ENGLISH MATTERS
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IT ALL ADDS UP:

MATHEMATICAL LANGUAGE

DODATEK

ENGLISH MATTERS

It All Adds Up: Mathematical Language

Mathematics, often referred to as the language of the universe, is a field rich with its own terms, expressions, and even slang. Whether you consider yourself to be mathematically minded, or not, this booklet looks at mathematical language in detail, providing insights into the terms and expressions that form the backbone of mathematical communication.

From the basic building blocks of numbers and operations to specific concepts like geometry and probability, we'll cover the language that mathematicians, students, and enthusiasts use to describe the abstract and concrete phenomena of our world.

it all adds up | to wszystko ma sens
whether | czy
insight into sth | wgląd w coś
backbone | *tu:* podstawa
to cover sth | *tu:* omówić coś
phenomenon | zjawisko

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Basic Arithmetics

Let's start with the basics.

Arithmetic is the branch of mathematics that deals with numbers and the basic operations applied to them: addition, subtraction, multiplication, and division. It also includes the study of more complex concepts like fractions, decimals, primes, and percentages.

to deal with sth | zajmować się czymś
addition | dodawanie
substraction | odejmowanie
multiplication | mnożenie
division | dzielenie
to include sth | obejmować coś
fractions | ułamki
decimals | ułamki dziesiętne
primes | liczby pierwsze

Addition (+)

Addition is the process of combining two or more numbers to get a total sum.

- Example: 2 + 3 = 5 (Two plus three equals five)

Subtraction (-)

Subtraction is the operation of taking one number away from another to get the difference.

- Example: 5 - 2 = 3 (Five minus two equals three)

Multiplication (×or *)

Multiplication is the process of adding a number to itself a certain number of times.

- Example: 4 × 2 = 8 (Four times two equals eight)

Division (÷)

Division is the operation of splitting a number into equal parts or groups.

- Terms: Dividend, Divisor, Quotient
- Operation: Divided by
- Symbol: ÷ or /
- Example: 8 ÷ 2 = 4 (Eight divided by two equals four)

to equal | równać się
dividend | dzielna, liczba, która jest dzielona w działaniu matematycznym
divisor | dzielnik, liczba, przez którą dzielimy w działaniu matematycznym
quotient | iloraz, wynik dzielenia

Fractions

Fractions represent parts of a whole. They consist of a numerator (top number) and a denominator (bottom number).

- Term: Fraction, Numerator, Denominator
- Example: 1/2 (One half)

Decimals

Decimals are numbers that have a decimal point to represent a fraction of a whole.

- Term: Decimal, Decimal Point
- Example: 0.5 (Zero point five)

Primes

Prime numbers are numbers greater than 1 that have no divisors other than 1 and themselves.

- Example: 2, 3, 5, 7 (Two, three, five, seven)

Percentages

Percentages are a way of expressing a number as a fraction of 100.

- Term: Percent
- Symbol: %
- Example: 50% (Fifty percent)

Square

The square of a number is the result of multiplying that number by itself.

- Term: Square
- Operation: Squaring
- Symbol: ^{2}
- Example: $4^2 = 16$ (Four squared equals sixteen)

Square Root

The square root of a number is a value that, when multiplied by itself, gives the original number. It is essentially the opposite operation of squaring.

- Term: Square Root
- Operation: Finding the square root
- Symbol: √ (radical)
- Example: √16 = 4 (The square root of sixteen is four)

denominator | mianownik (w matematyce)
decimal point | kropka dziesiętna, przecinek w ułamku dziesiętnym
divisor | dzielnik
square | kwadrat (liczby)
to multiply the number by itself | przemnożyć liczbę przez nią samą
square root | pierwiastek kwadratowy

Basic Algebra

Ah, Algebra. Doesn't everybody love algebra?

Algebra is a branch of mathematics that uses symbols, typically letters, to represent numbers in equations and formulas. It allows us to generalise arithmetic operations and to work with unknown values, called variables.

equation | równanie matematyczne
to allow sb to do sth | pozwalać komuś na z/robienie czegoś
variable | zmienna

Variable

A variable is a symbol, usually a letter, that stands for a number that is not yet known or that can change. In algebra, variables are used to create general expressions that can be solved for specific values.

- Example: In the equation $x+2=5$,
- x is the variable.

Coefficient

A coefficient is a number that is multiplied by a variable in an algebraic expression. It represents how many times to use the variable in a multiplication.

- Example: In the term $3x$
- 3 is the coefficient, indicating that
- x is to be multiplied by 3.

Constant

A constant is a fixed value that does not change. In algebra, constants are numbers on their own, without any variables attached to them.

- Example: In the expression $x+4$
- $x+4$, 4 is the constant.

Expression

An algebraic expression is a mathematical phrase that can include numbers, variables, and operation symbols. It does not have an equal sign, so it does not express a complete thought like an equation does:

- Example:
- $2x+3$ is an algebraic expression.

Equation

An equation is a statement that two expressions are equal, indicated by the equal sign (=). Solving an equation means finding the value of the variable that makes the statement true.

- Example:
- $x-1=7$ is an equation.

Term

A term is a single mathematical expression that can be a number, a variable, or numbers and variables multiplied together. Terms are separated by addition (+) or subtraction (-) signs in an expression.

- Example: In the expression $4x+5$
- $4x$ and 5 are both terms.

Polynomial

A polynomial is an expression that consists of multiple terms. It can be as simple as a monomial (one term), a binomial (two terms), or a trinomial (three terms), or it can have many terms.

- Example:
- $x2+3x+2$ is a polynomial.

Factor

To factor an expression means to write it as a product of its factors. Factors are numbers or expressions that are multiplied together to get the original expression.

- Example: Factoring $x2-9$ would give $(x+3)(x - 3)$

Solution

The solution to an equation is the value of the variable that makes the equation true. It is the result of solving the equation.

- Example: The solution to $x+3=10$ is $x=7$

Inequality

An inequality is like an equation, but instead of an equal sign, it uses inequality symbols to show that one expression is greater than (>), less than (<), greater than or equal to (≥), or less than or equal to (≤) another.

- Example: $x+5>10$ is an inequality.

to stand for sth | oznaczać coś
solved | rozwiązany
coefficient | współczynnik
constant | stała
fixed value | ustalona wartość
without sth | bez czegoś
attached to sth | związany z czymś
term | termin
polynomial | wielomian, funkcja matematyczna
monomial | jednomian
binomial | dwumian
trinomial | trójmian, suma trzech jednomianów
factor | czynnik
inequality | nierówność
instead of sth | zamiast czegoś

Charts and Graphs

Charts and graphs are essential tools for visualising data, making complex information easier to understand at a glance. They are used across various fields, from business and economics to science and education, to communicate trends, patterns and relationships within data sets.

chart | wykres
at a glance | na pierwszy rzut oka
pattern | wzorzec
within data sets | w obrębie zbiorów danych

Types of Charts and Graphs

1. Line Graphs

   Line graphs are used to display data points over a continuous interval or time span. They are particularly useful for showing trends in data at equal intervals, such as months, years, or decades. In a line graph, data points are plotted and connected by straight lines, making it easy to see whether the data is increasing, decreasing, or remaining constant over time.

2. Bar Charts

   Bar charts are used to compare different groups or to track changes over time. They consist of rectangular bars, where the length of the bar represents the value of the data. Bar charts can be oriented horizontally or vertically and are particularly useful for comparing data across categories.

3. Pie Charts

   Pie charts are circular charts divided into sectors or 'slices,' where each slice represents a proportion of the whole. They are best used when you want to show the relative sizes of parts to the whole, such as the percentage distribution of data across different categories.

4. Histograms

   Histograms are similar to bar charts but are used specifically for showing the frequency distribution of numerical data. They help identify the central tendency, dispersion and shape of the data's distribution. Unlike bar charts, the bars in a histogram touch each other, indicating the continuous nature of the data.

5. Scatter Plots

   Scatter plots typically display values for two variables for a set of data. The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis. Scatter plots are used to observe relationships between variables.

line graph | wykres liniowy
to display sth | pokazać coś
at equal intervals | w równych przedziałach (np. czasu)
plotted | nakreślony
connected by sth | połączony czymś
to increase | wzrastać
to descrease | maleć
to remain constant | pozostać na stałym poziomie
bar chart | wykres słupkowy
to compare sth | porównać coś
rectangular | prostokątny
vertically | pionowo
pie chart | diagram kołowy
divided into sth | podzielony na coś
slice | plasterek, kawałek
histogram | histogram
numerical data | dane numeryczne, liczbowe
dispersion | rozproszenie
unlike X | inaczej niż X
scatter plot | wykres punktowy (rozrzutu)
axis | oś
vertical | pionowy

Interpreting Charts and Graphs

To effectively interpret charts and graphs, consider the following steps:

- **Identify the Type of Chart or Graph**: Recognising the type of chart or graph is the first step in understanding the data presented.
- **Understand the Axes**: Look at the x-axis (horizontal) and y-axis (vertical) to understand what variables are being measured.
- **Read the Title and Labels**: The title provides context about the data, while labels on the axes and legends explain what the variables and symbols represent.
- **Analyse the Data**: Look for trends, patterns or outliers in the data. For example, in a line graph, is there an upward or downward trend? In a pie chart, which category is the largest or smallest?
- **Draw Conclusions:** Based on your analysis, what conclusions can you draw from the data? Remember, charts and graphs summarise data, but interpretation depends on the context.

to recognise sth | rozpoznać coś
measured | z/mierzony
label | etykieta
to look for sth | szukać czegoś
outlier | liczba która jest najniższa lub najwyższa spośród liczb w danym zbiorze
upward | zwyżkujący
to depend on sth | zależeć od czegoś

Geometry and Measurement

Geometry and measurement are fundamental branches of mathematics that deal with the properties and relations of points, lines, angles, surfaces, and solids. Geometrists explore the shapes and sizes of different objects, understand their positions in space and learn how to measure them accurately.

properties | właściwości
angle | kąt
surface | powierzchnia
solid | *tu:* bryła

Basic Geometric Shapes and Definitions

- Point: A location in space without size or dimension.
- Line: A collection of points extending infinitely in two directions. It has length but no thickness.
- Plane: A flat surface that extends infinitely in all directions, with length and width but no thickness.
- Angle: Formed by two rays (the sides of the angle) sharing a common endpoint (the vertex). Angles are measured in degrees.

Types of Angles

- Acute Angle: An angle less than 90 degrees.
- Right Angle: An angle of exactly 90 degrees.
- Obtuse Angle: An angle greater than 90 degrees but less than 180 degrees.
- Straight Angle: An angle of exactly 180 degrees.

Polygons

Polygons are closed figures with three or more straight sides. Based on the number of sides, polygons have specific names:

- Triangle: A three-sided polygon.
- Quadrilateral: A four-sided polygon, with subtypes including squares, rectangles, and parallelograms.
- Pentagon: A five-sided polygon.
- Hexagon: A six-sided polygon.
- Heptagon: A seven-sided polygon.
- Octagon: An eight-sided polygon.

Circles

A circle is a shape consisting of all points in a plane that are a given distance from a centre point. Key terms related to circles include:

- Radius: A line segment from the centre of the circle to any point on the circle.
- Diameter: A line segment that passes through the centre of the circle, connecting two points on the circle. The diameter is twice the length of the radius.
- Circumference: The perimeter or boundary line of a circle.
- Area: The space enclosed by the circle's circumference.

to extend | wydłużać się
infinitely | w nieskończoność
thickness | grubość
width | szerokość
ray | promień
vertex | wierzchołek
to be measured in degrees | być mierzonym w stopniach
acute angle | kąt ostry
right angle | kąt prosty
obtuse angle | kąt rozwarty
straight angle | kąt półpełny
polygon | wielobok, wielokąt
triangle | trójkąt
quadrilateral | czworokąt
pentagon | pięciokąt
hexagon | sześciokąt
heptagon | siedmiokąt
octagon | ośmiokąt
radius | promień
diameter | średnica
circumference | obwód
area | obszar

Measurement in Geometry

Measurement in geometry involves determining the length, area, and volume of various shapes and objects.

Length

- Measured in units such as millimetres (mm), centimetres (cm), metres (m), and kilometres (km) or inches (in), feet (ft), and miles (mi).
- Perimeter: The total length of the boundary of a polygon.

Area

- The amount of space enclosed within a shape.
- Measured in square units, such as square centimetres (cm^2), square meters (m^2), or square kilometres (km^2).

Volume

- The amount of space occupied by a three-dimensional object.
- Measured in cubic units, such as cubic centimetres (cm^3), cubic metres (m^3), or litres (L)

Geometric Transformations

- Translation: Moving a shape without rotating or flipping it.
- Rotation: Turning a shape around a fixed point.
- Reflection: Flipping a shape over a line to produce a mirror image.
- Scaling: Increasing or decreasing the size of a shape while maintaining its proportions.

inch | cal
feet | stopa
boundary | granica
amount | ilość
enclosed within a shape | ograniczony kształtem
square unit | jednostka kwadratowa
three-dimensional | trójwymiarowy
cubic unit | jednostka kubiczna
to flip sth | przerzucać, przewracać coś

Basic Probability and Statistics

Probability and statistics are branches of mathematics that help us understand and interpret data. While probability deals with predicting the likelihood of future events, statistics involves the analysis of the frequency of past events. Both are important for making decisions based on data.

to predict sth | przewidywać coś
likelihood | prawdopodobieństwo

Mean, Median and Mode

- Mean (Average)

  The mean, often referred to as the average, is one of the most commonly used measures to summarise data. To calculate the mean, you add up all the numbers in a set of data and then divide by the count of numbers.

  For example, in the data set 2, 3, 5, 7 and 11, you add those numbers together to get 28, then divide by 5 (because there are five numbers in the data set). The mean is therefore: 5.6

- Median

  The median is the middle value in a data set that has been arranged in ascending order. If there is an even number of observations, the median is the average of the two middle numbers.

  Finding the Median:

  1. Arrange the data in ascending order.
  2. If the number of observations is odd, the median is the middle number.
  3. If the number of observations is even, the median is the average of the two middle numbers.

  Examples:

  1. For the data set 1, 3, 3, 6, 7, 8, 9, the median is 6.
  2. For the data set 1, 2, 3, 4, the median is 2 + 3 / 2 = 2.5

- Mode

  The mode is the value that appears most frequently in a data set. A data set may have one mode, more than one mode, or no mode at all if no number repeats.

  Examples:

  1. For the data set 1, 2, 2, 3, 4, the mode is 2.
  2. For the data set 1, 1, 2, 3, 3, 4, 4, there are three modes: 1, 3, and 4.

mean | *tu:* średnia
median | mediana, wartość pośrednia
mode | *tu:* dominanta, wartość modalna
therefore | dlatego
in ascending order | rosnąco
to appear | pojawiać się

Basic Probability Concepts

Probability measures the likelihood of an event to occur. It is calculated by dividing the number of favourable outcomes by the total number of possible outcomes.

Formula:

Formula:

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$P(H) = \frac{1}{2}$$

Example:

When flipping a coin, the probability of getting heads (H) is

because there are 2 possible outcomes (heads or tails), and only one of them is favourable (heads).

favourable | sprzyjający
outcome | wynik, rezultat
to flip a coin | rzucać monetą
heads | orzeł, awers monety
tails | reszka, rewers monety

Data Analysis

Variance and standard deviation are two important ideas in statistics that help us understand how spread out or close together data points are in a set.

Imagine you're looking at the scores of a class on a test. These concepts can tell us if all students scored similarly (close together) or if their scores were all over the place (spread out).

Variance tells us on average how much each score differs from the average score of the whole class. If variance is high, it means students' scores were very different from each other. If it's low, most students scored around the same.

To find variance, we:

- Calculate the average score of the class.
- See how far away each student's score is from this average, square these differences (which makes them positive), and then find the average of these squared differences.

Standard Deviation is just the square root of the variance. It also tells us how spread out the scores are, but in the same units as the scores themselves. So, if the standard deviation is small, it means most students scored around the class average. If it's large, the scores are more spread out.

To get the standard deviation, we simply take the square root of the variance.

These two measures help us understand the consistency and reliability of data. For example, in a company, they can show if sales are steady or fluctuate a lot.

variance and standard deviation | wariancja i standardowe odchylenie
to spread out | rozkładać się
to close together | być blisko siebie
scores | punktacja
to differ from sth | różnić się od czegoś
consistency | *tu:* spójność, zgodność
reliability | *tu:* rzetelność
to fluctuate | wahać się, zmieniać się