AL-MUTHANNA UNIVERSITY
COLLEGE OF ENGINEERING
DEPARTMENT OF ARCHITECTURE

Mathematics

Class 1

Syllabus

- Functions; Domain and Range
- Intervals
- Inequalities
- Functions
- Parametric Functions
- Limits and Continuity
- Derivatives
- Application of Derivatives
- Conical Sections.

Functions; Domain and Range

- The temperature at which water boils depends on the elevation above sea level (the boiling point drops as you ascend).

- The area of a circle depends on the radius of the circle.

- The distance an object travels at constant speed along a straight-line path depends on the elapsed time.

In each case, the value of one variable quantity, ***say y, depends on the value of*** *another variable quantity, which we might call x*.

Functions; Domain and Range

We say that "y is a function of x" and write this symbolically as

$y = f(x)$ ("y equals f of x").

- f represents the function
- x is the independent variable representing the input value of f
- y is the dependent variable or output value of f at x.

DEFINITION A **function** f from a set D to a set Y is a rule that assigns a ***unique*** (single) element $f(x) \in Y$ to each element $x \in D$.

Functions; Domain and Range

- The set D of all possible input values (X) is called the **domain** of the function.

- The **range** may not include every element in the set (Y).

- A value of $f(x)$ as x varies throughout D is called the range of the function.

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Functions; Domain and Range

A function f is like a machine that produces an output value $f(x)$ in its range whenever we feed it an input value x from its domain (Figure 1.1 . The function keys on a calculator give an example of a function as a machine.

FIGURE 1.1 A diagram showing a function as a kind of machine.

Functions; Domain and Range

Example :- Let's verify the natural domains and associated ranges of some simple functions. The domains in each case are the values of x for which the formula makes sense.

No	Function	Domain (x)	Range (y)
1	$y = x^2$	$(-\infty, \infty)$	$[0, q)$
2	$y = 1/x$	$(-\infty, 0) \cup (0, \infty)$	$(-\infty, 0) \cup (0, \infty)$
3	$y = \sqrt{}_x$	$[0, \infty)$	$[0, \infty)$
4	$y = \sqrt{4 - x}$	$(-\infty, 4]$	$[0, \infty)$
5	$y = \sqrt{1 - x^2}$	$[-1, 1]$	$[0, 1]$

Solution:-

•The formula *y =x2* gives a real *y*-value for any real number *x*.

The range of *y =x2* is *[0, ∞*) because the square of any real number is nonnegative .

•The formula *y = 1/x* gives a real *y*-value for every *x* except *x = 0* because if x =0 result will be *∞*. Thus, range of *y = 1/x*, the set of reciprocals of all nonzero real numbers.

Functions; Domain and Range

Solution:-

1. The formula $y = \sqrt{x}$ gives a real y-value only if $x \geq 0$. The range of $y = \sqrt{x}$ is $[0, \infty)$.

2. In $y = \sqrt{4 - x}$, the quantity $4 - x$ cannot be negative. That is, $4 - x \geq 0$, or $x \leq 4$. The formula gives real y-values for all $x \leq 4$. The range of $\sqrt{4 - x}$ is $[0,\infty)$, the set of all nonnegative numbers.

3. The formula $y = \sqrt{1 - x^2}$ gives a real y-value for every x in the closed interval from -1 to 1. Outside this domain, $1 - x^2$ is negative and its square root is not a real number. The values of $1 - x^2$ vary from 0 to 1 on the given domain, and the square roots of these values do the same. The range of $\sqrt{1 - x^2}$ is $[0, 1]$.

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