

# MATHEMATICS FOR COMPUTING

## WEEK 1 - SEMINAR

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### MODULE INTRODUCTION AND ALGEBRAIC METHODS

#### Module Introduction

##### Logistics

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- Series of tutorials: 12 Weeks
- Module Code: 4COSC012C

##### Assessment

- Test 1 – 25%
- Test 2 – 25%
- Exam – 50%

##### Learning Outcomes

By the end of the module the successful student will be able to:

- Use fundamental mathematical notation to accurately carry out basic algebraic manipulations
- Apply linear algebra to solve systems of linear equations in terms of vectors and matrices
- Apply concepts of sets, relations and functions to solve simple problems
- Apply combinatorics and statistics to evaluate probability of events
- Apply the fundamental principles of calculus for problem solving
- Use the basic concepts of Boolean algebra and Logic to solve simple problems.

##### Lecture Recap

1. The word 'algebra' comes from the title of a book \_\_\_\_\_
  - a) Al-jabir w'al muqabala
  - b) Al-jabr w'al muqabala
  - c) Al-jabr r'al muqabala
  - d) Al-jibr w'al muqabala
2. What does 'al - jabr' means?
  - a) Refreshing and Restoring
  - b) Refreshing and Balancing

c) Restoring and Balancing    d) All of the above

3. What does 'w'al muqabala' means?

- a) Cancelling and simplifying                      b) Cancelling and Modeling  
c) Simplifying and Restoring                      d) Cancelling and Restoring

4. Translate the following situation into algebraic equation:

*“Tina wants to buy pencils and pens for \$15. Each pencil costs \$1, and the pen costs \$2 each. If  $x$  represents the number of pencils and  $y$  stands for pens”*

### ALGEBRAIC METHODS INTRODUCTION

**Task 1:** Mathew gets paid \$2 per hour for his part-time work in a farm. If he works for 10 hours a week, how much money will he make?

For an hour he gets \$2, for two hours \$4, for 3 hours \$6, and so on.

Let us tabulate this sequence and find the earning for the week.

No. of hours	Pay (\$)
1	2
2	4
3	6
4	8
5	10
6	12

Analyzing the pattern helps us find the amount that Mathew gets paid for any number of hours of work. The pattern in the sequence is that the pay is double the number of hours that he works. Therefore, for 10 hours of work, he will make \$20.

**Task 2:** Sam bought 3 boxes of chocolates online. Postage was \$9 and the total cost was \$45. How much was each box?

Let's use  $x$  for the price of each box.

3 times  $x$  plus \$9 is \$45:

$$3x + 9 = 45$$

Let's solve!

Start with:  $3x + 9 = 45$

Subtract 9 from both sides:  $3x + 9 - 9 = 45 - 9$

Simplify:  $3x = 36$

Divide by 3:  $3x / 3 = 36 / 3$

Simplify:  $x = 12$

So each box was \$12

### Working with Excel

- Open the excel sheet which is uploaded in the intranet.
- Go to sheet 1 Algebraic Methods.
- According to the given equation we need to find out the value of X, equation and final answer using 'Goal Seek'.

### How to use 'Goal Seek'?

- Go to Data menu then click What-if-Analysis.
- Click 'Goal Seek' sub menu from What-if-Analysis.
- Now you can see 'Set cell', 'To value', 'By changing cell'.
- Set cell value should be the equation (Note: you have to find out the equation before selecting it as Set cell value).
- To value should be constraint.
- By changing cell should be the value that what you're looking for.

### Algebraic manipulation

It involves rearranging and substituting for variables to obtain an algebraic expression in a desired form. During this rearrangement, the value of the expression does not change.

In this section you will learn the substitution method for finding a solution to a system of linear equations in two variables. You will be used substitution in different ways throughout this seminar, for example when you're using the formulas for the area of a triangle and simple interest. We substituted values that we knew into the formula to solve for values that we did not know. The idea is similar when applied to solving systems; there are just a few different steps in the process. You will first solve for one variable, and then substitute that expression into the other equation. Let's start with an example to see what this means.

Find the value of  $x$  for this system.

Equation A:  $4x + 3y = -14$

Equation B:  $y = 2$

The problem asks to solve for  $x$ . Equation B gives you the value of  $y$ ,  $y=2$ , so you can substitute 2 into Equation A for  $y$ .

$$4x + 3y = -14$$

$$Y = 2$$

Substitute  $y=2$  into Equation A.

$$4x + 3(2) = -14$$

Simplify and solve the equation for x.

$$4x+6 = -14$$

**-6      -6**

$$4x = -20$$

\_\_\_\_\_

4 4

$$x = -5$$

**Answer**

$$x = -5$$

**Exercise Task 1:**

Find the value of  $y$  for this system.

Equation A:  $12x + 6y = 48$

Equation B:  $x = 2$

**Task 2:**

You can substitute a value for a variable even if it is an expression. Here's an example.

Solve for  $x$  and  $y$ .

Equation A:  $y + x = 3$

Equation B:  $x = y + 5$

The goal of the substitution method is to rewrite one of the equations in terms of a single variable. Equation B tells us that  $x=y+5$ , so it makes sense to substitute  $y+5$  into Equation A for  $x$ .

$$y + x = 3$$

$$x = y + 5$$

Substitute  $y + 5$  into Equation A for  $x$ .

$$y + x = 3$$

$$y + (y + 5) = 3$$

Simplify and solve the equation for  $y$ .

$$2y + 5 = 3$$

$$-5 \quad -5$$

$$2y = -2$$

$$Y = -1$$

Now find  $x$  by substituting this value for  $y$  into either equation and solve for  $x$ . We will use Equation A here.

$$y + x = 3$$

$$-1 + x = 3$$

$$+1 \quad +1$$

$$x = 4$$

Finally, check the solution  $x=4$ ,  $y=-1$  by substituting these values into each of the original equations.

$$y + x = 3$$

$$-1 + 4 = 3$$

$$3 = 3 \quad \text{TRUE}$$

$$x = y + 5$$

$$4 = -1 + 5$$

$$4 = 4 \quad \text{TRUE}$$

**Answer**

$$x = 4 \text{ and } y = -1$$

**The solution is (4, -1)**

Remember, a solution to a system of equations must be a solution to each of the equations within the system. The ordered pair (4, -1) does work for both equations, so you know that it is a solution to the system as well.

### Exercise Task 2:

Solve for  $x$  and  $y$ .

$$y = 3x + 6$$

$$-2x + 4y = 4$$

**Homework Task:**

Solve for  $x$  and  $y$ .

$$2x + 3y = 22$$

$$3x + y = 19$$

Hints:

- Choose an equation to use for the substitution. The second equation,  $3x+y=19$ , can easily be rewritten in terms of  $y$ , so it makes sense to start there.
- Rewrite  $3x + y = 19$  in terms of  $y$ .

**References**

1. <https://en.wikipedia.org/wiki/Algebra>
2. <https://www.bbc.co.uk/bitesize/topics/z9yb4wx/articles/zkf7xfr>
3. <https://www.youtube.com/watch?v=vDqOol-4Z6M&list=PL7AF1C14AF1B05894>