



Lecture 01

Fundamentals of Business Mathematics

MATH-114 • BBA 2k26

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NUST Business School

National University of Sciences & Technology

Part 1: Course Orientation & Policies

- Course Overview & Learning Outcomes
- Grading & Assessment Breakdown
- Academic Integrity & AI Guidelines
- Key Policies & Classroom Norms
- Textbook & Learning Resources

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- Mathematical Definitions & Characteristics
- Graphical Representation & Intercepts
- The Concept of Slope
- Slope-Intercept Form
- Business Context & Cost-Volume-Profit



Course Introduction & Policies

Welcome to Fundamentals of Business Mathematics (MATH-114)

Course Identity & Objective

Mathematics is the quantitative language of modern business. In **MATH-114**, we bridge pure mathematical concepts with commercial decision-making to help you solve and optimize real-world business problems.



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- **Credit Hours:** 3 (Prerequisites: None)
- **Program:** BBA 2k26 (Sections A, B, & C)
- **Key Areas We Will Cover:**
 - ▶ Linear Equations & Mathematical Functions
 - ▶ Mathematics of Finance (Compound Interest, Annuities, DCF)
 - ▶ Matrix Algebra & Application of Systems
 - ▶ Differentiation & Optimization Techniques
 - ▶ Linear Programming (Simplex Method)



Course Learning Outcomes (CLOs)

By the end of this module, students will be able to:

- **CLO 1 (Understand):** Show an understanding of basic mathematical concepts in a business setting.
- **CLO 2 (Relate):** Relate mathematical concepts to business decision-making.
- **CLO 3 (Apply):** Apply mathematical tools to business problems.
- **CLO 4 (Model):** Model solutions for optimization problems in a business setting.

Alignment with Program Goals: This course directly builds your analytical capability (Goal 1: Solve business problems using disciplinary knowledge), technology integration (Goal 5), and written articulation (Goal 3).



Course Evaluation (Grade Breakup)

Grading is strictly based on NUST Business School (NBS) criteria:

Assessment Component	Weight	Format / Notes
Final Exam	45%	Unseen word problems
Mid Semester Exam	25%	Scheduled in Week 9, covers first half
Assignments / Class Activities	15%	Class activities, must be completed in-class
Quizzes	15%	4 announced quizzes



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Assessment Warning: There is a strict **No Make-ups Policy** for assignments, quizzes, and class activities. No "best-of" policy or retakes for sessional assessments!



Classroom Policies & Attendance Rules

Attendance Policy

- **Strict 75% Requirement:** If you fall below 75% attendance, you will be disqualified from sitting in the midterm and final exams.
- **First 5 Minutes:** Attendance is taken in the first 5 minutes. Arriving late means you will be marked absent.
- **Responsibility:** Check **Qalam** regularly. Attendance corrections must be resolved within a week with proof.

Discipline & Classroom Norms

- **Zero Deadline Extensions:** No individual favors. Deadlines are final to ensure equal footing.
- **Cell Phones:** Must be turned off or on silent. Disruption will not be tolerated.
- **Preparation:** Come to class prepared. Read assigned textbook sections before lectures.
- **Course Outline:** Keep it with you at all times!



Academic Integrity & Plagiarism Guidelines

Plagiarism Policy is strictly enforced at NUST Business School:

- **Similarity Index Limit:** An overall similarity of **19% or higher** is considered plagiarism and gets a score of **zero**.
- **Single Source Limit:** A similarity of **5% or higher with a single source** is treated as plagiarism.
- **Quotes:** Quoted text is included in the similarity index checks.



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- **Collaboration vs. Submission:** Studying in groups is encouraged, but your final submissions must reflect your own individual reflection.
 - **Cheating:** Using unauthorized materials, copying from others, or taking exams for other students will lead to immediate cancellation of sessional work and severe disciplinary action.



Generative AI Usage Guidelines

When AI is ALLOWED (With Disclosure)

- Language, grammar, and formatting improvements of your own drafts.
- Critical human editing and review are mandatory.
- **Disclosure:** Must include a brief statement in your submission detailing which tool was used, when, what prompt was used, and why.

When AI is NOT Allowed

- Generating final answers, text, or reports for assignments/projects.
- Producing mathematical code, data, or analyses.
- **Plagiarism Threshold:** Any submission containing **20% or higher AI-generated content** is marked as **zero**.
- **Accountability:** You are 100% responsible for any AI-induced inaccuracies or hallucinations.



Resources & Consultation Hours

Primary Textbook

- **Applied Mathematics for Business, Economics, and The Social Sciences**

Author: Frank S. Budnick

Edition: 4th Edition

Publisher: McGraw Hill Inc.

- Practice problems will be assigned from this textbook. Mastery requires doing these problems!



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Contact & Consultation

- **Instructor:** Dr. Rizwan Jahangir
- **Office:** Room 207 (First Floor), NBS
- **Regular Office Hours:**
Tuesdays & Wednesdays: **10:30 - 11:30 AM**
(Walk-ins welcome during these hours)
- **Appointments:** Email at rizwan.jahangir@nbs.nust.edu.pk at least 1 day in advance.



Introduction to Linear Equations

Why Linear Equations in Business?

The Real-World Connection

Linear relationships are the simplest and most widely used models in business. They represent constant rates of change, which apply to many baseline commercial activities:

- **Cost Structures:** Relationship between manufacturing volume and total cost.
- **Pricing & Revenue:** Relationship between price per unit and sales volume.
- **Depreciation:** Straight-line decline in asset value over time.
- **Market Dynamics:** Basic supply and demand curves.



Mathematical Characteristics of Linear Equations

Definition of a Linear Equation

An algebraic equation is linear if each term is either a constant or the product of a constant and the first power of a single variable. No variables are multiplied together, and no variables appear in denominators, square roots, or exponents.



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- **General Form (n Variables):**

$$a_1x_1 + a_2x_2 + \cdots + a_nx_n = b$$

where x_i are variables and a_i, b are constants (with not all $a_i = 0$).

- **Two-Variable Representation (Straight Line):**



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- **Two-Variable Representation (Straight Line):**

$$a_1x + a_2y = c \quad \text{or} \quad y = mx + k$$

The graph of a two-variable linear equation is **always a straight line**.



Graphical Representation & Intercepts

To graph a linear equation, we only need **two points**. The easiest points to find are the **coordinate intercepts**.

1. y-intercept

- The point where the line crosses the vertical y -axis.
- Set $x = 0$ and solve for y .
- Coordinates: $(0, y)$.



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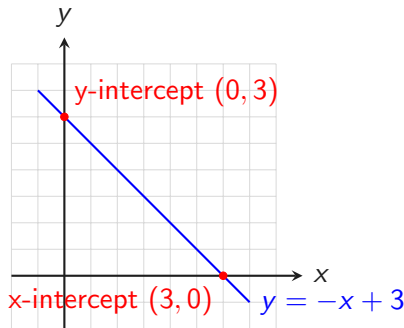
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The Concept of Slope

The **slope** (m) of a line measures its steepness and direction. It represents the **constant rate of change** of y relative to x .

Slope Formula:

Given two points (x_1, y_1) and (x_2, y_2) :

$$m = \frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} \quad (x_1 \neq x_2)$$



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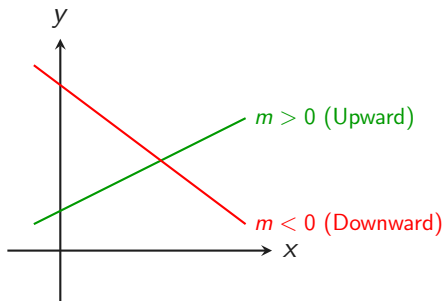
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Four Slope Directions:

- **Positive** ($m > 0$): Rises from left to right.
- **Negative** ($m < 0$): Falls from left to right.
- **Zero** ($m = 0$): Horizontal line ($y = c$).
- **Undefined**: Vertical line ($x = c$).



Slope-Intercept Form

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$$y = mx + c$$

where m is the slope of the line, and c is the y -intercept $(0, c)$.

- **Economic Interpretation:**



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- **Economic Interpretation:**

- ▶ c (**Intercept**): Represents the **fixed component** (value of y when $x = 0$, e.g., fixed cost).
- ▶ m (**Slope**): Represents the **variable component** (the change in y for each 1-unit increase in x , e.g., marginal cost per unit).

- **Graphing:** Start at $(0, c)$, and use the slope $m = \frac{\text{rise}}{\text{run}}$ to locate the next point.



Business Application: Total Cost Model

Suppose a small firm has fixed lease and administrative costs of **\$3,000 per month**, and the variable production cost is **\$20 per unit** produced.

Formulating the Total Cost (C) Equation:

$$C = 20q + 3000$$

where q is the quantity produced and C is total cost.

Interpretation:



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- **Slope (\$20):** Marginal cost. If production increases by 1 unit, total cost increases by \$20.



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Discussion

Discussion Question

What would happen to the graph of the cost function if:

- 1 Lease cost rises to \$4,000? (Shift or Pivot?)
- 2 Production raw materials become cheaper by \$5 per unit? (Shift or Pivot?)



Summary & Homework Assignment

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- MATH-114 is designed to develop quantitative skills for business problem solving.
- Strict attendance (75%), sessional deadline rules, and plagiarism guidelines are in force.
- Linear equations represent constant rates of change (slopes) and baseline scenarios (intercepts).



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Practice Homework (Budnick, 4th Ed)

- Read **Chapter 2 (Sections 2.1 - 2.4)**.
- Complete the following practice problems:
 - ▶ **Section 2.1:** Problems 1–15 (odd)
 - ▶ **Section 2.2:** Problems 5–19 (odd)
 - ▶ **Section 2.3:** Problems 1–11 (odd)
 - ▶ **Section 2.4:** Problems 3–21 (odd)
- These are for practice and are not graded, but they are essential preparation for Quiz 1 in Week 5!

