers to use non-standard and practical issues and provides the necessary recommendations, arguing that the targeted use of non-standard and practical issues is an effective tool for developing creative abilities in students.

KEYWORDS

Rectangular, non-standard, methodological bases of teaching, figure, field of mathematics education, student literacy, teaching, teaching quality, pedagogical technology.

INTRODUCTION

Particular attention is paid to the practice of modernization of mathematics education in the world, improving the methodological framework of teaching in accordance with modern development trends. The International Program for the Assessment of Applied and Scientific Literacy in Developed Countries (PISA), the International Center for Trends in Mathematics and Natural Sciences (TIMSS) The work being done on. A number of research works are being carried out around the world to improve the quality of teaching

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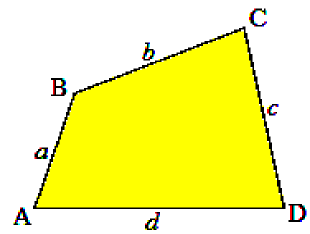
mathematics, the introduction of advanced pedagogical technologies in the educational process, the use of opportunities for interdisciplinary integration in education, the creation of methodological support aimed at developing students' creative abilities. In particular, the effective use of science in the teaching of mathematics, the improvement of methods of teaching problem-solving in solving practical and natural-scientific problems, the application of scientific and methodological developments on the theoretical foundations of science in the educational process are important.

Basic information about rectangles, their types

A rectangle (Greek tetragōnon) is a geometric figure (polygon) consisting of four points and four intersections connecting these points in series. There are convex and non-convex rectangles. Rectangles without intersections are considered simple, and in most cases only simple rectangles are considered to be rectangles.

A figure consisting of four points and four intersections connecting these points in series is called a rectangle. In this case, none of the three points should lie in a straight line, and the intersections connecting them should not intersect. These points are called the ends of the rectangle, and the intersections are called the sides of the rectangle. If the ends of a rectangle are the ends of one of its sides, they are called adjacent ends. The ends that do not have a neighbor are called opposite lying ends. The cross-sections connecting the opposite ends are called the diagonals of the rectangle.

A rectangle is said to be convex if it lies in a single half-plane relative to a straight line covering any side of it.



The sum of the interior angles of a convex rectangle is 360 °:

$\angle A+\angle B+\angle C+\angle D=360°$

The sum of the external angles taken from each end of a convex rectangle is 360 °. All corners of a rectangle cannot be sharp or all corners are impenetrable.

Each corner of a rectangle is always smaller than the sum of the remaining three corners:

$\angle A<\angle B+\angle C+\angle D$, $\angle B<\angle A+\angle C+\angle D$,

$\angle C<\angle A+\angle B+\angle D$, $\angle D<\angle A+\angle B+\angle D$.

The sum of the lengths of all the sides of a rectangle is called the perimeter of the rectangle.

Each side of a rectangle is always smaller than the sum of the other three sides:

$a<b+c+d$, $b<a+c+d$,

$c<a+b+d$, $d<a+b+c$

The intersections that connect the opposite ends of a rectangle are called the diagonals of the rectangle.

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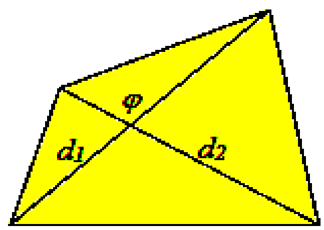
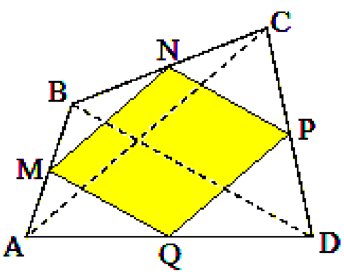
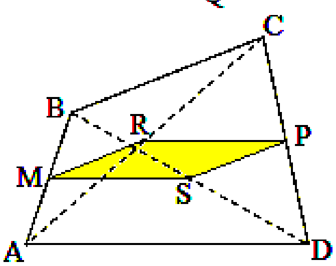
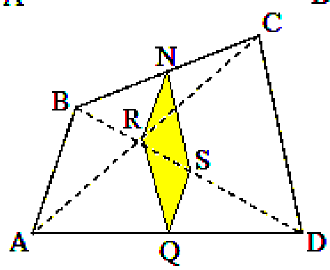


To find the face of a rectangle, the following formula, expressed by diagonals, is appropriate:

$$S = \frac{1}{2} d_1 d_2 \cdot \sin\varphi \, .$$

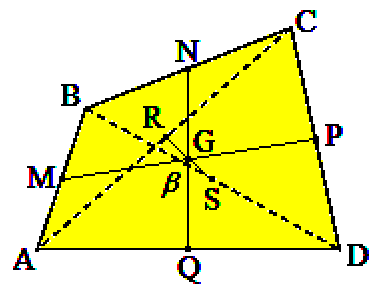






M, N, P, Q are the midpoints of the sides of the rectangle ABCD, a, R, S are the midpoints of its diagonals, and the rectangles MNPQ, MRPS, NSQR are parallelograms and are called Varion parallelograms. The shape and dimensions of the varion parallelograms depend on the dimensions of the rectangle ABCD given. Thus, MNPQ is a right angle, if the diagonals of the rectangle ABCD are perpendicular, MNPQ is a rhombus, if the diagonals of the rectangle ABCD are equal, MNPQ is a square, if the diagonals of the rectangle ABCD are perpendicular and equal.

if SABCD = S MNPQ



MP, NQ and RS are called the first, second and third lines of the rectangle.

All the median lines of a rectangle intersect at a single point and are divided into equal parts:

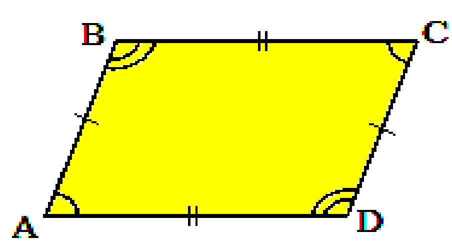
MG=GP, NG=GQ, RG=GS.

The sum of the squares of the midlines of a rectangle is equal to the sum of the squares of all the sides and diagonals of the rectangle.

$$MP^2 + NQ^2 + RS^2 = 1/4(AB^2 + BC^2 + CD^2 + AD^2 + AC^2 + BD^2)$$

1.2. Parallelogram

A rectangle whose opposite sides are parallel, that is, lying in parallel straight lines, is called a parallelogram.



AB||CD, BC||AD.

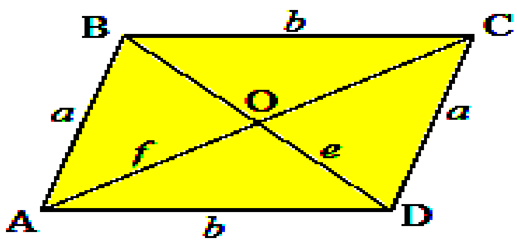
The opposite angles and opposite sides of a parallelogram are equal.

AB=CD, BC=AD

∠A=∠C, ∠B=∠D.

The sum of the adjacent angles of a parallelogram is 180 °:

∠A+∠B=∠B+∠C=∠C+∠D=∠A+∠D=180°



The diagonals of the parallelogram intersect at one point and are divided into two equal at the point of intersection.

AO=OC; BO=OD.

The diagonal of the parallelogram divides it into two equal triangles.

∠ABC=∠CDA; ∠ABD=∠CDB.

When the diagonals of a parallelogram intersect, it is divided into four equal triangles:

$S_{\Delta ABO}=S_{\Delta BCO}=S_{\Delta CDO}=S_{\Delta ADO}$.

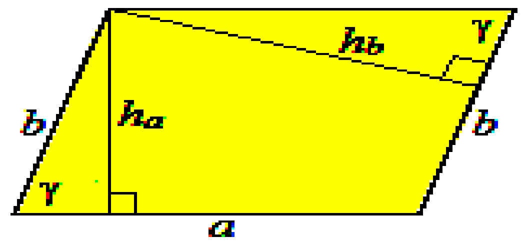
The sum of the squares of the diagonals of a parallelogram is equal to the sum of the squares of its sides.

$e^2+f^2 = a^2+b^2+a^2+b^2 = 2(a^2+b^2)$.

Properties of a parallelogram:

- If the diagonals of a rectangle intersect and are divided into two equal at the point of intersection, it is a rectangular parallelogram:
- The diagonals of the parallelogram intersect and are divided into two equal at the point of intersection:
- The opposite sides of the parallelogram are equal, the opposite angles are equal.

The perpendicular drawn from one end of a parallelogram to the opposite side is called its height.



$h_a = b \cdot \sin\gamma$; $h_b = a \cdot \sin\gamma$.

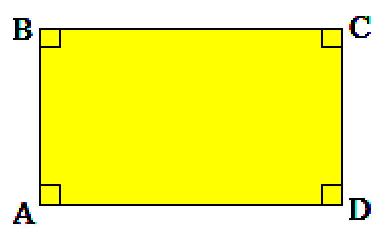
The face of a parallelogram is found by its side and the height drawn on it as follows.

$S = ah_a = bh_b$

through its two sides and the angle between them is found as follows:

$S = ab \cdot \sin\gamma$

1.3. Straight rectangle and rhombus



A parallelogram with all angles right is called a right rectangle.

∠A=∠B=∠C=∠D=90°

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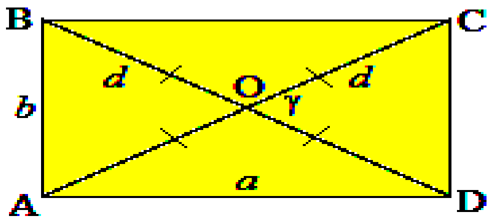


The diagonals of a right rectangle are equal.

AC=BD;

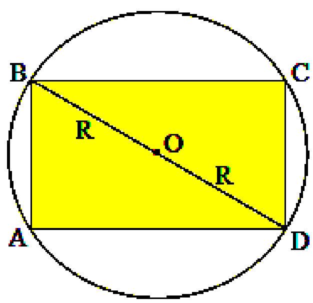
Its diagonals intersect and are divided into two equal at the point of intersection and:

AO=BO=CO=DO.

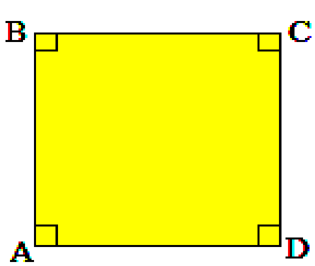
The face of a right rectangle is found by the following formulas: S = ab; (through the parties)

Through the diagonals and the angle between them:

$S = \frac{1}{2}d^2 \cdot \sin\gamma$



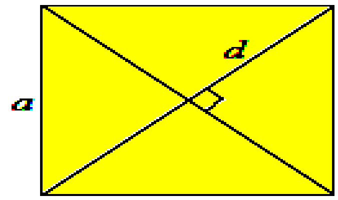
BD = 2R.



A right rectangle with all sides equal is called a square.

$\angle A=\angle B=\angle C=\angle D=90°$,

AB=BC=CD=AD



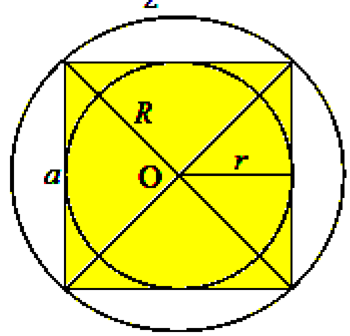
All sides of the square are equal. Therefore a square has the properties of a right rectangle and a rhombus.

1. All angles of a square are right angles.
2. The diagonals of the square are equal.
3. The diagonals of a square intersect at right angles and its angles are bisectors. The sides and diagonals of the square are connected as follows.

$$a = \frac{d}{\sqrt{2}}; \quad d = a\sqrt{2}.$$

The face of the square is found as follows:

$$S = a^2 = \frac{d^2}{2}.$$



The centers of the inner and outer drawn circles on the square overlap, and it is at the point where the diagonals intersect.

The radius of the circle drawn outside the square:

$$R = \frac{a}{\sqrt{2}}.$$

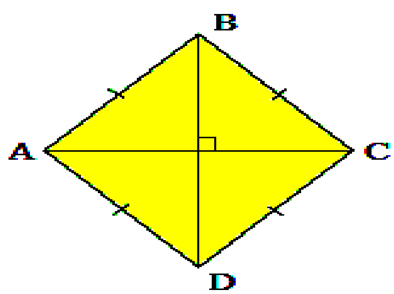
The radius of the circle drawn inside the square:

$$r = \frac{a}{2}.$$

found by formulas.

ROMB

A parallelogram with all sides equal is a rhombus.

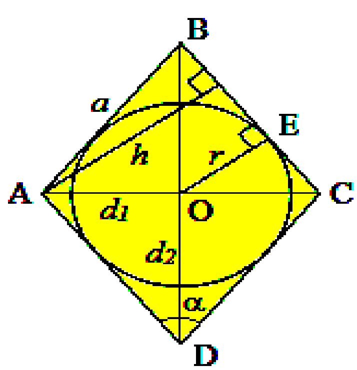


AB=BC=CD=AD.

The diagonals of a rhombus intersect at right angles and its angles are bisectors.

AC⊥BD.

∠ABD=∠CBD=∠ADB=∠CDB; ∠BAC=∠DAC=∠BCA=∠DCA.



The point where the diagonals of any rhombus intersect will be the center of the circle drawn inside it.

The radius of the circle drawn inside the rhombus can be found by the following formulas:

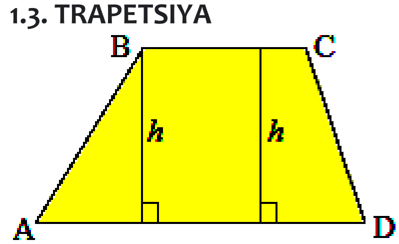
- Through the height of the rhombus:
  $$r = \frac{h}{2};$$
- Through the sides and diagonals of the rhombus:
  $$r = \frac{d_1 d_2}{4a};$$
- and
  $$r = \sqrt{BE \cdot EC}.$$

Formulas for finding the face of a rhombus:

- Through the diagonals of the rhombus
  $$S = \frac{d_1 d_2}{2};$$
- Through the side and corner of the rhombus
  $$S = a^2 \cdot \sin\alpha;$$
- Through the side and height of the rhombus
  $$S = ah;$$
- Through the side of the rhombus and the radius of the circle drawn inside it

$$S = 2ar.$$

1.3. TRAPETSIYA



AD||BC.

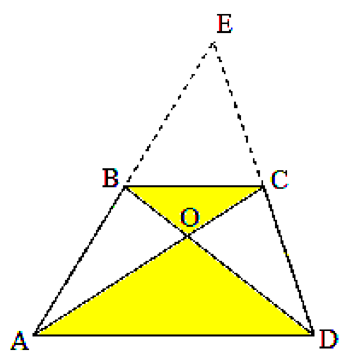
These parallel sides are the bases of the trapezoid, and the other two sides are its sides.

The section connecting the middle of the sides of a trapezoid is called the midline of the trapezoid. The midline of a trapezoid is parallel to its bases and is equal to half of their sum.

KL||AD; KL||BC;

KL = ½(AD+BC).

The height of a trapezoid is said to be perpendicular from one end to the opposite. The following relations are appropriate for similar triangles formed by continuing the sides of a trapezoid.

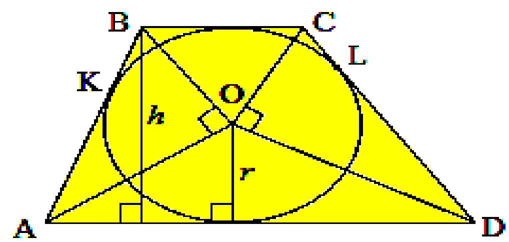


ΔAED~ΔBEC, k=AD/BC and ΔAOD~ΔCOB, k=AD/BC. SΔABO = SΔCDO

To draw an inner circle on a trapezoid, the sum of its opposite sides must be equal. The center of the inner drawn circle lies on the midline of the trapezoid, and the corner bisectors are at the point of intersection.

An inner circle is drawn on the trapezoid, the bisectors of the angles sticking to the sides intersect at right angles.

The diagonal of the middle line of the trapezoid and the height of the base are divided into two equal parts.



AD+BC=AB+CD.

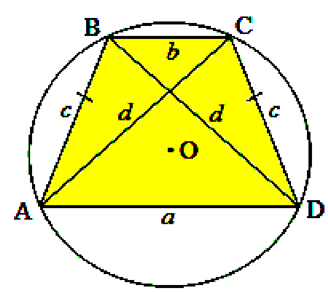
∠AOB=∠COD=90°.

$$r = \frac{h}{2};$$

$$r = \sqrt{AK \cdot KB}; \quad r = \sqrt{CL \cdot LD}.$$

To draw an outer circle on a trapezoid, the sum of its opposite angles must be 180 °.

If you can draw an outer circle on the trapezoid, it will be equilateral.

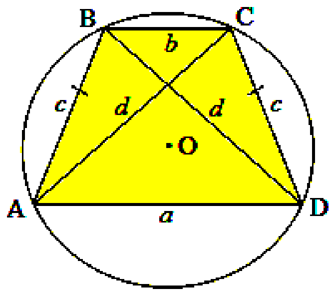


If the diagonal of the trapezoid is perpendicular to the side, the center of the circle drawn on it lies in the middle of the large base.

If the center of the circle drawn outside the trapezoid lies at its base, the diagonals of the trapezoid will be perpendicular to the sides. The center of the circle drawn outside the trapezoid lies in a straight line perpendicular to the center of the trapezoid.

An equilateral trapezoid is called an equilateral trapezoid.

AB=CD.



The two angles attached to each base of an equilateral trapezoid are equal.

∠A=∠D, ∠B=∠C;

∠A+∠C=∠B+∠D=180°.

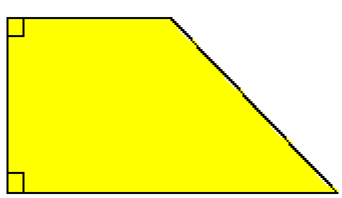
When the diagonal of an equilateral trapezoid is equal to its acute angle by two, the small base of the trapezoid is equal to its sides.

When the diagonal of an equilateral trapezoid is equal to two of its obtuse angles, the floor base of the trapezoid is equal to its sides.

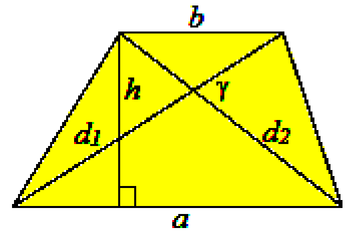
There is also the following connection between the sides and diagonals of an equilateral trapezoid:

$d^2 = ab+c$

If the bit angle of a trapezoid is a right angle, then this trapezoid will be a right-angled trapezoid.



To find the face of a trapezoid, we use the following formulas:



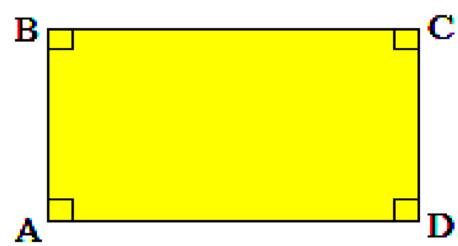
$$S = \frac{a+b}{2} \cdot h .$$

$$S = \frac{1}{2} d_1 d_2 \cdot \sin\gamma ;$$

1.5. Examples from rectangular issues

Issue 1. The diagonals of a right rectangle are 12 cm, they are the angles of the rectangle in the ratio 2: 1. Find the perimeter of the right rectangle.

AVSD – rectangular,



AC=12 см.

∠BAC :∠САД= 2:1

P-?

Solution:

I we say ∠SAD = x, then ∠VAS = 2x and ∠SAD + ∠VAS = x + 2x = 90 °.

Hence x = 30 °. AS*

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We find right-angled ADS triangular catheters:
СД= АС*sinСАД= 12sin30°=12*½=6(см)

АД=АС*cosСАД=12*cos30°=12*√3/2=6√3(см)

Find the perimeter of the rectangle:

Р=2*(АД+СД)= 2*(6+6√3)=12(1+√3) (см).

Answer:12(1+√3)см.

Issue 2. The large base of an equilateral trapezoid is 25 cm and the perimeter is 55 cm. If the diagonal of a trapezoid is equal to two of its acute angles, find the midline of the trapezoid.

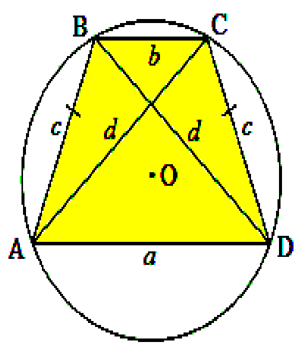
Given

АВ=СД

АД=25 см

Р=55 см.

КМ-?



Solution:

We know that, according to the property, if the diagonal of a trapezoid is equal to two of its acute angles, the small base of the trapezoid is equal to its side. So, If we define AV = SD = VS = x, the

Р=х+х+х+25

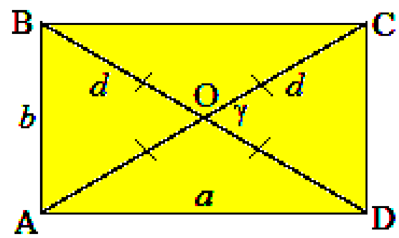
х+х+х+25=55.

3х=30

х=10 яъни, ВС=10 см КМ=(10+25)/2=17,5 см.

Answer: 17,5 см.

Issue 3. The sides of a right rectangle are 3 and 4 cm, find the cosine of the small angle between the diagonals.



Solution: Since ASD is a right triangle:

$АС^2=АД^2+СД^2$

$АС^2=4+16$ АС=5 (см)

ΔОСД да ОС=ОД=2,5 (см)

According to the cosines theorem:$СД^2=ОС^2+ОД^2-2*ОС*ОД*cosγ$

9=6,25+6,25–2*2,5*2,5* cosγ

12,5* cosγ=3,5

Cosγ=7/25.

Answer:7/25.

Issue 4. The large diagonal of a rhombus with a side of 5 cm is 6 cm. Find the face of the rhombus.

Given

AVSD rhombus

ВД=6 см

S-?

Solution:

ВО=ВД/2=3 (см)

ΔBOCsince it is right-angled

$OC^2=BC^2-BO^2$

$OC^2=25-9$

OC=4

AC=8 (см)

S=(AC*ВД)/2= (6*8)/2=24 (см²)

Answer: 27 см².

CONCLUSION

The following conclusions were made on the basis of scientific-theoretical and methodological-practical research on the methodology of developing students' creative abilities through a thematic approach to teaching mathematics:

1. Based on the conducted analytical, scientific-theoretical and methodological-practical research, it was determined that the thematic approach serves as a methodological basis for the development of creative abilities of students in the teaching of mathematics at school. Theoretical and experimental studies, the results of scientific research on the subject have shown that the first proposed scientific hypothesis has been fully confirmed.
2. In the process of teaching mathematics, it was found that teaching students to mathematically model problem-solving mathematical problems of non-standard, practical content with a systematic, systematic goal-oriented effect has an effective effect on the development of creative qualities in them. The use of such issues serves to develop students' creative abilities, and the acquired knowledge, experiences and personal qualities form in them the ability to form problem-solving ideas, predict their behavior, control and critically evaluate their activities.
3. On the basis of the analysis of psychological-pedagogical and scientific-methodical literature the current state of a problem of development of creative abilities of pupils is studied in detail. In particular, it was found that teaching students to solve non-standard problems requires the formation of basic knowledge, skills and competencies. The development of creative skills requires the development of effective motivation in students, the formation of self-confidence, a positive psychological environment during the lesson, the desire to learn mathematics and master the learning process.
4. In the course of theoretical and practical research it was found that the inclusion of elements of mathematical modeling of problem situations of practical and applied content in the structure of educational and creative activities contributes to the development of creative abilities of students. A structural-functional model of developing creative abilities in students was developed and proposed.
5. A system of non-standard, practical issues aimed at fostering students' interest in learning, independence and spiritual, creative qualities was developed and proposed. Stages of solving practical problems through mathematical modeling were developed and the knowledge, skills and abilities required at each stage were demonstrated.

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