NON-STANDARD ISSUES ABOUT THE PROPERTIES OF THE DETERMINANT

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ABSTRACT

In this article, non-standard Olympic problems on determinants are given with development and methods of development, the article can be used by students of higher education institutions and high school students.

Keywords: *determinant, non-standard problem, minor, algebraic complement, property.*

INTRODUCTION

The science of algebra and number theory is an important part of higher mathematics, which is studied by students of all branches of higher mathematics with applications. Determinants are one of the main sections of algebra and number theory. Determinants are one of the main directions of computational mathematics, and we can find them in solving important problems of many fields such as computer technologies, information and communication technologies, biotechnology, economics. [1]

METHODS

The dictionary meaning of the word determinant is determinant, which characterizes a square matrix. That is, the number characterizing a square matrix is called the determinant of this matrix. The determinant has several remarkable properties. For example, if all elements of a row or column of the determinant consist of zeros, its value is equal to zero. Or, if two rows or two columns of the determinant are equal in alignment, its value is equal to zero. As a result of swapping any two rows or columns of the determinant, its sign changes, etc. Below we use similar properties to calculate nonstandard determinants. [2], [3], [4].

RESULTS

Matter. Solve the following equation.

$$\begin{vmatrix} 1 & 1 & 1 & \dots & 1 \\ 1 & 1-x & 1 & \dots & 1 \\ 1 & 1 & 2-x & \dots & 1 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 1 & 1 & 1 & n-x \end{vmatrix} = 0$$

Solving. According to the property of the determinant, if any 2 row (column) elements of the determinant are equal, the value of such determinant is equal to zero. If we consider the second element of the above determinant to be equal to 1, then according to the property of the determinant, its value is equal to zero. So $1-x=1$ $x=0$. On the other hand, if the element a_{33} of the determinant is equal to one, the value of the determinant is equal to zero: $2-x=1,\ x=1$. So, if the elements of the main diagonal of the given determinant are equal to 1, then the determinant is equal to zero. From this, $x=0,1,2,3,\dots n-1$.

Matter. Calculate the determinant.

$$\begin{vmatrix} a & 3 & 0 & 5 \\ 0 & b & 0 & 2 \\ 1 & 2 & c & 3 \\ 0 & 0 & 0 & d \end{vmatrix}$$

Solving. We spread the given determinant on the 2nd and 4th lines:

$$\begin{vmatrix} a & 3 & 0 & 5 \\ 0 & b & 0 & 2 \\ 1 & 2 & c & 3 \\ 0 & 0 & 0 & d \end{vmatrix} =$$

$$= \begin{vmatrix} 0 & b \\ 0 & 0 \end{vmatrix} \cdot (-1)^{2+4+1+2} \cdot \begin{vmatrix} 0 & 5 \\ c & 3 \end{vmatrix} + \begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix} \cdot (-1)^{2+4+1+3} \cdot \begin{vmatrix} 3 & 5 \\ 2 & 3 \end{vmatrix}$$

$$+ \begin{vmatrix} 0 & 2 \\ 0 & d \end{vmatrix} \cdot (-1)^{2+4+1+4} \cdot \begin{vmatrix} 3 & 0 \\ 2 & c \end{vmatrix} = 0+0+0=0$$

Metter. Prove the following equality.

$$\begin{vmatrix} 0 & x & y & z \\ x & 0 & z & y \\ y & z & 0 & x \\ z & y & x & 0 \end{vmatrix} = \begin{vmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & z^2 & y^2 \\ 1 & z^2 & 0 & x^2 \\ 1 & y^2 & x^2 & 0 \end{vmatrix}$$

Solving.

$$\begin{vmatrix} 0 & x & y & z \\ x & 0 & z & y \\ y & z & 0 & x \\ z & y & x & 0 \end{vmatrix} = xyz \begin{vmatrix} 0 & x & y & z \\ 1 & 0 & \frac{z}{x} & \frac{y}{x} \\ 1 & \frac{z}{y} & 0 & \frac{x}{y} \\ 1 & \frac{y}{z} & \frac{x}{z} & 0 \end{vmatrix} = (xyz)^2 \begin{vmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & \frac{z}{yx} & \frac{y}{xz} \\ 1 & \frac{z}{xy} & 0 & \frac{x}{yz} \\ 1 & \frac{y}{xz} & \frac{x}{yz} & 0 \end{vmatrix}$$

given that $xyz = 1$,

$$\begin{vmatrix} 0 & x & y & z \\ x & 0 & z & y \\ y & z & 0 & x \\ z & y & x & 0 \end{vmatrix} = \begin{vmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & z^2 & y^2 \\ 1 & z^2 & 0 & x^2 \\ 1 & y^2 & x^2 & 0 \end{vmatrix}$$

we will have.

CONCLUSION

When applying the properties of determinants in solving non-standard problems, the students' ability to apply the acquired knowledge in unfamiliar situations develops. This, in turn, has a significant positive effect on students' thinking abilities. So, as a result of teaching non-standard issues in class, the professor-teacher also develops students' visual thinking. [8], [9], [10].

LITERATURE

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