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НЕОПРЕДЕЛЕННЫЕ ВЫРАЖЕНИЯ И ГРАФИКИ

Аннотация: в статье рассматриваются новые системы координат на комплексной плоскости и уравнения фиксированных множеств точек (графиков). В разделе 2 исследуется уравнение для нового масштаба, позволяющее совместить два графика различных кривых (пример 4). Доказывается существование нового уравнения фиксированного множества точек в новых системах координат (теоремы 1, 2; примеры 1–3). В теореме 1 две различные переменные рассматриваются как один аргумент; в теореме 2 для комплексного поля получены два уравнения: регулярная функция и диагональное поле. Отмечается возможное применение к доказательству большой теоремы Ферма.

Ключевые слова: системы координат, теорема Ферма, комплексная плоскость, фиксированное множество точек, регулярная функция, диагональное поле, новый масштаб.

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INDEFINITE EXPRESSIONS AND GRAPHS

Abstract: new coordinate systems on the complex plane and equations of fixed sets of points (graphs) are considered. Section 2 examines the equation for a new scale, which allows consolidating two graphs of different curves (Example 4). The existence of a new equation of a fixed set of points in new coordinate systems is proved (Theorems 1, 2; Examples 1–3). Theorem 1 treats two different variables as one ar-

gument; Theorem 2 yields two equations for the complex field: a regular function and a diagonal field. Possible application to the proof of Fermat's Last Theorem is noted.

Keywords: complex plane, coordinate systems, fixed set of points, regular function, diagonal field, new scale, Fermat's theorem.

Introduction.

In the section 2 we consider the $y = x^n$ equation for a new scale too. From point of view of the new scale we obtain the full consolidation of two graphs of different curves on the plane (the example 4).

In different situations the existence of new equation of the fixed set of points (graph) is proved, if we consider a new systems of coordinates on the complex plane (the theorems 1,2 and the 1–3 examples in the introduction). We use the definitions: the $z = f(p)$, $z = h(r)$, $z = g(s)$ equations are the equations of the M set of points in the systems of co-ordinates with the $(0,0)$, $(A,0)$ and $(-A,0)$ centers of coordinates accordingly, the $z = f(p)$ function is regular for all $p \in G$ [1,2,3], where $M = \{(z, f(p)) : p \in G \cap z = f(p)\}$, $G = \{p : |p| < A_0\}$.

It is obvious,

$$z = g(s) = f(p - A)|_{p=s},$$

and

$$z = h(r) = f(p + A)|_{p=r}.$$

With different points of view as P so as p are the arguments for the $z = f(p + A)|_{p=r} = h(r)$ and $z = f(P) = h(r)$ equalities, $P = r + A$ as in the theorem 1 for the s argument. In main results of the article we consider the different equations with the same p argument in the primary system of coordinates, (the theorems 1,2, the 1–3 examples). In the obvious 1–3 examples we will illustrate the untraditional assertion [1,3].

First of all, $z = h(r) = f(p + A)|_{p=r}$ is as the new equation of the M set of points (graph) in the second system with the r variable so as the

$$M_{leftA} : z = f(P + A)|_{P=r}$$

equalities for all the same $z, p = P = r$ complex variables, where, by definition, the M_{leftA} set of points is the M set moved to the left on the A value, $p - A = r$ [1,2,3].

Example 1.

A both

$$z = f(p) = f((p + A) - A) \big|_{p=s} = g(s + A)$$

and

$$z = f(p) = f((p - A) + A) \big|_{p=r} = h(r - A)$$

equalities are not the M equalities, $(M : z = f(p))$; $z = g(s + A)$ is the M_{left} equality, $z = h(r - A)$ is the M_{right} equality, (in the «left» and the «right» system of coordinates); the M_{right} set of points is the M set moved to the right on the A value.

Example 2.

We can consider a two equalities: the $z = f(p)$ equation is the $z = f(s - A)$ equation, (we use $s = p + A \in G, p \in G$) in the «left» system of co-ordinates, $A > 0$; the $z = f(p)$ equation is the $z = h(r - A)$ equation with the same z and $r = p$, (we use

$$z = f(r) \big|_{r=p} = h(r - A)$$

for all $p = r$) in the «right» system of co-ordinates, $s = p + A, p = r$. We obtain $z = f(s) = h(r)$ for all the $r + A = s \in G, p = r$ values. The $z = f(s)$ is the M_{leftA} equalities, the $z = h(r)$ is the M equality with the $r + A = s$ association as in the «neighboring» systems with the $(-A, 0)$ and $(0, 0)$ centers of co-ordinates, (instead of $r + A = P$ - the argument in the primary system of coordinates), [3]. The examples (and the theorem 1) are the first interesting fact of the article.

Example 3.

The methods of the first theme (related to new co-ordinates in the first section) result in many other new surprising facts, for instance : the $z = g(A - s)$ and $z = f(-A - p)$ with the same $z = z_0$ is the result of reflection of the M set of points of the $f(p)$ function in relation to the $(-A/2, 0)$ points in the primary system of co-ordinates (with the p variable) and in the «left» system of co-ordinates with the $(-A, 0)$ center, (with the s variable and the $z = g(s)$ equation in the «left» system); (the

$(-A/2, 0)$ and $(-A, 0)$ coordinates we consider in the primary system with the $(0, 0)$ center); but the $z = f(-A - p)$ equation in the form

$$z = f(P - a) = g(P)|_{P=-s} = g(-s): z = g(-s)$$

(with the same $z = z_0$) is not equal to the $z = g(a - s)$ equation of the same reflection.

It is proved in the theorem 1, that a two different variables are possible to be considered as one argument in the primary system of coordinates on the complex plane for the $z = f(p)$ function [3].

The second interesting fact we can obtain for the complex $z = F_x(p) = F(p)$ x-field in the theorem 2 too, where, by definition,

$$F_x(x + iy) = f(-x + iy)$$

for all $p = x + iy$ complex variables, $p \in G$. In the theorem 2 instead of the OX axis we consider the iOX axis, and instead of the iOY axis we consider the OY axis; it is the second $K2$ system of coordinates for the fixed M set of points. For the fixed M set of points in the $K2$ system of coordinates we get the two different equations, (the theorem 2, [1,3]): the two

$$z \rightarrow x + iy: z = f(x + iy), p = x + iy,$$

$$z \rightarrow iy + x: z = f(ix + y)$$

(with the same z, x, y) representations corresponds to the M set of points in the same $K2$ system of coordinates; the first representation is the regular function, (the formula of the first representation in $K2$ system is proved in the theorem 2), the second representation is the x-field in relation to the $f(-ip)$ function, (the diagonal-field in the theorem 2).

1. New systems of coordinates.

Theorem 1.

As a result of the consideration of the s and r complex variables a two different the p variables $p = p_1$ and $p = p_2$ take place for the same

$$M = \{(z, f(p)): p \in G \bigcap z = f(p)\}$$

set of points in the primary system of coordinates, $p_1 - A = p_2 \in G$ for all $A > 0$,

$$p_1, p_2, p \in G, 7A < A_0.$$

Proof.

The

$$z = f(p - A)|_{p=s} = g(p)|_{p=s} = g(s)$$

equality takes place for all $p > A, p = s \in [A, 2A]$. In the equalities p is the first version of the variable for the $z = f(p)$ function in the primary system with the $(0,0)$ center for all the $p = p_1 > A$, [3]. But, by definition, the $z = g(s)$ equation of the M set is equivalent to the $z = f(p) = g(s)$ equation of the same M set of points in the new system of coordinates with the s variable, $s \in [A, 2A], A > 0$ (we use

$$z = g(s) = f(p)$$

always, if $s, p \in G$ with the same end of the s, p vectors). We obtain, that $p = p_2$ is the second version of the p argument in the primary system of coordinates, $p = p_2$, but $p_2 < A$, [3].

The theorem 1 is proved.

By definition, $F_x(p) = f(-x + iy)$ for all $p = x + iy$ complex variables, $p \in G$,

$$G = \{p : |p| < A_0\}, A_0 > 0,$$

[1,2]. The $z = F_x(p)$ function we will name the x-field in relation to $f(p)$ function, $p = x + iy$,

$$F_y(p) = f(x - iy)$$

we will name y-field in relation to $f(p)$ function, $p = x + iy$. The

$$z = F_{dia}(p) = f(y + ix) = u(y, x) + v(y, x)i$$

function we will name the diagonal-field in relation to the $z = f(p)$ function, $p = x + iy$, (diagonal-field relatively of the $x = y$ diagonal). For the function we get

$$z = F_{dia}(x + iy) = u(y, x) + v(y, x)i = f(y + ix),$$

$$F_{dia}(y + ix) = f(x + iy); x, y \in (-\infty, \infty), p = x + iy.$$

The M equation in the primary system of coordinates is as $z = f(x + iy), p \in G$, so as

$$z = F_{dia}(y + ix), y + ix \in G [1-3].$$

It is the equation of the $z \rightarrow x + iy$ representation in the primary system coordinates. It is obvious,

$$f(i(y + ix)) = f(-x + iy), y + ix \in G,$$

$$f(y + ix) = f(-i(-x + iy)), y + ix \in G,$$

and $F_{dia}(p)$ is x-field in relation to $f(-ip)$ function, we use

$$f(y + ix) = f(-i(-x + iy)), y + ix \in G.$$

Theorem 2.

In the K2 system of coordinates the M equations is x-field in relation to the regular function $z = f(-ip)$ in the K2 system of coordinates, and the same M set of points is possible to be considered as regular $z = f(p)$ function with point of view of other mathematical facts in the same K2 system.

Proof.

If instead of the OX axis we consider the iOX axis, and instead of the iOY axis we consider the OY axis, by definition, we obtain the second K2 system of coordinates. If on the coordinate axes in the primary system of coordinates we will change the x, y variables by places, by definition, we obtain the third K3 system of coordinates. The M set of points is fixed in all the system of coordinates, and the M equation in the K3 system of coordinates is

$$z = u(y, x) + v(y, x)i = f(y + ix) = F_{dia}(p),$$

$$z = f(x + iy) = u + iv,$$

$$p = x + iy \in G.$$

To obtain the M equation in the K2 system we can use the

$$f_0 : z_0 = z \rightarrow y + ix = (\cdot)p$$

representation in K2 system of coordinates, if $z_0 = z = f(x + iy)$, (the point $(\cdot)p = x + iy$ in the primary system of coordinates, and $(\cdot)p = ix + y$ in the K2 system of coordinates). We get, that the equation in the K2 system is

$$z = f_0(y + ix), (z = f_0(y + ix),$$

if and only if $z = f(x + iy)$ for all the $p = x + iy \in G$).

By definition,

$$z = f_0(y + ix) = F_{dia}(y + ix),$$

and

$$f_0 = F_{dia} : z_0 = z \rightarrow y + ix = (\cdot)p$$

representation in $K2$ system of coordinates is the diagonal-field in relation to the $z = f(p)$ function in the $K2$ system, (or the x -field in relation to the regular function $z = f(-ip)$ in the $K2$ system of coordinates, not in the primary system of coordinates) [1; 3].

We will prove the second fact of the theorem 2. The OY, iOX axes of $K2$ system are the result of rotation of the $K3$ system on the $\pi/2$ angle and the change of the new iOX direction on opposite. As result the M equations in the $K2$ systems is some regular function!? We use, that the M equation in the $K3$ system is the $z = f(y + ix)$ function (the diagonal-field), and

$$z = f(i(y + iX))|_{-x=X} = f(x + iy) = f(p)$$

in the $K2$ system of coordinates, [1; 3; 4].

2. Some indefinite graphs.

In the section we consider the $y = x^n$ equations for the new systems of coordinates with a new scale.

By definition, $L(n)$ is the $y = x^n$ graph in the primary system of coordinates with the $(0,0)$ center, and $L(\alpha, n)$ is the $y = x^n / \alpha^n$ graph in the primary system of coordinates with the $(0,0)$ center,

$$x, y, \alpha \in (-\infty, \infty), n \in 2, 3, \dots$$

The $L_{\alpha e}(\alpha, n), L_{\alpha e}(n)$ graphs are the same graphs, but on the plane with the new $E = \alpha e$ unit of scale; the e vector is the primary unit of scale: $\|e\|=1$ in the primary system of coordinates.

Example 4.

We can use the

$$y = x^n, \alpha y = \alpha x^n = (\alpha x)^n / \alpha^{n-1}$$

equality; the

$$\alpha y = (\alpha x)^n / \alpha^{n-1}$$

curve on the plane is the result of the both

$$L(\alpha, n) \supset (x, y) \rightarrow (\alpha x, \alpha y) \in L_{\alpha e}(\alpha, n),$$

$$\forall (x, y) \in L(\alpha, n),$$

$$L(n) \supset (x, y) \rightarrow (\alpha x, \alpha y) \in L_{\alpha e}(n),$$

$$\forall (x, y) \in L(n),$$

$$\alpha y = \alpha x^n = (\alpha x)^n / \alpha^{n-1}$$

representations. We use

$$Y = X^n / \alpha^{n-1}, (X, Y) = (\alpha x, \alpha y) \in L_{\alpha e}(\alpha, n)$$

in the first equality, and

$$y = x^n, (X, Y) = (\alpha x, \alpha y), (x, y) \in L(n)$$

in the second equality, (it is equivalent to $(X, Y) \in L_{\alpha e}(n)$ for all the same variables in the both equalities). We obtain the main expressions

$$L_{\alpha e}(\alpha, n) \equiv L_{\alpha e}(n),$$

where

$$L_{\alpha e}(\alpha, n): Y = X^n / \alpha^{n-1},$$

$$L_{\alpha e}(n): Y = X^n,$$

for all the

$$(X, Y) = (\alpha x, \alpha y)$$

variables, $(x, y) \in L(n)$.

3. Conclusion

Is of interest to consider the results of the 1–2 sections from point of axioms of geometry and applications to physics.

The results of the example 4, probably, it is possible to apply to proof of the large theorem Ferma (Fermat).

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