Search...

Relations in Mathematics

Last Updated : 10 May, 2025

Relation in Mathematics is defined as the relationship between two sets. If we are given two sets set A and set B and set A has a relation with set B then each value of set A is related to a value of set B through some unique relation. Here, set A is called the domain of the relation, and set B is called the range of the relation.

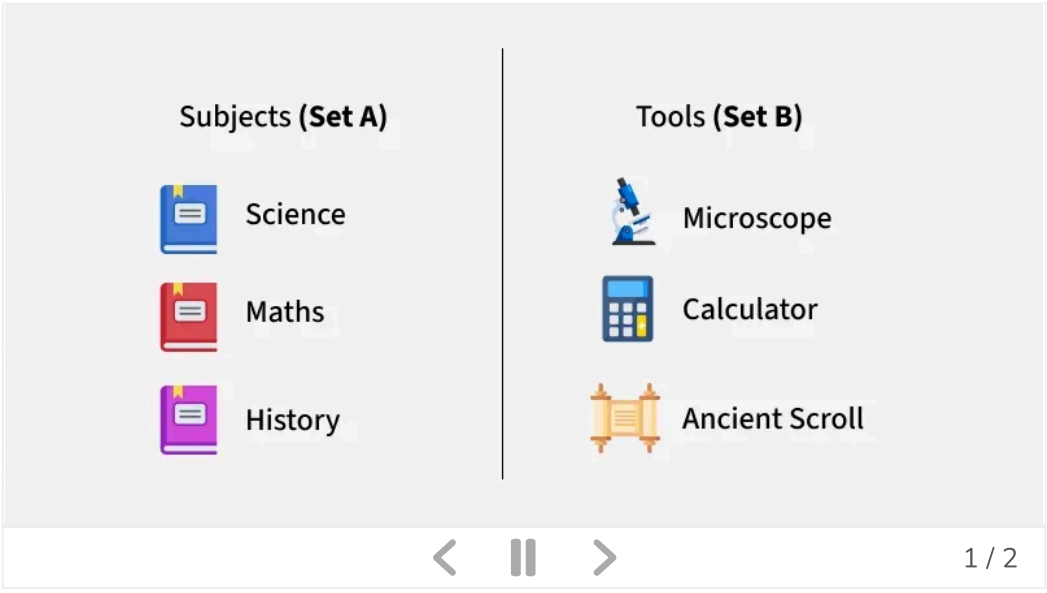
For example, if we are given **two sets**,

- Set A = {1, 2, 3, 4} and Set B = {1, 4, 9, 16}

The relation R from set A to set B is defined by the rule: $y = x^2$: $y \in B, x \in A\}$

Ordered Pairs:

- R = {(1, 1), (2, 4), (3, 9), (4, 16)}



Relation is defined as the relation between two different sets of

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Got It !

Suppose we are given a set A that contains the name of girls of a class and another set B that includes the height of girls then a relation connects set A with set B. In mathematical terms, we can say that,

"A set of ordered pairs is a relation"

Table of Content

Example of a Relation

Examples of relation in mathematics include,

Suppose there are two sets X = {4, 36, 49, 50} and Y = {1, -2, -6, -7, 7, 6, 2}. A relation R states that

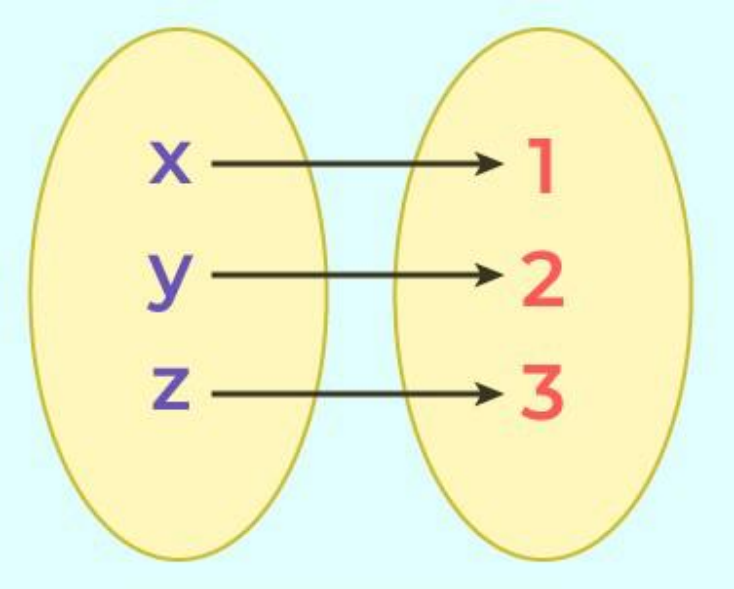
"(x, y) is in the relation R if x is a square of y" can be represented using ordered pairs,

- R = {(4, -2), (4, 2), (36, -6), (36, 6), (49, -7), (49, 7)}

Also, the image added below shows two sets A and B, and the relation between them,

- Set A = {x, y, z}
- Set B = {1, 2, 3}

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy



Representation of Relations

are,

- Set Builder Notation
- Roaster Notation

Let's study them in detail in the article below,

Set Builder Notation

if are relation between two sets is represented using the logical formula then this type of representation is called the set builder notation.

For example, if we are given two sets set X = {2, 4, 6} and set Y = {4, 8, 12}. Then after observing clearly, we can see that each element of set Y is twice each element of set X the relation between them is,

- R {(a, b): b is twice of a, a ∈ X, b ∈ Y}

Roaster Form

Roaster form is another way of representing a relation. In roaster form,

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

relation R such that,

- R = {(2, 4), (4, 8), (6, 12)}

Types of Relation

Various types of relations defined in mathematics are,

- Empty Relation
- Reflexive Relation
- Symmetric Relation
- Transitive Relation
- Equivalence Relation
- Universal Relation
- Identity Relation
- Inverse Relation

Now let's learn about them in detail.

Empty Relation

A relation R on a set A is called Empty if the set A is an empty set, i.e. any relation where no element of set A is not related to the element of set B then it is called an empty relation. For example, A = {1, 2, 3} and B = {5, 6, 7} where, R = {(x, y) where x + y = 22}, then it is an empty relation.

Reflexive Relation

A relation R on a set A is called reflexive if (a, a) $\in$ R holds for every element a$\in$ A . i.e. if set A = {a, b} then R = {(a, a), (b, b)} is reflexive relation.

For example, A = {2, 3} then the reflexive relation R on A is,

- R = {(2, 2), (3, 3)}

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

A relation R on a set A is called symmetric if (b, a) ∈ R holds when (a, b) ∈ R i.e. The relation R = {(a, b), (b, a)} is a reflexive relation on (a, b)

For example, A = {2, 3} then symmetric relation R on A is,

- R = {(2, 3), (3, 2)}

Transitive Relation

A relation R on a set A is called transitive if (a, b) ∈ R and (b, c) ∈ R then (a, c) ∈ R for all a,b,c ∈ A i.e.

For example, set A = {1, 2, 3} then transitive relation R on A is,

- R = {(1, 2), (2, 3), (1, 3)}

Equivalence Relation

A relation is an Equivalence Relation if it is reflexive, symmetric, and transitive. i.e. relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2), (1, 3), (3, 1)} on set A = {1, 2, 3} is equivalence relation as it is reflexive, symmetric, and transitive.

Universal Relation

A universal relation is a relation in which all elements of the set are mapped to another element of the set then it is called universal relation. For example, A = {4, 8, 12} and B = {1, 2, 3} then universal relation is, R = {(x, y) where x > y}

Identity Relation

An identity relation is a relation defined such all elements in a set are related to itself. It is defined as, I = {(x, x): for all x ∈ X}.

For example P = {1, 2, 3} then Identity Relation(I) = {(1, 1), (2, 2), (3, 3)}

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

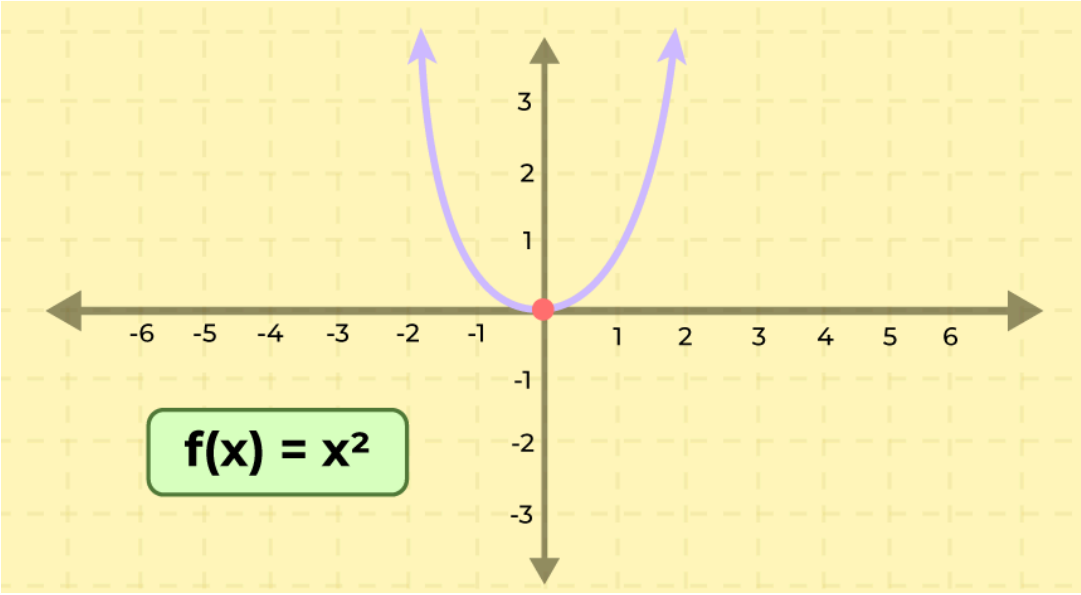
A relation is called the inverse of any relation if elements of one set are inverse pairs of another set. The inverse of a relation R is denoted as R^{-1}. i.e., $R^{-1} = \{(y, x): (x, y) \in R\}$.

Graphing Relations

Relations can be easily represented on the graphs and representing them on graphs is an easy way of explaining them. The ordered pair in a relation represents a coordinate that can be plotted on the cartesian coordinate system. We can easily graph the relation by following the steps added below,

- Substitute x with random numerical values in the relation.
- Find the corresponding y value of the respective x value.
- Write the ordered pair such that, {(x, y)}
- Plot these points and join them to find the required curve.

The graph of the relation $y = x^2$ is added below,



Articles related to Relations in Mathematics:

- Types Of Sets
- Relation and Function
- Types of Functions
- Representation of Relation in Graphs and Matrices
- Relations in Mathematics

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Question 1: Find the inverse relation of R = {(1, 3), (2, 4), (3, 5)}

Solution:

Inverse relation is defined as $R^{-1} = \{(y, x): (x, y) \in R\}$

Given,
R = {(1, 3), (2, 4), (3, 5)}

Inverse relation of R is R^{-1} then,
R^{-1} = {(3, 1), (4, 2), (5, 3)}

Question 2: Find the inverse relation of R = {(a, x), (b, y), (c, z)}

Solution:

Inverse relation is defined as $R^{-1} = \{(y, x): (x, y) \in R\}$

Given,
R = {(a, x), (b, y), (c, z)}

Inverse relation of R is R-1 then,
R^{-1} = {(x, a), (y, b), (z, c)}

Question 3: Is the relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)} on set A = {1, 2, 3} an equivalence relation?

Solution:

No, it's not an equivalence relation. It's reflexive and symmetric, but not transitive.

Question 4: Find the domain and range of the relation R = {(1, 2), (2, 3), (3, 4), (4, 5)}.

Solution:

Domain = {1, 2, 3, 4}, Range = {2, 3, 4, 5}

Question 5: Is the relation R = {(x, y) | $x^2 + y^2 = 25$} on the set of real numbers a function?

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Question 6: Find the inverse of the relation R = {(1,1), (2,4), (3,9), (4,16)}.

Solution:

R^{-1} = {(1, 1), (4, 2), (9, 3), (16, 4)}

Question 7: Determine if the relation R = {(x, y) | x - y is even} on the set of integers is an equivalence relation.

Solution:

Yes, it's an equivalence relation. It's reflexive, symmetric, and transitive.

Question 8: Find the composition R ∘ S for R = {(1, 2), (2, 3), (3, 4)} and S = {(1, 1), (2, 2), (3, 3), (4, 4)}.

Solution:

R ∘ S = {(1, 2), (2, 3), (3, 4)}

Question 9: Is the relation R = {(a, b) | a is a multiple of b} on the set of positive integers transitive?

Solution:

Yes, it's transitive.

Question 10: Find the reflexive closure of R = {(1, 2), (2, 3), (3, 1)} on set A = {1, 2, 3}.

Solution:

Reflexive closure = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (3, 1)}

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Similar Reads

Reflexive Relations in Mathematics

Reflexive Relation is a mathematical or set-theoretical relation in which every element is related to itself, meaning that for every element 'x' in th...

15+ min read

Types of Relation in Maths

A relation is like a rule that tells us how two things are connected.For example:In a classroom, the relation can be "is the friend of."In numbers,...

15+ min read

Mathematics Practice Questions

Mathematics Practice Questions: This collection of advanced maths practice questions is designed to test and enhance the problem-solving...

15+ min read

Discrete Mathematics | Representing Relations

Prerequisite - Introduction and types of Relations Relations are represented using ordered pairs, matrix and digraphs: Ordered Pairs - In...

8 min read

Asymmetric Relation

A relation is a subset of the cartesian product of a set with another set. A relation contains ordered pairs of elements of the set it is defined on. A...

15+ min read

Antisymmetric Relation

Antisymmetric Relation is a type of binary relation on a set where any two distinct elements related to each other in one direction cannot be related...

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Inverse Relation

Inverse Relation: An inverse relation is the opposite of a given relation obtained by interchanging or swapping the elements of each ordered pai...

15+ min read

Equivalence Relations

Equivalence Relation is a type of relation that satisfies three fundamental properties: reflexivity, symmetry, and transitivity. These properties ensur...

15+ min read

Binary Relation

A binary relation is just a way to show a connection between two things, like saying "is a friend of, " "is greater than, " or "is married to." It's like...

15+ min read

Asymmetric Relation on a Set

A relation is a subset of the cartesian product of a set with another set. A relation contains ordered pairs of elements of the set it is defined on. To...

15+ min read

GeeksforGeeks

Corporate & Communications Address:

A-143, 7th Floor, Sovereign Corporate Tower, Sector- 136, Noida, Uttar Pradesh (201305)

Registered Address:

K 061, Tower K, Gulshan Vivante Apartment, Sector 137, Noida, Gautam Buddh Nagar, Uttar Pradesh, 201305

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

GET IT ON Google Play
Download on the App Store

Advertise with us

Company
About Us
Legal
Privacy Policy
Careers
In Media
Contact Us
GfG Corporate Solution
Placement Training Program

Explore
Job-A-Thon Hiring Challenge
GfG Weekly Contest
Offline Classroom Program
DSA in JAVA/C++
Master System Design
Master CP
GeeksforGeeks Videos

Languages
Python
Java
C++
PHP
GoLang
SQL
R Language
Android Tutorial

DSA
Data Structures
Algorithms
DSA for Beginners
Basic DSA Problems
DSA Roadmap
DSA Interview Questions
Competitive Programming

Data Science & ML
Data Science With Python
Data Science For Beginner
Machine Learning
ML Maths
Data Visualisation
Pandas
NumPy
NLP
Deep Learning

Web Technologies
HTML
CSS
JavaScript
TypeScript
ReactJS
NextJS
NodeJs
Bootstrap
Tailwind CSS

Python Tutorial
Python Programming Examples
Django Tutorial
Python Projects
Python Tkinter
Web Scraping
OpenCV Tutorial
Python Interview Question

Computer Science
GATE CS Notes
Operating Systems
Computer Network
Database Management System
Software Engineering
Digital Logic Design
Engineering Maths

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy

Kubernetes
Azure
GCP
DevOps Roadmap

Interview Guide
Design Patterns
OOAD
System Design Bootcamp
Interview Questions

School Subjects

Mathematics
Physics
Chemistry
Biology
Social Science
English Grammar

Databases

SQL
MYSQL
PostgreSQL
PL/SQL
MongoDB

Preparation Corner

Company-Wise Recruitment Process
Aptitude Preparation
Puzzles
Company-Wise Preparation

More Tutorials

Software Development
Software Testing
Product Management
Project Management
Linux
Excel
All Cheat Sheets

Machine Learning/Data Science

Complete Machine Learning & Data Science Program - [LIVE]
Data Analytics Training using Excel, SQL, Python & PowerBI - [LIVE]
Data Science Training Program - [LIVE]
Data Science Course with IBM Certification

Programming Languages

C Programming with Data Structures
C++ Programming Course
Java Programming Course
Python Full Course

Clouds/Devops

DevOps Engineering
AWS Solutions Architect Certification
Salesforce Certified Administrator Course

GATE 2026

GATE CS Rank Booster
GATE DA Rank Booster
GATE CS & IT Course - 2026
GATE DA Course 2026
GATE Rank Predictor

@GeeksforGeeks, Sanchhaya Education Private Limited, All rights reserved

We use cookies to ensure you have the best browsing experience on our website. By using our site, you acknowledge that you have read and understood our Cookie Policy & Privacy Policy