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Functional Image Analysis and Its Research of Application

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***Abstract*—The concept of function has existed for a long time in ancient times. At first, people studied functions, but calculated them repeatedly against the analytic formula of functions. Later, the famous French mathematician Descartes introduced the plane rectangular coordinate system, which consists of two number axes. The two axes are perpendicular to each other, the origin coincides and the unit length is equal. Traditionally, the number axis of lead is called y axis, the horizontal number axis is called X axis, the top of Y axis is in the positive direction, and the right of X axis is in the positive direction. From then on, every point on the plane can be represented by the coordinates of the plane rectangular coordinate system.**

Keywords—Function, Number, Coincides, Direction

I. Introduction

After the introduction of Cartesian coordinate system, it is found that Cartesian coordinate system uses ordered number pairs to represent points, and the two numbers of ordered number pairs can exactly be expressed by two variables in the function.[1] This is a great pioneer in the history of mathematics! Since then, people have known that functions can be transformed into graphics through coordinate system, so that they can be studied intuitively. [2] Number and form are the two foundations of mathematics. They have nothing to do with each other before. It is the emergence of coordinate system that transforms functions as numbers into images as shapes. Since then, mathematics has developed more vigorously. In calculus, the geometric meaning of derivative is the slope of tangent of a function's image at a point. How to define of functional image. [3]

II. Definition of Functional Image

For a function y=f(x), if the independent variable x is regarded as the abscissa of a point in the Cartesian coordinate system and the unique function value y is regarded as the ordinate of the point, then the function y=f(x), whatever the value of x, determines a point at the same time. Because the range of value of X is infinite, there are also infinite points of y, and there are infinite points of expression. The graph composed of these points on the plane is the image of this function, which is called image for short.[4]

III. Shape of Functional Image

Are these innumerable points irregular in the plane? The answer is No. In fact, there are many general categories of functions, and the images of the same function are similar intuitively. For example, the image of the first function f (x) = KX + B is a straight line; and the image of the positive proportion function f (x) = KX is a special first function, so the image of the positive proportion function is also special for the image of the first function, which is a straight line through the origin; the image of the second function is a parabola; the image of the inverse proportion function is a set of hyperbolas; and the image of the sinusoidal function is a set of hyperbolas. It's called a sinusoidal curve. It's actually what we call a wave line, and so on. Not all images of functions are straight lines or curves of infinite length. For some special functions, the image is a point, while for some functions which specify the range of independent variables, the image is a line segment. [5]

IV. Drawing of Function Image

We know that every point of a function in the coordinate system is regular. We know the basic shape of the image of a function, and we can easily make the image of the function. [6]

For example, for a positive proportional function, we only need to substitute an x value to get a Y value, then we can determine a point, which can be successfully linked with the point. Because the image of a positive proportional function is a straight line passing through the origin. [7]And a function needs to find one more point, and connect two points together, because the image of a function is a straight line, two points determine a straight line. [8]

Images of non-first-order functions are more troublesome because their images are curves. At this time, it is necessary to adopt the multi-point mapping method. As we have discussed before, the image of each function is the same intuitively. [9]For example, if we want to make an image of a quadratic function more precise, we will find 10 points, because the image of a quadratic function is a parabola, so we roughly connect it with a smooth curve according to the trajectory of the parabola. Roughly, you can find three points and connect them with a smooth curve. The shape is roughly in line with the parabola.

For some trigonometric functions, such as sinusoidal functions, five-point plotting method is often used, that is, to find five points, three intersections with the x-axis, one highest point and one lowest point, connected by a smooth curve. If the

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technique is skillful, the five-point plotting method is very accurate. Here we look at the steps of drawing general function images. The specific method is as follows: first, the rectangular coordinate system can be correctly drawn, the origin of the coordinate, x axis, y axis, unit length can be specified. [10]

Not every kind of functional relation can be expressed by algebraic expression. There are three ways to express functional relation.

Analytical Formula Method - Expressing Functional Relations with Mathematical Formulas.

Listing method - The corresponding relationship between function y and independent variable x is given by listing.

Image method: the independent variable x is taken as the abscissa of the point, and the corresponding function value y is taken as the ordinate of the point, in the rectangular coordinate. The system describes the corresponding points. The set of all these points is called the image of this function. The image is used to represent the corresponding relationship between function y and independent variable x.

Each of these three methods has its own advantages and disadvantages.

Express the function relation by analytic method. Advantages: concise and clear. From the analytic formula, we can clearly see all the dependencies between the two variables, and it is suitable for theoretical analysis and deduction calculation. Disadvantage: When calculating the corresponding value, more complicated calculation is needed.[11]

The list method is used to represent the functional relationship. Advantages: For each value of the independent variable in the table, the function value can be found directly without calculation, which is very convenient for query. Disadvantage: The table cannot list all independent variables and corresponding values of functions, and the corresponding rules between variables cannot be seen from the table.

Represent functional relations by image method. Advantages: Visual and intuitive. It can vividly reflect the changing trend and some properties of function relations, and visualize the abstract concept of function. However, it is often difficult to find the exact value of the corresponding function from the value of the independent variable in the function image. If we can find the specific function description, we can get the exact value. Each of the three basic representations of functions has its own advantages and disadvantages. Therefore, according to different problems and needs, we should flexibly adopt different methods in mathematics or other scientific research and application. Sometimes these three methods are combined. That is, we can list the tables of independent variables and corresponding function values from the known function analytic formula, and then draw its image. [12]

Reasonable and effective use of functional images to solve mathematical problems can simplify the problem, make it easy to solve, and multiply the effort with half the effort.

V. Application of Functional Image

For example, from the rise and fall of functions, we can see whether the independent variables of a function increase or decrease the value of a function in a certain range of values; for a binary system of equations, each equation can be regarded as a function, corresponding to an image, the intersection point of the image of these functions is the solution of the system of equations; we can see an equation as a function, from the intersection of its image and the number axis. For a graph composed of curves, it can be put into a rectangular coordinate system to solve the function analytic formula of these curves, and then the area of the graph can be calculated by calculus, which is impossible for elementary mathematics to do. [13] The functions mentioned above are only very rare. With the deepening of mathematical research, the applications of functions are more and more extensive, and it is necessary to study functions with images.

Application of Functional Image in Solving Physical Problems

In physical experiments, image analysis and data processing are required. The design intention of the image test questions has obviously changed from "focusing on obtaining information from images and analyzing state" to "focusing on understanding and processing of processes, judging, analyzing and evaluating images", "focusing on the analysis and conclusion of experimental data" and "focusing on logical reasoning, analysis and evaluation with the idea of combining numbers and figures".

VI. Summary

Function images can help solve mathematical problems and can also play an auxiliary teaching function for physics or other disciplines. The functional image has a clear description of the target layer of the number theory of square law teaching, and it has established a basic foundation for the establishment of a mathematical thinking theory of square theory. In practical applications, functional images can be used to solve practical problems.

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