

The definition of value in math

Unveiling the Enigma: Deciphering Value in Mathematics

From the intricate dance of fractions to the soaring heights of calculus, mathematics is a language of precise definitions and profound concepts. Central to this language is the idea of "value," a seemingly simple term yet brimming with layers of meaning. This delves into the multifaceted definition of value in mathematics, exploring its applications, limitations, and the broader implications it holds beyond the realm of numbers. **The Core Essence: Defining Mathematical Value** The concept of value in mathematics isn't monolithic. It depends heavily on the context. A value can represent a numerical quantity, a variable's assigned worth, a function's output at a specific input, or even the measure of a geometric figure. In essence, a value quantifies something, providing a measurable representation of a concept or attribute.

Numerical Values

These are the most straightforward values. They represent quantities using numbers (integers, decimals, fractions, etc.). Examples include the value of π (approximately 3.14159), the value of a variable 'x' in an equation, or the

price of an item. • *Example:* The value of $2 + 2 = 4$; the value of x in the equation $2x = 6$ is 3.

Functional Values

Functions assign values to inputs. The value of a function at a particular input is the output generated by that function when the input is substituted into its expression.

• **Example:** Consider the function $f(x) = x^2$. The value of $f(3)$ is 9 because substituting $x = 3$ into the equation results in $3^2 = 9$.

Geometric Values

In geometry, values represent measurements of shapes. These could be lengths, areas, volumes, angles, etc. •

Example: The value of the area of a circle with radius 5 units is calculated as $\pi * 5^2 = 25\pi$ square units. *Real-World*

Applications and Implications The concept of value permeates various facets of our lives. From financial transactions to scientific discoveries, the quantification and analysis of values are critical.

Value in Algebra and Equations

Solving for Unknowns

Algebraic equations often involve finding the value of an unknown variable. This process, involving manipulation

and simplification, is fundamentally about assigning a value to a placeholder. • *Example:* Solving $3x + 5 = 11$ for x involves isolating x , leading to the value $x = 2$. This process is crucial in countless practical applications.

Analyzing Relationships

Equations and inequalities reveal the relationships between variables. Finding the values of variables helps understand these relationships and their implications in real-world scenarios. • **Example:** The relationship between distance, speed, and time ($d = st$) dictates that if you travel at a constant speed of 60 mph for 3 hours, the distance (value) covered is 180 miles.

Value in Calculus and Beyond

Optimization Problems

Calculus allows us to find maximum and minimum values (extrema) of functions. These applications span from engineering (optimizing designs) to economics (maximizing profits). • *Example:* A company wants to maximize its profit (a value). Calculus provides the tools to find the production level that will result in the maximum profit.

Rate of Change and Accumulation

Calculus calculates the rate at which values change. This provides insights into trends and patterns in numerous fields like physics, economics, and medicine. • **Example:** Calculating the instantaneous velocity of a moving object involves determining the rate of change of its position. This has practical implications in physics.

Financial Modeling and Value

Stock Valuation

Calculating the value of a stock involves various methods, considering factors like earnings, growth prospects, and market trends. • **Example:** Using discounted cash flow models (DCF) in finance, one can determine the intrinsic value of a stock, aiding investment decisions. A chart showing different approaches to stock valuation can be beneficial here.

Investment Strategies

Investment decisions hinge on assessing the value of potential investments, balancing risks, and maximizing returns. • Example: The value of a portfolio is determined by the combined value of the assets it holds, and strategies for maximizing this value are continuously evolving.

Limitations and Considerations

While value is ubiquitous in mathematics, it's crucial to acknowledge its limitations: • **Context is crucial:** The same number can have different values depending on its context. • **Abstraction can be misleading:**

Mathematical values are often abstract and may not directly map to the complexities of real-world phenomena.

• **Interpretation is vital:** Extracting meaningful insights from values requires careful consideration of the surrounding conditions.

Conclusion The concept of value in mathematics is profoundly interconnected with various aspects of our lives, spanning from simple arithmetic to sophisticated mathematical models. Its versatility stems from the ability to quantify and analyze a vast array of concepts. This exploration has highlighted the significance of understanding context, relationships, and potential limitations in interpreting values. Recognizing its multifaceted nature empowers us to use mathematical tools effectively in solving complex problems across diverse fields.

Advanced FAQs 1. *How does the concept of value differ in discrete and continuous mathematics?* 2.

What is the role of units in defining the value of a quantity in physics? 3. **How are probabilities and**

expected values related, and what are their applications in decision-making? 4. How do mathematical values and

numerical quantities interrelate in graph theory and network analysis? 5. **Can value be assigned to**

qualitative attributes, and if so, how? (Note: Detailed answers to these questions could expand the significantly beyond the 2500-word target.)

The Elusive Definition of Value in Math: More Than Just a Number

When we hear the word "value" in everyday conversation, we often think of monetary worth, importance, or usefulness. But in the realm of mathematics, "value" takes on a much more precise and multifaceted meaning. It's not just about how much something is worth in dollars and cents; it's about what a particular symbol, expression, or function *represents* and what its specific numerical outcome or characteristic signifies within a given context. Understanding the definition of value in math is fundamental to grasping mathematical concepts, from basic arithmetic to advanced calculus. It's the bedrock upon which mathematical reasoning is built. So, let's dive deep into what "value" truly means in the world of numbers and symbols, exploring its various interpretations and its crucial role in problem-solving.

What Does "Value" Mean in Mathematics? A Foundational

Understanding

At its core, the definition of value in math refers to the **numerical or symbolic representation that a variable, expression, or function assumes.** Think of it as the answer, the result, or the specific quantity being described. When we solve an equation, we are often looking for the value of an unknown variable. When we evaluate a function, we're finding its value at a particular input. This might seem straightforward, but the context is key. The "value" of 'x' in the equation $x + 5 = 10$ is 5. The "value" of the expression $3 * (2 + 4)$ is 18. And the "value" of the function $f(x) = x^2$ when $x = 3$ is 9. It's important to distinguish between the **symbol** (like 'x' or 'f(x)') and its **value**. The symbol is a placeholder, a representation, while the value is the concrete numerical outcome.

The Many Faces of Value: Different Contexts, Different Meanings

While the fundamental definition remains consistent, the specific nature of "value" can shift depending on the mathematical domain. Let's explore some of these different facets:

1. The Value of a Variable: The Heart of Algebraic

Equations

In algebra, variables are symbols that represent unknown or changing quantities. The "value" of a variable is the specific number or quantity it represents at a given moment or in a particular solution. **Solving for a Variable:** When we solve equations like $2y - 3 = 7$, we are seeking the *value* of 'y' that makes the equation true. In this case, by adding 3 to both sides and then dividing by 2, we find that the value of 'y' is 5 . This is often referred to as the **solution set** of the equation, where each element in the set is a possible value for the variable. **Independent vs. Dependent Variables:** In functions, we often encounter independent and dependent variables. The *value* of the independent variable (often 'x') is chosen, and this choice dictates the *value* of the dependent variable (often 'y' or $f(x)$). For instance, in $y = 2x + 1$, if the value of 'x' is 3 , then the value of 'y' is $2(3) + 1 = 7$. The concept of **parameter** also plays a role here. Parameters are constants within an equation or function that can be changed to produce different results. Their "value" influences the outcome, but they are not the primary variable being solved for.

2. The Value of an Expression: Computing Numerical Outcomes

Mathematical expressions are combinations of numbers, variables, and operations. To find the "value" of an

expression means to perform the indicated operations and arrive at a single numerical result. This process is called **evaluating the expression**. **Order of Operations (PEMDAS/BODMAS):** To ensure consistency, we follow specific rules like PEMDAS (Parentheses, Exponents, Multiplication and Division from left to right, Addition and Subtraction from left to right) or BODMAS (Brackets, Orders, Division and Multiplication from left to right, Addition and Subtraction from left to right) to determine the correct order of calculations and thus the unique value of an expression. **Example:** Consider the expression $10 + 2 * (6 - 3)^2$. 1. Parentheses: $6 - 3 = 3$ 2. Exponents: $3^2 = 9$ 3. Multiplication: $2 * 9 = 18$ 4. Addition: $10 + 18 = 28$ The value of this expression is 28 .

3. The Value of a Function: Mapping Inputs to Outputs

Functions are powerful mathematical tools that describe relationships between sets of numbers. The "value" of a function at a specific input is the output that the function produces for that input. **Function Notation:** We use notation like $f(x)$ to represent a function named 'f' that takes an input 'x'. The expression $f(x)$ itself represents the **rule** of the function, and its "value" is the result of applying that rule to a specific input. **Domain and Range:** The set of all possible input values for a function is called its **domain**, and the set of all possible output

values is called its **range**. The "value" of a function is always an element of its range. **Example:** For the function $g(t) = 3t - 1$: * If the input value $t = 4$, then the function's value is $g(4) = 3(4) - 1 = 12 - 1 = 11$. * If the input value $t = -2$, then the function's value is $g(-2) = 3(-2) - 1 = -6 - 1 = -7$. Understanding the relationship between inputs and outputs is crucial for analyzing function behavior and their graphical representations.

4. The Value of a Mathematical Term: Individual Components

Sometimes, we refer to the "value" of individual terms within a larger expression or equation. For instance, in the expression $5x + 3y - 7$, the terms are $5x$, $3y$, and -7 . If we know the values of x and y , we can determine the numerical value of each term. * If $x = 2$ and $y = 4$, then the value of the term $5x$ is $5 * 2 = 10$, the value of the term $3y$ is $3 * 4 = 12$, and the value of the term -7 is simply -7 .

5. The Value of a Mathematical Statement: Truth or Falsehood

In logic and set theory, mathematical statements can have a "truth value." This value is either **true** or **false**. This is a more abstract interpretation of value but is fundamental to mathematical proof and reasoning. **Example:** The statement " $2 + 2 = 4$ " has a truth value of **true**. The statement " $5 > 7$ " has a truth value of

****false****.

Why is Understanding "Value" So Important in Math?

The concept of value permeates every level of mathematics. Without a clear grasp of what it means, progress can be significantly hindered. Here's why it's so critical:

- * **Problem Solving:** The ultimate goal of most mathematical problems is to find a specific value or a set of values. Whether you're solving for the unknown in an equation, calculating a measurement, or predicting an outcome, you're always working towards determining a value.
- * **Understanding Relationships:** Values help us understand the relationships between different mathematical entities. By analyzing how the value of one variable affects the value of another, we gain insights into how systems work.
- * **Building Complexity:** Simple values are the building blocks for more complex mathematical structures. From the value of a single digit to the value of an integral representing an area, each step builds upon the precise definition of value.
- * **Communication:** Using precise terminology, including "value," ensures clear communication among mathematicians and students. It avoids ambiguity and allows for efficient sharing of ideas.
- * **Applications in the Real World:** Mathematical values have direct applications in countless real-world scenarios. From

engineering calculations to financial modeling, from scientific research to everyday decision-making, the accurate determination of values is paramount. Think about determining the value of a stock, the value of a property, or the value of a statistical measure.

Common Pitfalls and Nuances Related to "Value"

While the definition of value seems straightforward, there are a few areas where students might encounter confusion:

- * **Ambiguity in Natural Language:** As mentioned earlier, "value" in everyday language is broad. In math, it's precise. It's essential to differentiate between subjective importance and objective numerical or symbolic representation.
- * **Undefined Values:** Not all mathematical expressions or operations result in a defined value. For example, division by zero is undefined. Similarly, certain functions might have restricted domains, meaning there are no defined values for specific inputs.
- * **The Difference Between a Variable and its Value:** It's crucial to remember that a variable is a placeholder, not the value itself. When we say "let $x = 5$," we are *assigning* a value to the variable 'x'.
- * **Units:** In applied mathematics and physics, the value often comes with units (e.g., 5 meters, 10 kilograms). The units are integral to the meaning of the value and should not be ignored.

Conclusion: The Enduring Significance of Value in Mathematics

The definition of value in math, while seemingly simple, is a cornerstone of the discipline. It's the concrete outcome of operations, the solution to problems, and the key to understanding relationships within mathematical systems. Whether we are evaluating an expression, solving for an unknown variable, or analyzing the output of a function, we are consistently working with and understanding the concept of value. This fundamental understanding empowers us to navigate the complexities of mathematics, from the simplest arithmetic to the most intricate theories. So, the next time you encounter a number, a symbol, or an equation, remember that you are looking at a representation that can hold a specific, crucial, and often powerful **value**. It's this precision and universality that makes the concept of value so enduringly significant in the world of mathematics and beyond. Understanding mathematical concepts like the ***value of an expression***, ***finding the value of x ***, and ***evaluating a function*** are all critical steps in developing mathematical fluency. This mastery allows us to unlock the potential of mathematics in solving real-world problems and advancing our understanding of the universe.

The Definition of Value in Mathematics: A Deep Dive into

Meaning and Meaningful Application In the world of mathematics, the concept of value extends far beyond simple numbers on a page. At its core, value represents a quantitative measure that expresses the amount, quantity, or significance of a mathematical entity within a given context. Whether dealing with real numbers, variables, functions, or abstract constructs, understanding value is essential to interpreting and solving mathematical problems with precision and purpose. Value in mathematics is not merely about what a number equals; it encompasses relationships, scales, and comparative significance. For instance, in arithmetic, value determines magnitude—how large or small a quantity is—but it also plays a foundational role in operations such as addition, subtraction, multiplication, and division. When we add two numbers, the result is not just a new number; it reflects the combined value of the original quantities, preserving their relative importance. Similarly, in algebra, variables carry values that shift dynamically, enabling equations to model real-world change and uncertainty. One of the key insights into the definition of value lies in its connection to measurement and representation. In geometry, value often corresponds to lengths, areas, or volumes—concrete interpretations that ground abstract symbols in physical reality. In calculus, value becomes a dynamic concept tied to limits, derivatives, and integrals, where it captures instantaneous change or accumulated magnitude. This evolution of value—from static measurement to evolving

function—highlights its centrality in both theoretical exploration and practical application. The applications of mathematical value are vast and deeply interwoven into modern life. In science and engineering, precise value calculations ensure the reliability of models, from predicting structural loads to simulating fluid dynamics. In finance, value determines interest rates, investment returns, and risk assessments, shaping economic decisions across global markets. Even in data science, value underpins statistical analysis, where measures like mean, median, and variance assign meaningful positions to data points, transforming raw numbers into actionable intelligence. Beyond utility, the benefits of a clear understanding of value in mathematics are profound. It fosters logical reasoning, enabling problem-solvers to make informed comparisons, evaluate trade-offs, and optimize outcomes. It strengthens analytical rigor, allowing for accurate interpretations of complex systems. Moreover, it bridges abstract theory with real-world application, making mathematics not just a discipline of symbols, but a powerful language for understanding and shaping reality. Looking to the future, the role of value in mathematics continues to expand. As artificial intelligence and machine learning grow, the precise definition and manipulation of value will drive more sophisticated predictive models and autonomous decision-making systems. In education, evolving pedagogical approaches emphasize conceptual mastery of value, helping learners

build deeper intuition and adaptability. Meanwhile, interdisciplinary research increasingly relies on sophisticated value frameworks—from quantum mechanics to behavioral economics—underscoring its enduring importance as a fundamental pillar of quantitative reasoning. Ultimately, value in mathematics is more than a numerical attribute; it is the cornerstone of meaning, measurement, and insight. By grasping its definition and significance, we unlock the full potential of mathematical thinking to explain, predict, and innovate across every domain of human knowledge.

The Elusive Essence: Unpacking the Definition of Value in Mathematics

In the vast and intricate landscape of mathematics, the concept of "value" appears ubiquitous. We encounter it when solving equations, analyzing functions, and interpreting data. Yet, pinning down a singular, universally applicable definition of "value" proves surprisingly nuanced. It's not merely a number; it's a descriptor, a measure, a result that signifies something particular within a given mathematical context. This article delves into the multifaceted nature of value in mathematics, exploring its diverse interpretations and the underlying principles that govern its meaning.

Understanding value is fundamental to grasping mathematical operations and their applications. From the simple assignment of a numerical quantity to a variable to the complex evaluation of a limit, the idea of "what something is worth" or "what it represents" is at the core of mathematical inquiry. This exploration will touch upon how value is determined, how it changes, and its crucial role in problem-solving and theoretical development.

Value as a Numerical Quantity: The Cornerstone

At its most basic level, value in mathematics often refers to a specific numerical quantity. When we say the value of 'x' is 5, we are assigning a definite number to a variable. This is the foundation of arithmetic and algebra. For instance, in the equation $2x + 3 = 11$, the value of 'x' that satisfies this equation is 4. Here, the value is the solution, the numerical outcome that makes the statement true.

This numerical interpretation extends to measurement. When we measure the length of a table, the value we obtain (e.g., 1.5 meters) represents a specific quantity of distance. Similarly, in statistics, the value of a data point might be the score achieved by a student, or the temperature recorded on a particular day. These values are concrete representations of real-world quantities that can be manipulated and analyzed mathematically.

The concept of **assigning values** is central to how we model the world. Whether we're dealing with discrete values in counting or continuous values in measurement, the assignment of a numerical representation is the first step in mathematical analysis.

The Dynamic Nature of Value: Functions and Variables

While a constant has a fixed value, the true power of mathematics lies in exploring how values can change. This is where the concept of functions becomes paramount. A function can be thought of as a rule that assigns an output value to each input value. For example, the function $f(x) = x^2$ takes an input value 'x' and produces an output value that is the square of 'x'. If the input value is 3, the output value is 9. If the input value is -2, the output value is 4.

In this context, the "value" of the function depends on the "value" of its input variable. This dynamic relationship is crucial for understanding trends, rates of change, and predictions. Calculus, for instance, is heavily concerned with how the value of a function changes as its input values change, leading to concepts like derivatives and integrals. The **rate of change of a function** is a prime example of how value isn't static but can be described by its behavior.

The set of all possible input values a function can accept is

known as its **domain**, while the set of all possible output values is its **range**. Understanding these sets helps us define the boundaries within which a function's value is meaningful.

Value in Equations: Solutions and Roots

In algebra, finding the "value" of a variable often means solving an equation. The solution to an equation is the specific value (or set of values) that, when substituted for the variable(s), makes the equation a true statement. For linear equations like $3y - 7 = 8$, the value of 'y' that satisfies it is 5. For quadratic equations like $x^2 - 4 = 0$, there are two values of 'x' that work: 2 and -2. These are also referred to as the **roots** or **zeros** of the equation.

Beyond simple equations, we encounter value in more complex mathematical structures. In systems of linear equations, the "value" refers to the unique set of numbers that satisfies all equations simultaneously. In differential equations, the "value" might be a function itself that, when its derivatives are taken and plugged into the equation, makes the equation hold true. This broadens the definition of value beyond single numbers to encompass functions and other mathematical objects.

The process of **solving for a variable** is inherently

about determining its specific value within a given constraint.

The Value of Expressions and Terms

An algebraic expression is a combination of variables, numbers, and mathematical operations. The "value" of an expression is determined by substituting specific numerical values for its variables and then performing the indicated operations. For example, the value of the expression $2a + b$ when $a=3$ and $b=5$ is $(2 * 3) + 5 = 6 + 5 = 11$.

In polynomial expressions, each individual term also has a value. A term might consist of a coefficient and a variable raised to a power (e.g., $5x^2$). When specific values are assigned to the variables, each term can be evaluated, and these term values contribute to the overall value of the expression. This concept is fundamental in understanding polynomial behavior and their graphical representations.

Understanding the **evaluation of expressions** is a prerequisite for more advanced algebraic manipulation and analysis.

Value in Limits: Approaching Infinity

and Infinitesimals

In calculus, the concept of value takes on a more dynamic and often abstract interpretation when dealing with limits. A limit describes the value that a function "approaches" as the input approaches some value. This is particularly useful when the function is undefined at that specific input value. For instance, the limit of $(x^2 - 1) / (x - 1)$ as x approaches 1 is 2. Even though plugging in $x=1$ results in division by zero, the function's values get arbitrarily close to 2 as x gets arbitrarily close to 1.

Here, "value" isn't about a direct substitution but rather about the behavior and trend of the function's output. This concept is crucial for defining continuity, derivatives, and integrals. The **limit of a sequence** is another instance where we examine the value a sequence approaches as the number of terms increases indefinitely.

The idea of an **infinitesimal** – a value that is arbitrarily close to zero but not zero itself – also plays a role in understanding limits and their associated values.

Value in Geometry and Trigonometry

In geometry, value often relates to measurements of geometric objects. The value of the area of a circle is πr^2 , representing the space enclosed by the circle. The value of the perimeter of a rectangle is $2(l + w)$, representing the total length of its sides. These values provide

quantitative descriptions of geometric figures.

Trigonometry assigns values to angles through trigonometric functions like sine, cosine, and tangent. For example, $\sin(30^\circ)$ has a specific value, 0.5. These values are ratios of sides in right-angled triangles and have wide-ranging applications in physics, engineering, and navigation. The **value of an angle** is fundamental to understanding its orientation and relationships with other geometric elements.

The Pythagorean theorem, $a^2 + b^2 = c^2$, relates the values of the sides of a right triangle, allowing us to calculate the value of one side if the other two are known.

Value in Abstract Mathematics: Sets, Vectors, and Matrices

As mathematics progresses to more abstract domains, the notion of "value" evolves. In set theory, the "value" can refer to the elements within a set or properties of the set itself, such as its cardinality (the number of elements). A set $\{1, 2, 3\}$ has elements whose individual values are 1, 2, and 3, and its cardinality is 3.

In linear algebra, vectors and matrices are fundamental objects. A vector can be represented by a list of numbers, and its "value" can be interpreted as a point in space or a direction and magnitude. A matrix, a rectangular array of numbers, can represent transformations, systems of

equations, or data. The "value" of a matrix might be its determinant, which provides information about its invertibility and the scaling effect of the transformation it represents. The **eigenvalues and eigenvectors** of a matrix are specific values and vectors that reveal fundamental properties of the linear transformation represented by the matrix.

The **rank of a matrix** is another example of a numerical value that describes a crucial characteristic of the matrix itself.

The Importance of Context: Defining Value by Its Use

Ultimately, the definition of "value" in mathematics is heavily dependent on its context. What constitutes a "value" in an arithmetic problem differs from what constitutes a "value" in a calculus problem or a linear algebra problem. The underlying theme, however, is always about assigning a meaningful quantity, a result of an operation, or a descriptor that allows for further analysis and understanding.

Whether it's a single number, a function, a set of solutions, or a property of an abstract object, the "value" is what allows us to quantify, compare, and manipulate mathematical entities. The pursuit of understanding these values drives mathematical exploration and its application

to solve real-world challenges. Therefore, rather than a single rigid definition, value in mathematics is a flexible concept defined by its utility and significance within a specific mathematical framework.

The ability to discern and interpret value in various mathematical contexts is a hallmark of mathematical proficiency and is essential for building a strong foundation in STEM fields.

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And in that steady rhythm—open, pause,
return—knowledge finds its place naturally.

Questions & Answers About the definition of value in math

No	Question	Answer
1	What's the simplest way to think about 'value' in math?	Think of value as the 'number' or 'quantity' a symbol represents. For example, in ' $x + 5 = 10$ ', the value of ' x ' is 5 because 5 is the number that makes the equation true.
2	How is the concept of 'value' used in algebra?	In algebra, value refers to the specific number that a variable can be substituted for to satisfy an equation or expression. Finding the value of a variable is a common goal in solving algebraic problems.
3	Does 'value' always mean a positive number in math?	No, value can be positive, negative, or zero. For instance, the value of -3 is a negative number, and the value of 0 is zero.
4	What's the difference between a 'variable' and its 'value'?	A variable is a symbol (like ' x ' or ' y ') that can represent different values. The value is the specific number that the variable represents at a given time or in a particular context.

5	How do we determine the 'value' of an expression like ' $3 * (4 + 2)$ '?	We calculate the value by following the order of operations (PEMDAS/BODMAS). First, calculate inside the parentheses: $4 + 2 = 6$. Then, multiply: $3 * 6 = 18$. So, the value of the expression is 18.
6	Can 'value' be something other than a number?	In most standard mathematical contexts, 'value' refers to a numerical quantity. However, in advanced mathematics, concepts like 'truth value' in logic (true/false) or 'eigenvalue' in linear algebra extend the idea, but they still represent a specific state or property.
7	Why is finding the 'value' important in problem-solving?	Finding the value allows us to get a concrete answer, check if a solution is correct, and understand the outcome of a mathematical situation. It's the end result of calculations or solving for unknowns.
8	What does 'absolute value' mean, and how does it relate to the general concept of value?	Absolute value represents the distance of a number from zero on the number line, always resulting in a non-negative value. For example, the absolute value of -5 is 5 (written as $ -5 = 5$), and the absolute value of 5 is also 5 ($ 5 = 5$). It focuses on magnitude rather than direction.

value in mathematics definition, mathematical concept of value, definition of value in algebra, mathematics value

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