Discrete Mathematics

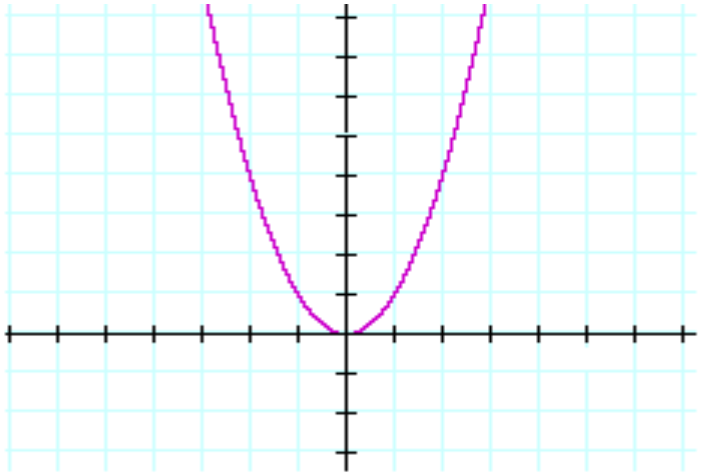
Introduction in Discrete Mathematics

1st Lecture

Lecturer: Dr. Mustafa F. Mohammed
Class: 1st stage.
Time:10:30AM-12:30 PM

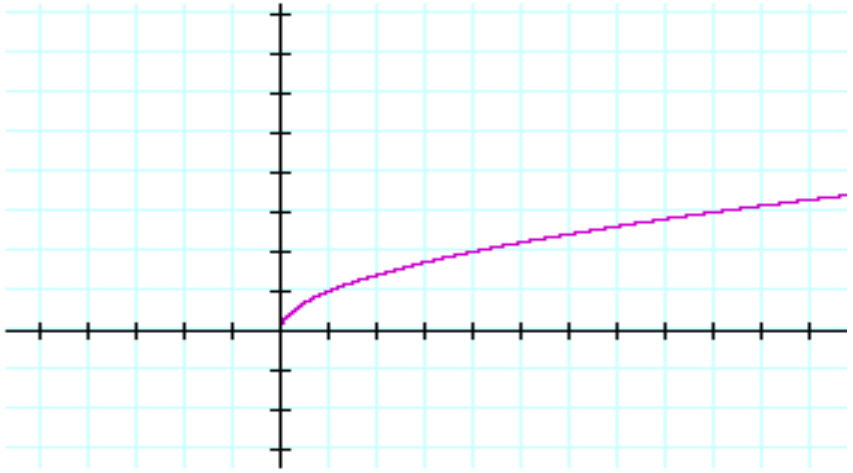
What is Discrete Mathematics?

- The mathematics means the study of numbers. In part, but also study functions and lines and triangles and parallelepipeds and vectors and . . . . Or perhaps it has to say that mathematics is a collection of tools that allow you to solve problems.
- In an algebra or calculus class, you might have found a particular set of numbers (maybe the set of numbers in the range of a function). You would represent this set as an interval: $[0,\infty]$is the range of f (x)=x^2, since the set of outputs of the function are all real numbers 0 and greater. This set of numbers is NOT discrete.



$y = x^2$

A parabola

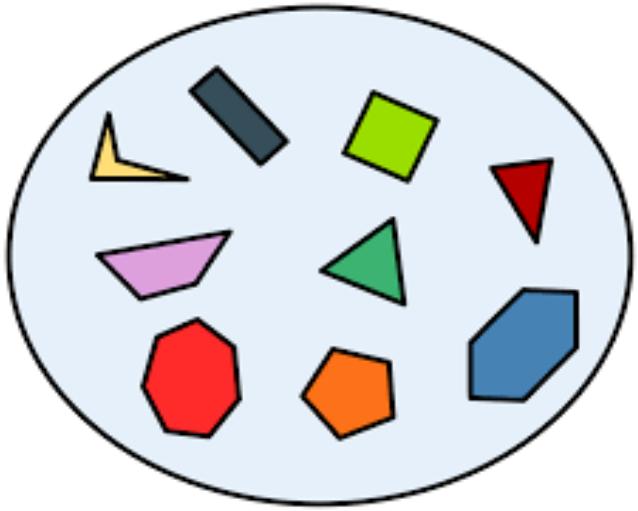


$y = \sqrt{x}$

The square root function

What is Discrete Mathematics?

- Discrete mathematics is the part of mathematics devoted to the study of discrete objects.
- Discrete math could still ask about the range of a function, but the set would not be an interval. Consider the function which gives the number of children of each person reading this. What is the range? I'm guessing it is something like {0,1,2,3} Maybe 4 is in there too. But certainly there is nobody reading this that has 1.32419 children. This output set *is* discrete because the elements are separate. The inputs to the function also form a discrete set because each input is an individual person.
- (Here discrete means consisting of distinct or unconnected elements.)



The kinds of problems solved using discrete mathematics include:

- How many ways are there to choose a valid password on a computer system?
- What is the probability of winning a lottery?
- Is there a link between two computers in a network?
- How can I identify spam e- mail messages?
- How can I encrypt a message so that no unintended recipient can read it?
- What is the shortest path between two cities using a transportation system?
- How can a list of integers be sorted so that the integers are in increasing order?
- How many steps are required to do such a sorting?
- How can it be proved that a sorting algorithm correctly sorts a list?
- How can a circuit that adds two integers be designed?
- How many valid Internet addresses are there?

and More…

WHY STUDY DISCRETE MATHEMATICS?

1st: Through this course you can develop your mathematical maturity : that is, your ability to understand and create mathematical arguments. You will not get very far in your studies in the mathematical sciences without these skills.

2nd: Discrete mathematics is the gateway to more advanced courses in all parts of the mathematical sciences. Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems. Students find these courses much more difficult when they have not had the appropriate mathematical foundations from discrete math.

3rd: Math courses based on the material studied in discrete mathematics include logic, set theory, number theory, linear algebra, abstract algebra, combinatorics, graph theory, and probability theory (the discrete part of the subject).

4th: discrete mathematics contains the necessary mathematical background for solving problems in operations research (including many discrete optimization techniques), chemistry, engineering, biology, and so on.

Main topics of **Discrete Mathematics** that will be coved this semester are:

- ❑ Sets, Relations, and Functions
- ❑ Basic Logic
- ❑ Proof Techniques
- ❑ Basics of Counting
- ❑ Graphs and Trees
- ❑ Discrete Probability

Recommended Book

Discrete Mathematics and its Applications
by (Kenneth H. Rosen) **7th edition**

THANK YOU