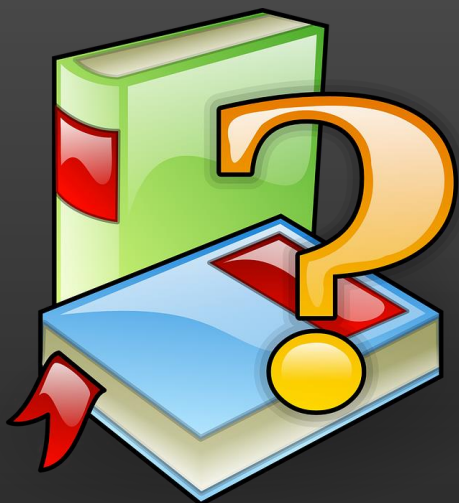


Potęga technologii internetowych w nauczaniu matematyki po angielsku

Iwona Mokwa-Tarnowska



Jakie technologie połączyć?

Tekst

Dźwięk

Obraz

Film

Animacja



Jakie materiały dydaktyczne?

- Moduły e-learningowe
- Filmy edukacyjne
- Interaktywne prezentacje
- Interaktywne podręczniki
- Gry edukacyjne
- Rozszerzona rzeczywistość
- Wirtualne laboratoria

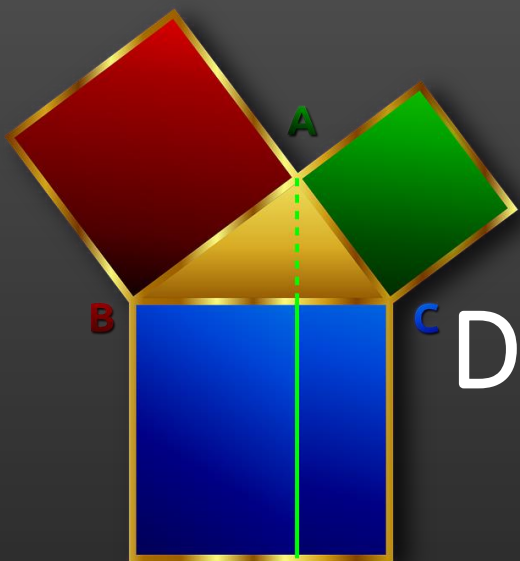


Jaka koncepcja metodyczna?

Konstruktywizm

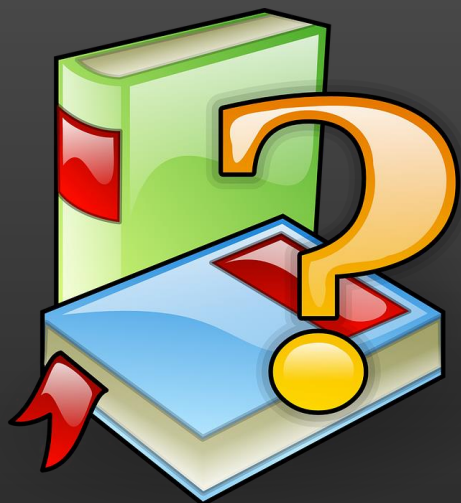
- Nacisk na zindywidualizowane podejście do uczącego się i na jego autonomię.
- Wprowadzenie indywidualnych ścieżek edukacyjnych.
- Zdobywanie umiejętności, które pozwolą samodzielnie doksztalać się przez całe życie.



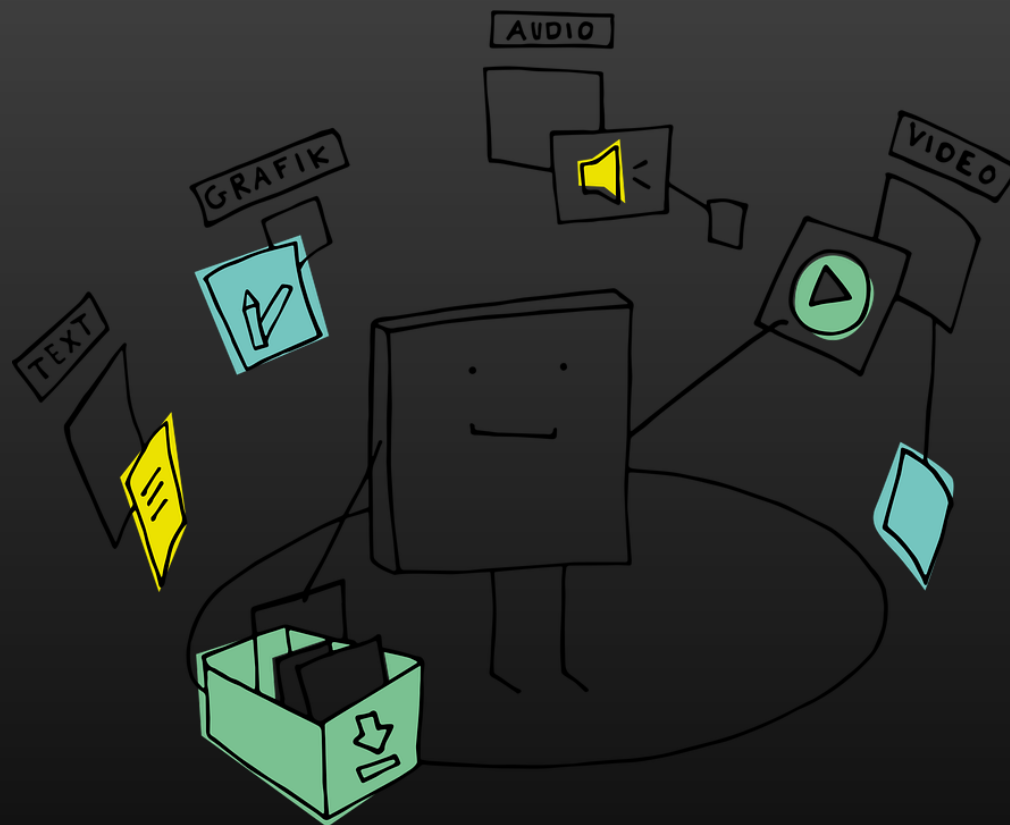


Dlaczego potęga technologii internetowych?

- Zwiększenie zaangażowania studentów.
- Lepsze rozumienie skomplikowanych konceptów.
- Polepszenie zapamiętywania poprzez wielosensoryczną stymulację.
- Personalizacja uczenia się.
- Zaspokajanie różnych stylów uczenia się.



Dlaczego multimedialność?



Nowe, bardziej stymulujące do pracy materiały edukacyjne z różnych dyscyplin nauki, którym podstawy daje matematyka.

Jakie wyzwania?

- Innowacyjność koncepcji
- Pomysłowość wizualizacji
- Kreatywność w szukaniu nowych rozwiązań



- Funkcjonalności i afordancje technologii
- Język angielski – język instrukcji i interakcji
- Narzucone formy zajęć
- Finansowanie

Język angielski w nauczaniu matematyki

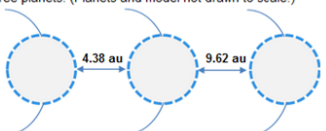
PISA (The Program for International Student Assessment is an international assessment that measures 15-year-old students' reading, mathematics, and science literacy).

PISA 2022


Solar System
Question 1 / 2

Refer to "Solar System" on the right. Use drag and drop to answer the question.

The following model shows the average distances between three planets. (Planets and model not drawn to scale.)



Based on the distances given, which planets belong in the model? Drag the correct three planets in the correct order. To change an answer, first drag the previous planet out.



SOLAR SYSTEM

The table below shows the average distance from the Sun to the primary planets in Astronomical Units (au).

1 au is approximately 150 million kilometres.

Planet	Average distance from Sun in au
Mercury	0.39
Venus	0.72
Earth	1.00
Mars	1.52
Jupiter	5.20
Saturn	9.58
Uranus	19.20
Neptune	30.05

PISA 2022

Solar System
Question 1 / 2

Refer to "Solar System" on the right. Use drag and drop to answer the question.

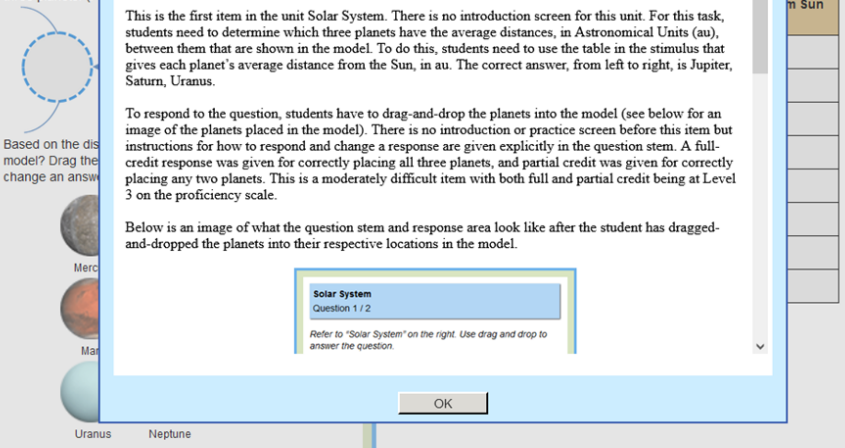
The following model shows the average distances between three planets. (Planets and model not drawn to scale.)

This is the feedback for CMA123Q01 in English.

This is the first item in the unit Solar System. There is no introduction screen for this unit. For this task, students need to determine which three planets have the average distances, in Astronomical Units (au), between them that are shown in the model. To do this, students need to use the table in the stimulus that gives each planet's average distance from the Sun, in au. The correct answer, from left to right, is Jupiter, Saturn, Uranus.

To respond to the question, students have to drag-and-drop the planets into the model (see below for an image of the planets placed in the model). There is no introduction or practice screen before this item but instructions for how to respond and change a response are given explicitly in the question stem. A full-credit response was given for correctly placing all three planets, and partial credit was given for correctly placing any two planets. This is a moderately difficult item with both full and partial credit being at Level 3 on the proficiency scale.

Below is an image of what the question stem and response area look like after the student has dragged-and-dropped the planets into their respective locations in the model.



OK

Wyzwania językowe na zajęciach z matematyki

- Rozumienie nieznananych kontekstów.
- Rozwiązywanie skontekstualizowanych problemów matematycznych.
- Rozpoznawanie i rozumienie rejestrów językowych.
- Rozumowanie na złożonych poziomach kognitywnych.
- Radzenie sobie z pojęciami, które nie istnieją w języku ojczystym.
- Wyszukiwanie informacji zapisanych zwięzłym językiem, w którym każde słowo ma znaczenie - wykorzystujące strategie wyuczone na zajęciach z języka ogólnego.
- Przełączanie się z jednego kodu językowego na drugi.
- Wykorzystywanie zaawansowanych umiejętności językowych i metajęzykowych, tj.:

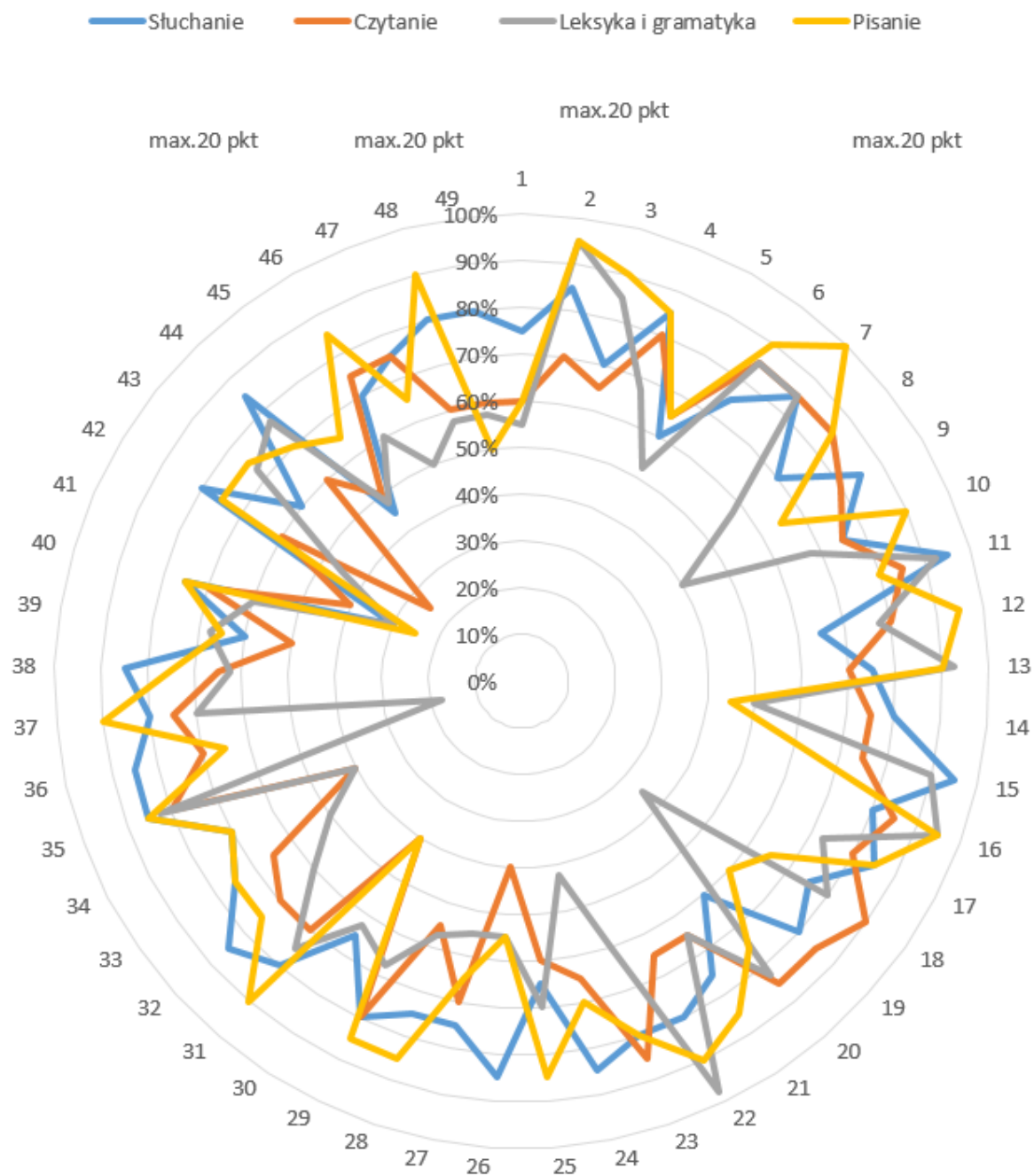
- umiejętności refleksji nad używanymi terminami, symbolami, definicjami oraz strukturami logicznymi;
- umiejętności wyrażania myśli w sposób jasny i precyzyjny, zarówno w mowie, jak i w piśmie;
- umiejętności wykorzystywania metafor i analogii do wyjaśniania złożonych koncepcji matematycznych, co pomaga w lepszym zrozumieniu abstrakcyjnych idei.



Umiejętności językowe

studenci
matematyki PG

Wyniki egzaminu pisemnego czerwiec 2024

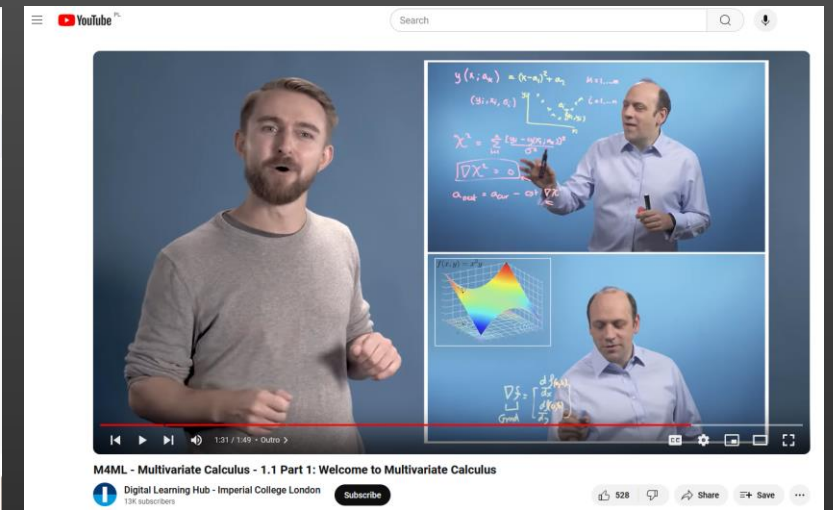
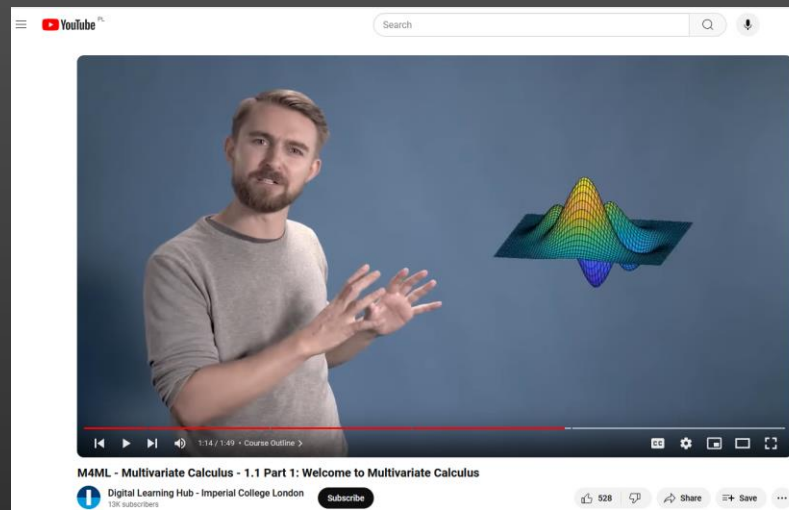
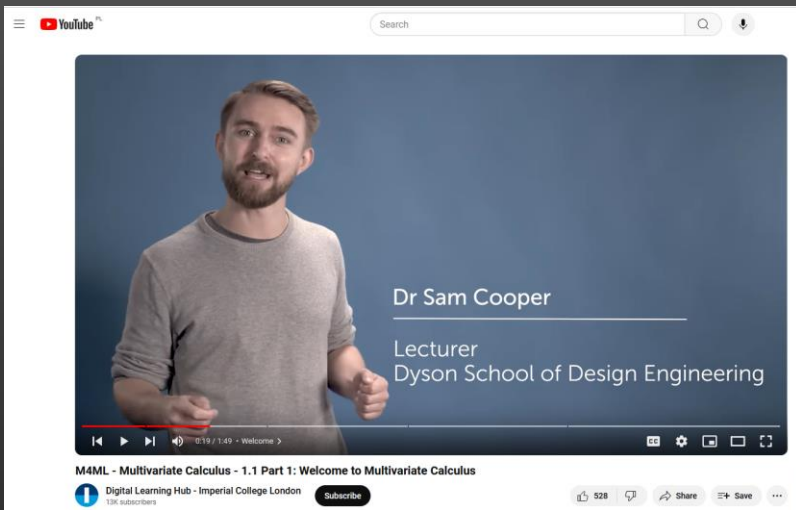


Co możemy wykorzystać?

Co możemy sami stworzyć, aby nauczanie i uczenie się matematyki było łatwiejsze?



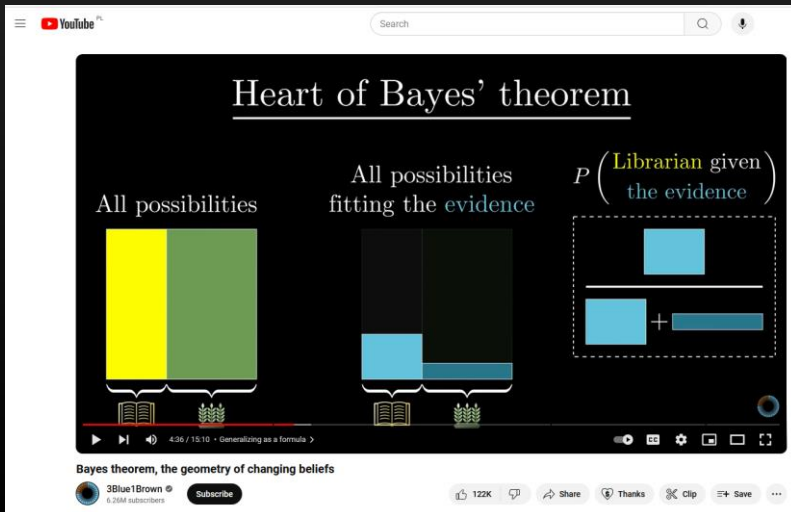
Zasoby dostępne w Internecie



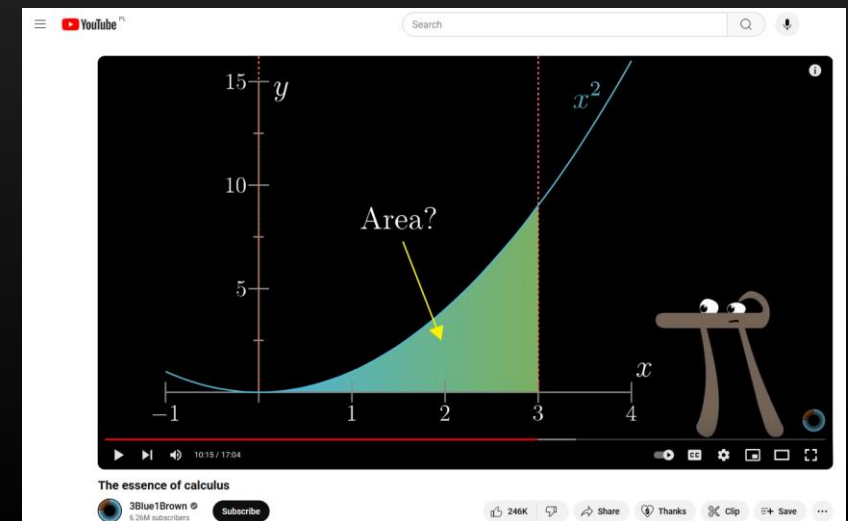
<https://www.youtube.com/watch?v=cWZLPv4ZJhE&list=PLiiljHvN6z193BBzS0Ln8NnqQmzimTW23>

Wykłady i animacje w jęz. angielskim

<https://www.youtube.com/watch?v=HZGCoVF3YvM>



<https://www.youtube.com/watch?v=WUvTyaaNkzM>



Interaktywne podręczniki

Contents

What is Discrete Mathematics?

Mathematical Statements

Sets

Functions

Counting

Additive and Multiplicative Principles

Binomial Coefficients

Combinations and Permutations

Combinatorial Proofs

Stars and Bars

Advanced Counting Using PIE

Chapter Summary

Sequences

Describing Sequences

Arithmetic and Geometric Sequences

Polynomial Fitting

Solving Recurrence Relations

Induction

Chapter Summary

Symbolic Logic and Proofs

Propositional Logic

Proofs

Chapter Summary

Graph Theory

Index

< Prev

Up

Next >

Give recursive definitions for the functions described below.

1. $f: \mathbb{N} \rightarrow \mathbb{N}$ gives the number of snails in your terrarium n years after you built it, assuming you started with 3 snails and the number of snails doubles each year.

2. $g: \mathbb{N} \rightarrow \mathbb{N}$ gives the number of push-ups you do n days after you started your push-ups challenge, assuming you could do 7 push-ups on day 0 and you can do 2 more push-ups each day.

3. $h: \mathbb{N} \rightarrow \mathbb{N}$ defined by $h(n) = n!$. Recall that $n! = 1 \cdot 2 \cdot 3 \cdot \dots \cdot (n-1) \cdot n$ is the product of all numbers from 1 through n . We also define $0! = 1$.

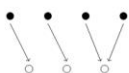
Solution.

Surjections, Injections, and Bijections


We now turn to investigating special properties functions might or might not possess.

In the examples above, you may have noticed that sometimes there are elements of the codomain which are not in the range. When this sort of the thing does not happen, (that is, when everything in the codomain is in the range) we say the function is *onto* or that the function maps the domain *onto* the codomain. This terminology should make sense: the function puts the domain (entirely) on top of the codomain. The fancy math term for an onto function is a *surjection*, and we say that an onto function is a *surjective* function.

In pictures:



Surjective



Not surjective

https://discrete.openmathbooks.org/dmoi3/sec_intro-functions.html



Algebra and Trigonometry 2e

12.1 The Ellipse

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Polynomial and Rational Functions

Exponential and Logarithmic Functions

The Unit Circle: Sine and Cosine Functions

Periodic Functions

Trigonometric Identities and Equations

Further Applications of Trigonometry

Systems of Equations and Inequalities

Analytic Geometry

Introduction to Analytic Geometry

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Conic Sections in Polar Coordinates

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Practice Test

Sequences, Probability, and Counting Theory

Proofs, Identities, and Toolkit Functions

Answer Key

Solve applied problems involving ellipses.




Figure 1 The National Statuary Hall in Washington, D.C. (credit: Greg Palmer, Flickr)

Can you imagine standing at one end of a large room and still being able to hear a whisper from a person standing at the other end? The National Statuary Hall in Washington, D.C., shown in Figure 1, is such a room.¹ It is a semi-circular room called a *whispering chamber* because the shape makes it possible for sound to travel along the walls and dome. In this section, we will investigate the shape of this room and its real-world applications, including how far apart two people in Statuary Hall can stand and still hear each other whisper.

Writing Equations of Ellipses in Standard Form

A conic section, or *conic*, is a shape resulting from intersecting a right circular cone with a plane. The angle at which the plane intersects the cone determines the shape, as shown in Figure 2.

Algebra and Trigonometry 2e

4.1 Linear Functions

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Real Numbers: Algebra Essentials

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Periodic Functions

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Further Applications of Trigonometry

Systems of Equations and Inequalities

Analytic Geometry

change, or slope of the function. The y-intercept is at $(0, b)$.

EXAMPLE 1

Using a Linear Function to Find the Pressure on a Diver

The pressure, P , in pounds per square inch (PSI) on the diver in Figure 4 depends upon her depth below the water surface, d , in feet. This relationship may be modeled by the equation, $P(d) = 0.434d + 14.696$. Restate this function in words.




Figure 4 (credit: Ise Rejs and Jan-Noud Hutten)

[Show/Hide Solution]

Solution

To restate the function in words, we need to describe each part of the equation. The pressure as a function of depth equals four hundred thirty-four thousandths times depth plus fourteen and six hundred ninety-six thousandths.

Analysis

The initial value, 14.696, is the pressure in PSI on the diver at a depth of 0 feet, which is the surface of the water. The rate of change, or slope, is 0.434 PSI per foot. This tells us that the pressure on the diver increases 0.434 PSI for each foot her depth increases.

https://openstax.org/books/algebra-and-trigonometry-2e/pages/12-1-the-ellipse#Figure_10_0_1_015

Algebra and Trigonometry 2e

12.1 The Ellipse

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Answer Key

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3. Substitute the values for a^2 and b^2 into the standard form of the equation determined in Step 1.

EXAMPLE 1

Writing the Equation of an Ellipse Centered at the Origin in Standard Form

What is the standard form equation of the ellipse that has vertices $(\pm 8, 0)$ and foci $(\pm 5, 0)$?

TRY IT #1

What is the standard form equation of the ellipse that has vertices $(0, \pm 4)$ and foci $(0, \pm \sqrt{15})$?

Q&A

Can we write the equation of an ellipse centered at the origin given coordinates of just one focus and vertex?

Yes. Ellipses are symmetrical, so the coordinates of the vertices of an ellipse centered around the origin will always have the form $(\pm a, 0)$ or $(0, \pm a)$. Similarly, the coordinates of the foci will always have the form $(\pm c, 0)$ or $(0, \pm c)$. Knowing this, we can use a and c from the given points, along with the equation $c^2 = a^2 - b^2$, to find b^2 .

Samodzielnie wykonane moduły e-learningowe,
blended learningowe i wspomagane technologiami
internetowymi

Wiki – Miejsce Współpracy

Projekty grupowe oparte na rozwiązywaniu problemów życia codziennego

Kształcenie umiejętności twardych i miękkich

Autentyczne interakcje

Collaborative Projects:

- Mathematical Modeling
- Statistical Data Analysis
- Topology and its Applications
- Combinatorics and Probability
- Game Theory Models
- Mathematical Patterns in Art

Project Stages:

- literature review
- Data collection
- Model development
- Implementation of algorithms, analysis
- Presentation of results
- Assessment



Peer Review – Współocenywanie Prac



- Representing: Did they choose a good method?
- Analysing: Is the reasoning correct – are the calculations accurate? Did you find any mistakes in the work?
- Interpreting: Are the conclusions sensible? Do you agree with their conclusions? What extensions to the task did you, or can you suggest? What alternative approaches to the task did you, or could you suggest?
- Communication: Was the reasoning easy to understand and follow? How could this work be improved?

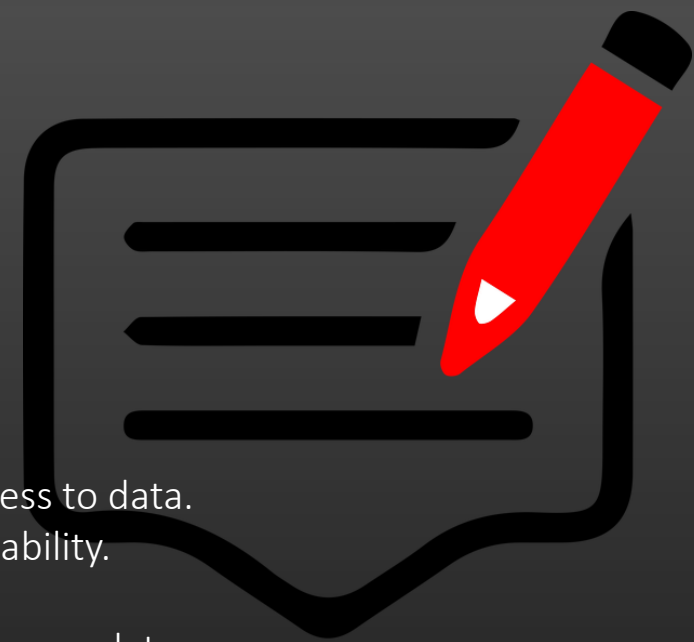
Peer Review – Kryteria

Did they choose a good method?

- 5 points: The method is entirely feasible and practical within the constraints of time, resources, and access to data.
- 4 points: The method is generally feasible within expected constraints of time, resources, and data availability.
- 3 points: The method is somewhat feasible but requires careful planning and resource management.
- 2 points: The method is marginally feasible but may encounter significant challenges with resources, time, or data access.
- 1 point: The method is impractical or unrealistic given available resources.
- 0 points: The feasibility of the method cannot be evaluated due to fundamental flaws in its design.

Is the reasoning correct – are the calculations accurate? Did you find any mistakes in the work?

- 5 points: Calculations are entirely accurate, demonstrating precision and meticulous attention to detail.
- 4 points: Calculations are mostly accurate, with few minor errors that do not detract from the validity of results.
- 3 points: Calculations are generally accurate, with minor errors that do not substantially affect the overall findings.
- 2 points: There are noticeable errors in calculations that impact the accuracy of results.
- 1 point: There are numerous significant errors in calculations, resulting in incorrect or unreliable results.
- 0 points: The results are completely incorrect and unreliable.



Feedback 

Are the conclusions sensible? Do you agree with their conclusions?

5 points: The conclusions are logically coherent, thoroughly supported by robust and comprehensive evidence, consider the broader context, and address alternative viewpoints.

4 points: The conclusions are mostly logical and well-supported by strong evidence, with minor gaps in context or consideration of alternative viewpoints.

3 points: The conclusions are generally logical and supported by evidence, but there are notable gaps in context, support, or consideration of alternative viewpoints.

2 points: The conclusions have noticeable logical flaws or lack sufficient evidence, significantly affecting their sensibility and reliability.

1 point: The conclusions are illogical, lack credible evidence, and fail to consider the broader context or alternative viewpoints, making them unreliable.

0 points: There are no conclusions.




Feedback

Was the reasoning easy to understand and follow? How could this work be improved?

5 points: The reasoning is clear, the work is logically structured, and it is presented in an easily comprehensible manner.

4 points: The reasoning is mostly clear and well-structured, with minor instances where clarity could be improved or additional background information provided.

3 points: The reasoning is generally understandable but could be improved by addressing gaps in logic or evidence.

2 points: The reasoning is somewhat unclear; significant improvements are needed to clarify the reasoning, provide stronger evidence, and ensure logical flow.

1 point: The reasoning is confusing; substantial revisions are required to restructure the work, clarify the reasoning, and significantly strengthen the evidence base.

0 points: The work requires a complete overhaul to provide clear reasoning and substantive support for any conclusions or findings.

Grywalizacja

Pobudzanie ciekawości poprzez
metaforyczną narrację
i wyzwania jak w grach.



Grywalizacja

Zróżnicowane aktywności
Interaktywne środowisko uczenia się

Zadania koncepcyjne



Zróżnicowane quizy, nie tylko obliczeniowe



Infografiki – cyfrowe narracje



Technologie w edukacji matematycznej w UK

A report from a working group of
the Joint Mathematical Council of
the United Kingdom (2023)

Word cloud based on 395 technologies that respondents used and considered to be impactful.



white-rose-maths
big-maths
seesaw



Naszą misją jest odważnie robić to, czego nikt wcześniej nie dokonał.



„Bez wsparcia ze strony nauczyciela nawet najlepsze materiały na świecie mogą okazać się rozczarowujące. Z drugiej strony, całkiem podstawowe materiały mogą być efektywne, jeśli uczący się otrzymują wsparcie od wrażliwych i sumiennych nauczycieli. Praca nauczyciela zaczyna się w miejscu, w którym kończą się zadania materiałów” (Rowntree 1997, 115).

Rowntree, D. 1997. *Making materials-based learning work*.
Kogan Page.



IMT – nauczyciel akademicki po
sprostaniu wszystkim wyzwaniom

Dziękuję za uwagę.

Iwona Mokwa-Tarnowska

Stowarzyszenie E-learningu Akademickiego, Politechnika Gdańska