Salahaddin University-Erbil
College of Engineering
Department of Architectural Engineering
First Year Students
2nd Semester

Mathematics I
Function and Graphs (Ch.1)

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1.2. Function and the Graphs

• Sums, differences, products, and Quotients

Like numbers, functions can be added, subtracted, multiplied, and divided (except where the denominator is zero) to produce new functions

- Example

The function f(x) and g(x) are defined as $f(x) = \sqrt{x}$, $g(x) = \sqrt{1-x}$

Function	Formula	Domain
$f + g$	$\sqrt{x} + \sqrt{1-x}$	[0,1]
$f - g$	$\sqrt{x} - \sqrt{1-x}$	[0,1]
$g - f$	$\sqrt{1-x} - \sqrt{x}$	[0,1]
$f.g$	$\sqrt{x(1-x)}$	[0,1]
f/g	$\sqrt{\frac{x}{1-x}}$	[0,1)
g/f	$\sqrt{\frac{1-x}{x}}$	(0,1]

1.2. Function and the Graphs

- Composite function

if f and g are functions, the **composite** function $f \circ g$ is defined by

$$f \circ g(x) = f\big(g(x)\big)$$

The domain of $f \circ g$ consists of the numbers x in the domain of g for which $g(x)$ lies in the domain of f.

- Example

if $f(x) = \sqrt{x}$ and $g(x) = x + 1$

Find

$f \circ g(x)$

$g \circ f(x)$

$f \circ f(x)$

$g \circ g(x)$

$g \circ g(5)$

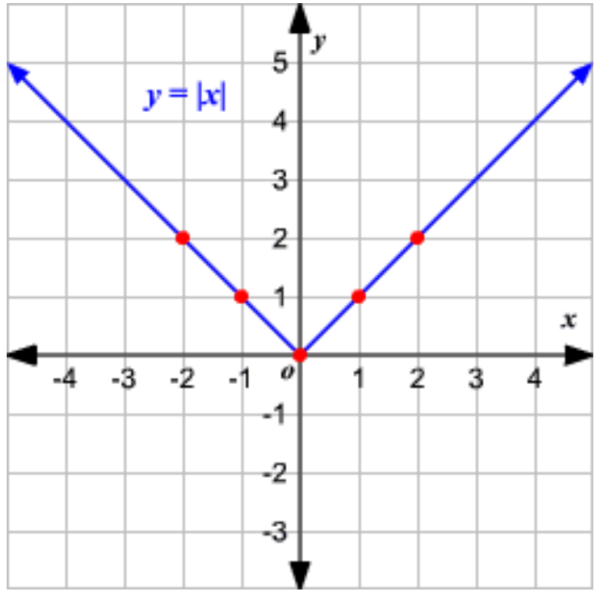
1.2. Function and the Graphs

- Absolute values and absolute functions
- Definition: An **absolute value** function is a function that contains an algebraic expression within absolute value symbols. Recall that the absolute value of a number is its distance from 0 on the number line.

The absolute value function written as $f(x) = |x|$, is defined as

$$f(x) = |x| = \begin{cases} x & if\ x > 0 \\ 0 & if\ x = 0 \\ -x & if\ x < 0 \end{cases}$$

- Graph of $f(x) = |x|$



- Example
- Solve $|2x - 3| = 11$

1.2. Function and the Graphs

- Rules

1. $|-a| = |a|$

2. $|ab| = |a|\,|b|$

3. $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$

- Triangle inequality

4. $|a+b| \leq |a| + |b|$

- Note: For same signs variables are equal but for differ signs it will be less than
- Example

$$|-3+5|$$
$$|-3-5|$$

- The number $|a-b|$ are always equal to $|b-a|$ because

$|a-b| = |(-1)(b-a)| = |-1||b-a| = |b-a|$

1.2. Function and the Graphs

Absolute Values and Intervals

If a is any positive number, then

5. $|x| = a$ if and only if $x = \pm a$

6. $|x| < a$ if and only if $-a < x < a$

7. $|x| > a$ if and only if $x > a$ or $x < -a$

8. $|x| \leq a$ if and only if $-a \leq x \leq a$

9. $|x| \geq a$ if and only if $x \geq a$ or $x \leq -a$

1.2. Function and the Graphs

- Example

What values of x satisfy the inequality

$$|x - 5| < 9$$

- Example

What value of x satisfy the inequality $\left|\frac{2x}{3}\right| \leq 1$

For next lecture we will learn

- Derivatives