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# ENCOURAGING STUDENTS TO INDEPENDENT WORK IN THE EXAMPLE OF TRIGONOMETRY

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**Abstract:**
**The article is devoted to some issues of the teaching methodology, in particular, it focuses on the logical construction of trigonometry, the simple presentation of its main topics and concepts to students, and the aspects of independent study.**

**Keywords**
**Methodology, teaching, trigonometry, concept, simplicity, topic, effectiveness of teaching, independent teaching.**

**Introduction**

Improvement of the teaching methodology is inextricably linked with the development of students' ability to work independently. There are great opportunities to increase the effectiveness of the pedagogical process in the development of students' independence. Both teachers and parents should teach and encourage students to read books and, in general, to think independently. A number of experts have also shown this.

We hope that this work will help, even partially, to illuminate topics in the course of study, including in the field of independent education, and in their wider mastery by students.

At the time, mathematics in schools was treated as three separate branches, i.e. algebra, geometry and trigonometry, each of which was taught as an independent subject, including trigonometry. We know that teaching is a complex process, and finding and applying effective methods of conveying and presenting topics and concepts to students is an even more complex and important issue.

Below, we want to focus on the issues of consistent, logical teaching of trigonometry, taking into account its features.

Of course, in this regard, it is necessary to pay special attention to principles such as simplicity and comprehensibility in teaching.

It is known that trigonometry mainly includes topics and problems about triangles. Right triangles will be considered first, then arbitrary triangles.

For example, given a right-angled triangle ABC, diagram 1. Here, $\angle C=90^0$, $\angle A$ and $\angle B$ are acute angles, a and b are legs, and c is the hypotenuse.

Here are the traditional definitions of the main trigonometric functions:

The sine of an acute angle is defined as the ratio of the leg opposite the angle to the hypotenuse:

$\sin A=\frac{a}{b}$, $\sin B=\frac{b}{c}$.

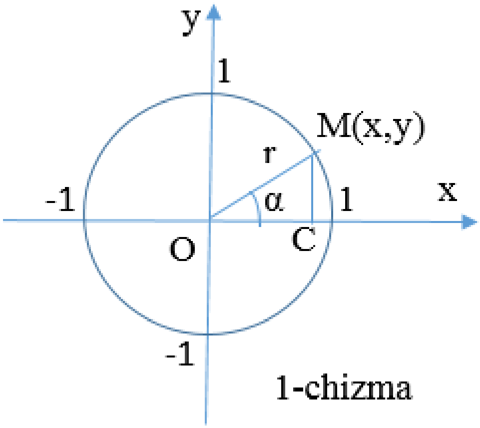
The cosine of an acute angle is the ratio of the leg next to the angle to the hypotenuse:

$\cos A = \frac{b}{c}$ , $\cos B = \frac{a}{c}$ .

The tangent of an acute angle is defined as the ratio of the leg opposite to this angle to the leg next to it, and the cotangent, on the contrary, is the ratio of the leg opposite to the leg next to it:

$\operatorname{tg} A = \frac{a}{b}$ , $\operatorname{tg} B = \frac{b}{a}$ , $\operatorname{ctg} A = \frac{b}{a}$ , $\operatorname{ctg} B = \frac{a}{b}$ .

Based on these, the problems of solving triangles with right angles and then with arbitrary angles are studied. However, such traditional definitions of the trigonometric function are valid only in the right-angled triangle, and for arbitrary angles α, these definitions lose their validity. Therefore, the article describes a method of defining trigonometric functions that is suitable for any arbitrary angle, which makes it easier to develop all the properties and formulas within the framework of trigonometry without difficulty, one after the other, in a simple way on a logical basis. and this creates methodical convenience in teaching topics and concepts and conveying them to students.
According to the definition, we consider the rectangular Cartesian coordinate system and the unit circle obtained in it.



1-chizma

We present the definitions of the main trigonometric functions based on diagram 1, based on the ΔOCM:

The sine of an angle is called the ratio of the leg opposite to this angle to the hypotenuse, and the cosine is the ratio of the leg adjacent to it to the hypotenuse.

Also, the tangent of an angle is the ratio of its opposite side to the side adjacent to this angle, and the cotangent is the ratio of the opposite side to the opposite side, i.e.

$\sin \alpha = \frac{CM}{OM}$, $\cos \alpha = \frac{OC}{OM}$ , $\operatorname{tg} \alpha = \frac{CM}{OC}$ , $\operatorname{ctg} \alpha = \frac{OC}{CM}$ .

If we take into account that OM= r =1, OC=x, CM=y, these equations take the following form:

$\sin \alpha = y$ , $\cos \alpha = x$ , $\operatorname{tg} \alpha = \frac{y}{x}$, $\operatorname{ctg} \alpha = \frac{x}{y}$ .

Accordingly, it is possible to come to a simple definition, for example, the sine of the angle a is the ordinate of the point M, and the cosine is its abscissa.

This method of defining trigonometric functions allows to use them for any arbitrary angles.

For example, from Figure 2, sin0°=0, cos0°=1, sin90°=1, cos90°=0, sin180°=0, cos180°=-1, sin270°=-1, cos270°=0 and finally sin360 It is clear that °=sin0°=0, cos360°=cos0° =1 (Figure 2).

3-chizma bo'yicha, $M_1OC$ va $M_2OC$ uchburchaklar o`zaro teng, shuningdek $\angle M_1OC_1$=30°, $\angle M_2OC_2$=30°, $\angle C_1OM_2$=240°. Bulardan esa $M_1C_1$=$OC_2$, $M_2C_2$=$O_1C_1$ bo'lib, sin240°=$M_2C_2$= $OC_1$

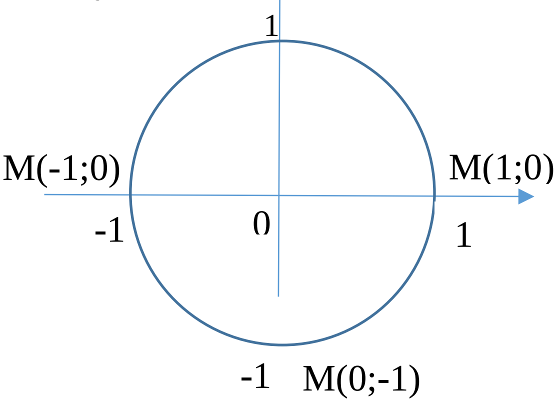
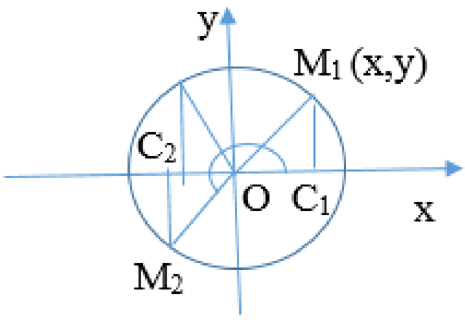



Figure 2

Or, for example, let's look at the sine and cosine of the angle α=240°.

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According to Figure 3, $M_1OC$ and $M_2OC$ triangles are equal to each other, as well $\angle M_1OC_1$=30°, $\angle M_2OC_2$=30°, $\angle C_1OM_2$=240°.
Of these, $M_1C_1$=$OC_2$, $M_2C_2$=$O_1C_1$ is sin240°= sin240°=$M_2C_2$= $OC_1$
is sin240°=M_2 C_2= OC_1

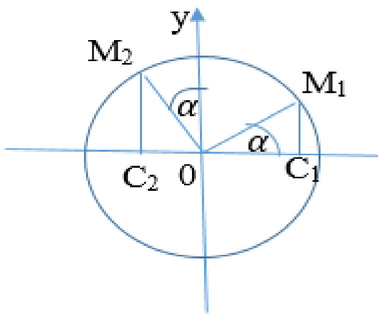
Also, since the leg opposite the 30 angle is equal to half of the hypotenuse Sin240°=$M_1C_1$=$\frac{1}{2}$, cos240°=$\sqrt{1-sin^2 240°}$ =$\sqrt{1-\frac{1}{4}}$=$\frac{\sqrt{3}}{2}$ originates.

In this way, using a sequence of logical arguments, the values of some other angle trigonometric functions can also be easily determined without a table:

| | | | |
|---|---|---|---|
| $\sin120° = \frac{\sqrt{3}}{2}$ | $\cos120° = -\frac{1}{2}$ | $\sin210° = -\frac{1}{2}$ | $\cos210° = -\frac{\sqrt{3}}{2}$ |
| $\sin135° = \frac{\sqrt{2}}{2}$ | $\cos135° = -\frac{\sqrt{2}}{2}$ | $\sin225° = -\frac{\sqrt{2}}{2}$ | $\cos225° = -\frac{\sqrt{2}}{2}$ |
| $\sin150° = \frac{1}{2}$ | $\cos150° = -\frac{\sqrt{3}}{2}$ | $\sin300° = -\frac{\sqrt{3}}{2}$ | $\cos300° = \frac{1}{2}$ |

$\sin315° = -\frac{\sqrt{2}}{2}$ $\cos315° = \frac{\sqrt{2}}{2}$

Another important topic is citation formulas. Similar to the above, these formulas can be easily based on the concept of a unit circle. We will give examples.




For example, $M_1OC_1$ and $M_2OC_2$ in Figure 4 comparing the triangles $\sin(90°+\alpha) = M_2C_2$, $M_2C_2 = \cos\alpha$ and according to these, $\sin(90°+\alpha) = \cos\alpha$ it can be deduced that

4-chizma

Also, $\cos(90°+\alpha) = OC_2$ and $OC_2 = M_1C_1$, from which $\cos(90°+\alpha) = -\sin\alpha$.

The following formulas are also defined in the same way:$\text{Sin}(180°+\alpha) = -\sin\alpha$, $\cos(180°+\alpha) = -\cos\alpha$.

$\text{Sin}(270°+\alpha) = -\cos\alpha$, $\cos(270°+\alpha) = \sin\alpha$.

$\text{Sin}(360°+\alpha) = \sin\alpha$, $\cos(360°+\alpha) = \cos\alpha$.

**References**

1. М. Р. Кубаев. К вопросу о воспитании математической культуры студентов. Сборник научно-методических статьей. Математика. Москва. Изд-во МПИ. 1989.
2. П. В. Стратилатов.“Тригонометрия”. Дополнительный материал к курсу геометрии 9, 10 классов. «Просвещение». М. 1967.
3. D. Роуа. Математическое открытие. Наука. М. 1970.
4. Р. Джуракулов, Р. Умаров. «Об обучении в преподавании: простота и доступность». Республика Беларусь, ГГАУ 2021-108-111. 2021.
5. Р. Джуракулов, Р. Умаров. «Преподавание - это искусство». Экономика и социум. Выпуск №11(90), 2021.

6. B. Qulmatova, D. Buranova. “Oliy ta’limda zamonaviy ta’lim texnologiyarini qo‘llashning afzalliklari”. Муғаллим ҳәм үзликсиз билимлендириў[3]. Nukus. 3/4-2022 жыл. ISSN 2181-7138. Илимий-методикалық журнал. 56-59 betlar.
7. B. Qulmatova. D. Buranova.“Ta’lim jarayonida elektron ta’lim va ananaviy ta’limning integratsiyasi”. NamDU ilmiy axborotnomasi. 2020, 2-son. 366-373 bet.