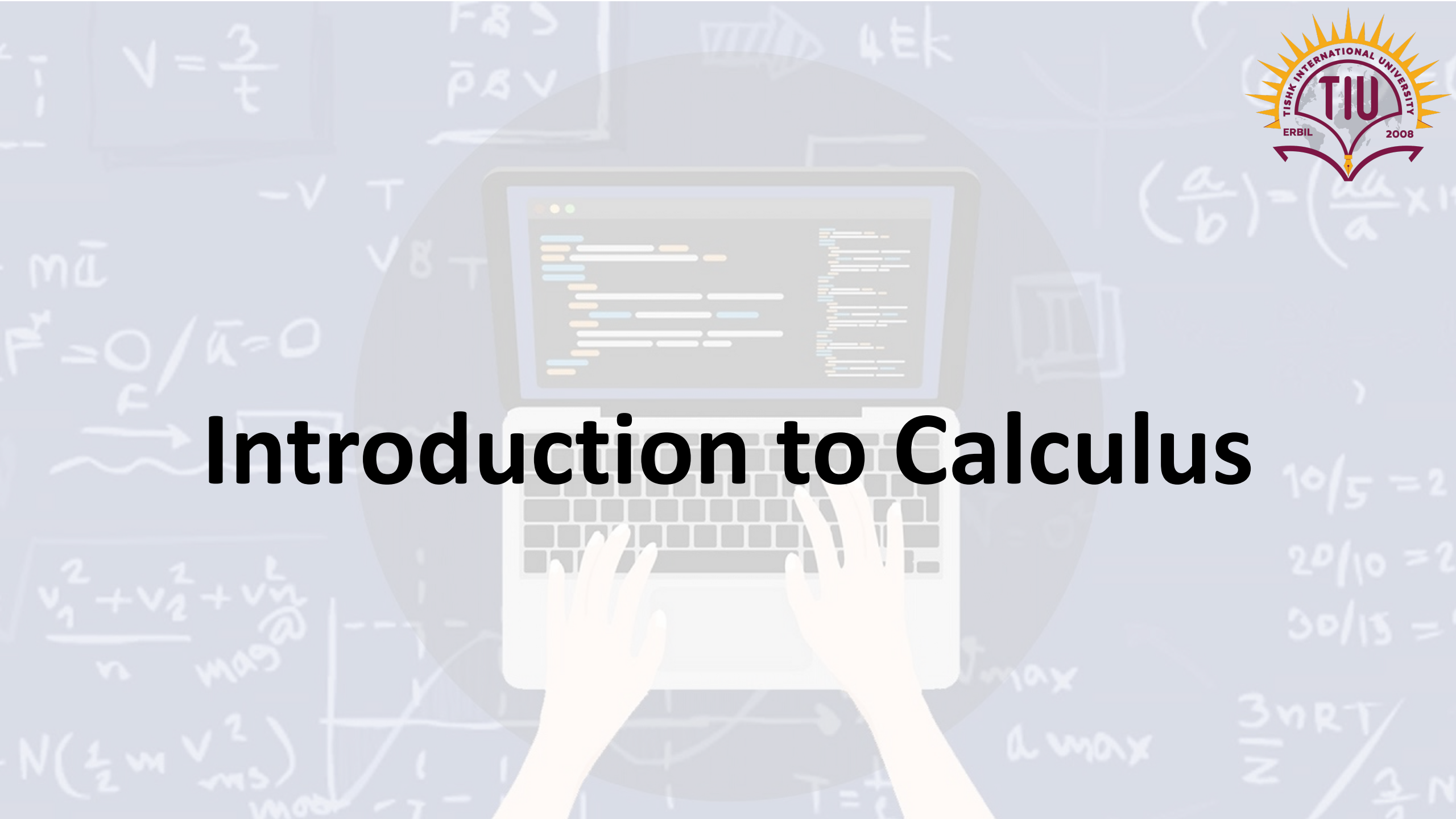


# Introduction to Calculus

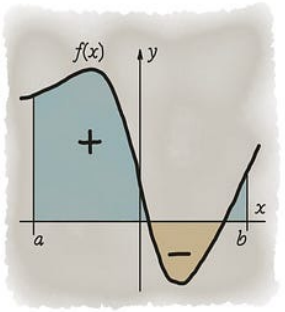
# Class Rules

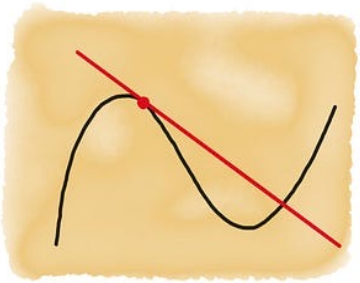
- Students have an obligation to arrive **on time** and **remain in the classroom** for the duration of scheduled classes and activities.
- Students have an **obligation** to write, homework, quizzes and final examinations at the times scheduled by the teacher and university.
- Students have an obligation to show **respectful behavior** and appropriate classroom deportment. Should a student be disruptive and/or disrespectful, **the teacher has the right to exclude the disruptive student** from learning activities (classes) and may refer the case to the Director of Student Services under the Student Code of Conduct.
- **Food** and **Mobile Phones** are **not allowed** in the classroom.
- Should a student leave the classroom during lecture hours, he/she should ask for a permission.

# What is Calculus?

**Calculus** is a branch of mathematics that studies **change** and **accumulation**.

- Studies rate of change. Speed of a car (Derivative = rate of change).
- What is the area under a curve? How much total quantity is built up?
- Basic topics are Real numbers, functions, limits, continuity, derivatives and integrals.

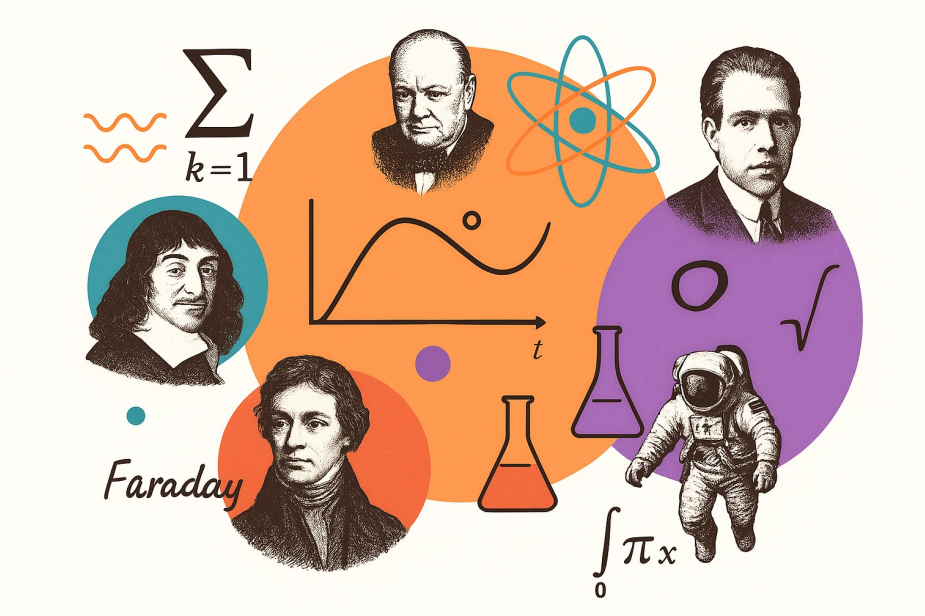


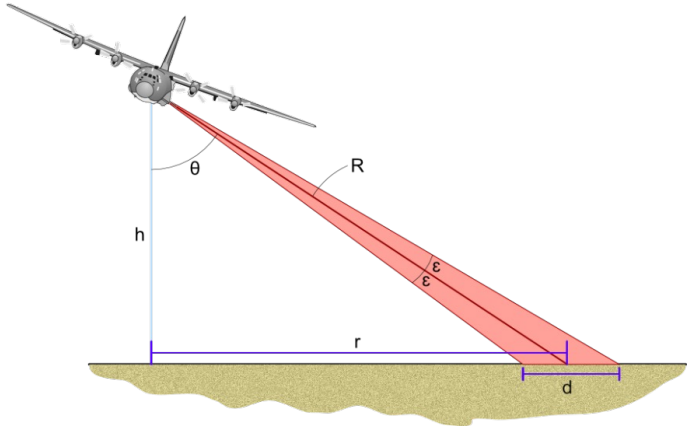
# Where do you use calculus in the real world?

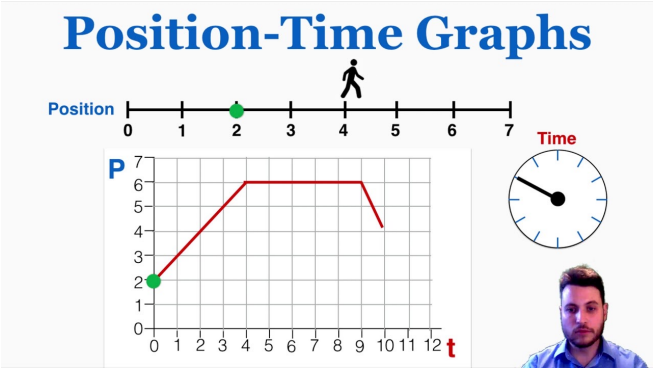
In fact, you can use calculus in a lot of ways and applications. Among the disciplines that utilize calculus include

- Mathematics
- Physics
- Engineering
- Economics
- Statistics
- Medicine
- IT (Information Technology)/Computer Science
- etc.



# In Physics

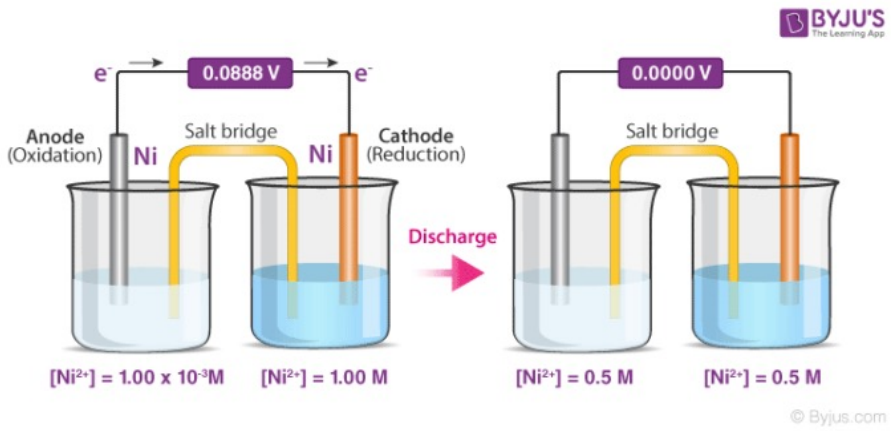


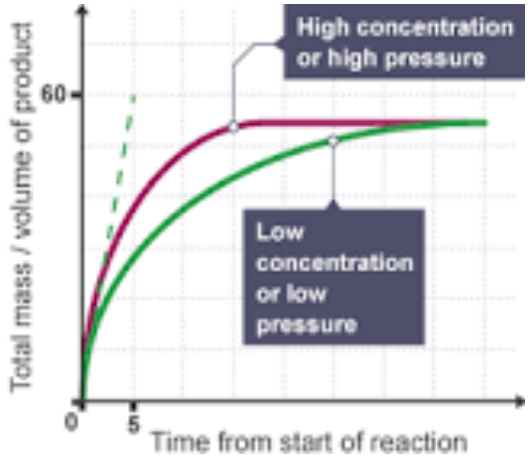




- Among the physical concepts that use concepts of calculus include **motion (**Calculus tells us how fast position changes with time), **electricity**, **heat**, **light**, **harmonics**, **acoustics**, **astronomy**, and **dynamics**.
- In fact, even advanced physics concepts including **electromagnetism** and **Einstein's theory of relativity** use calculus.

# In Chemistry

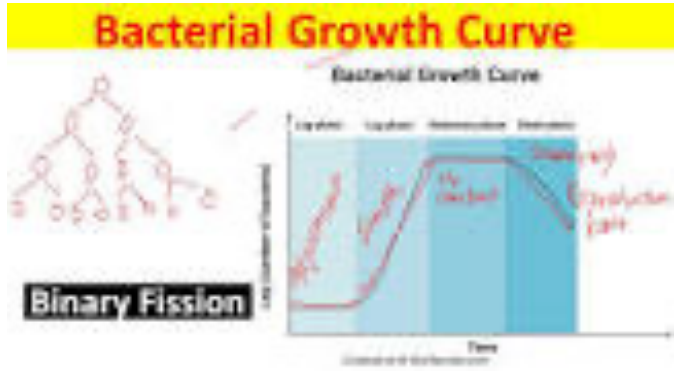
Can be used to predict functions such as **reaction rates**, **Electrochemistry** and **radioactive decay**.



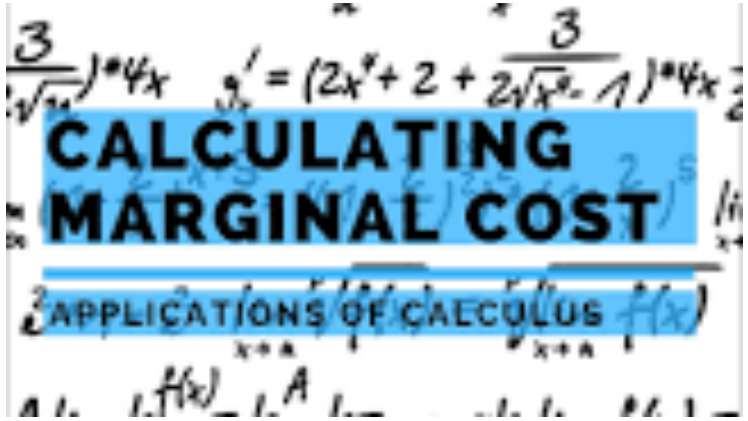
# In Biological Science

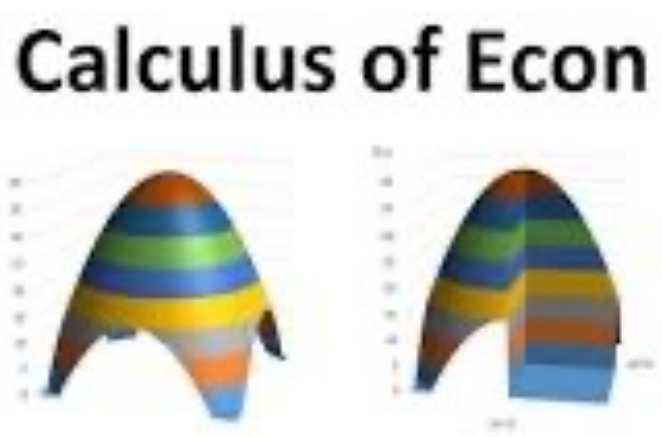
Biologists use differential calculus to **determine the exact rate of growth in a bacterial culture** when different variables such as temperature and food source are changed.



# In Economics

It is used to compute marginal cost and marginal revenue, enabling economists to **predict maximum profit** in a specific setting.

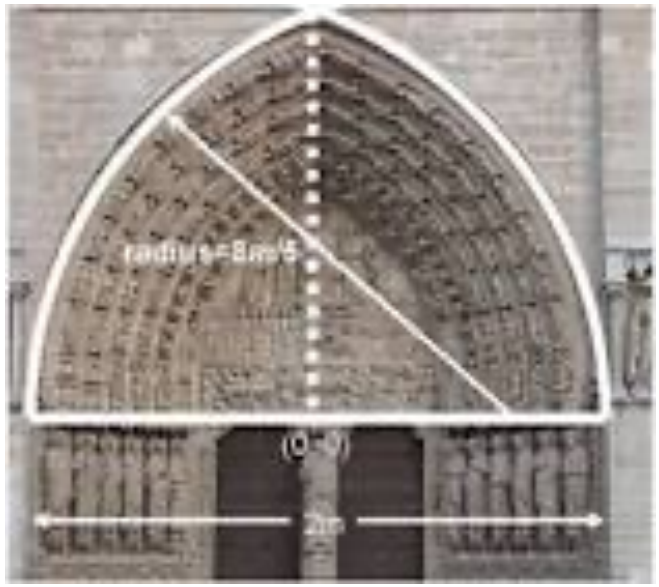


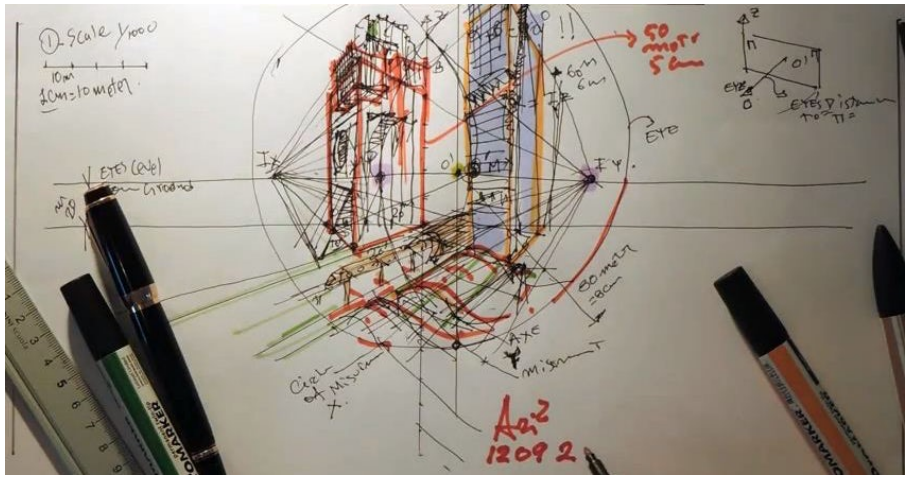



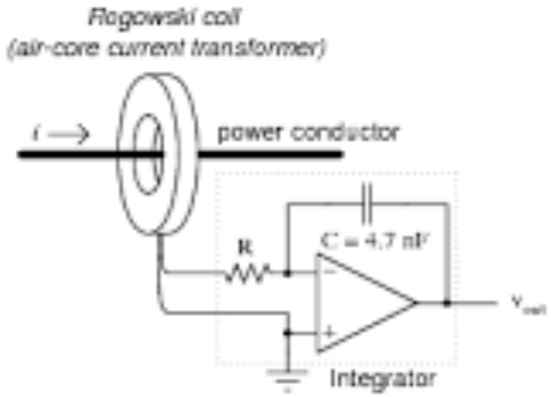
# In Engineering

- An Architect Engineer uses integration in determining the **amount of the necessary materials to construct curved shape constructions**. Calculus is also used to improve the architecture not only of **buildings** but also of important infrastructures such as **bridges**.

- In Electrical Engineering, Calculus (Integration) is used to determine the **exact length of power cable** needed to connect two substations.


radius=8m/5
(0,0)
2m


1 Scale 1/1000
10m
1cm=10 meter
50 meter
5cm
Eye
Axe
Axe
12092

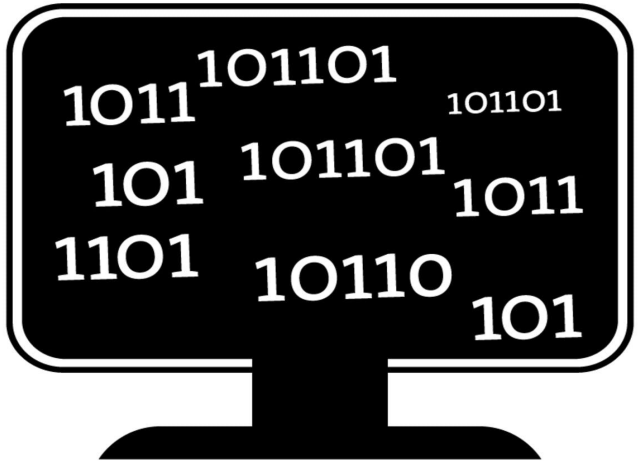

Rogowski coil
(air-core current transformer)
i
power conductor
R
C = 4.7 nF
Integrator

# Further examples

- Credit card companies use calculus to **set the minimum payments due on credit card statements** at the exact time the statement is processed by considering multiple variables such as changing interest rates and a fluctuating available balance.
- Doctors and lawyers use calculus to help build the discipline necessary for solving complex problems, such as **diagnosing patients** or **planning a prosecution case**.
- The field of epidemiology — the study of the spread of infectious disease — relies heavily on calculus. It can be used to determine **how far and fast a disease is spreading**, where it may have originated from and how to best treat it.

# In Information Technology

Calculus is used for **machine learning**, **data mining**, **scientific computing**, **image processing**, and **creating the graphics** and **physics engines for video games**, including the **3D visuals for simulations**. Calculus is also applied in many **software programs** that utilize it



# Course Evaluation Criteria

| | |
|---|---|
| • Quiz | • 15 |
| • Classwork | • 10 |
| • Homework | • 10 |
| • Midterm | • 25 |
| • Final Exam | • 40 |

# High School Topics

- Equations, Inequalities
- Operation properties
- Word Problems
- Powers
- Angles
- Solving the system
- Fractions

- Graphs
- Logarithm
- 2D Shapes
- Arithmetic and Geometric Sequence
- Limits
- Matrices
- Derivatives
- Integrals

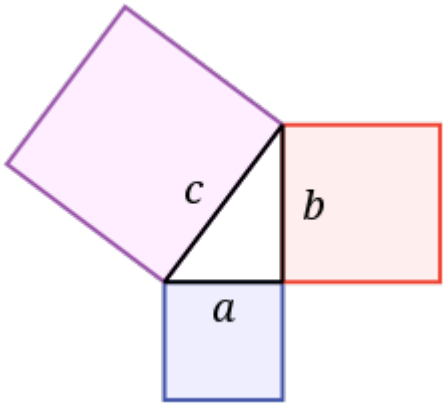
# Fall 2025-2026 Calculus I Syllabus

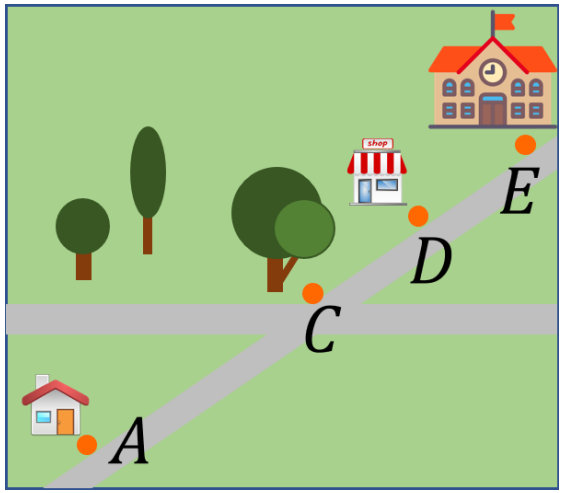
# Week 1 (Pre-calculus)

- Numbers and their representations & Types
- Math Operations
- Scientific Notation
- Significant Numbers
- Factorials

# Week 2 - Week 3 (Pre-calculus)

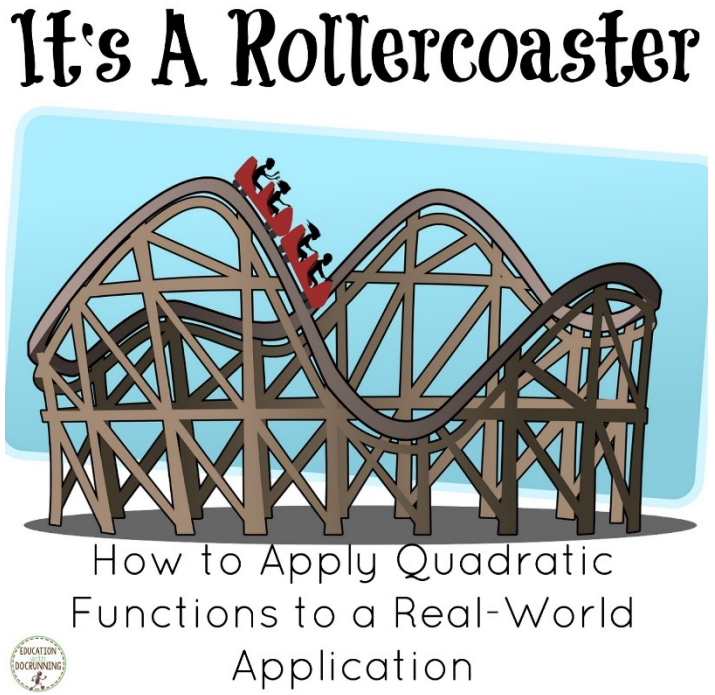
- Squares & Differences of Squares
- Theorem of Pythagoras
- Rationalizing denominator
- Factorization of zero & Inequalities
- Distance, midpoint & Absolute Value
- Lines and Circles and their equations





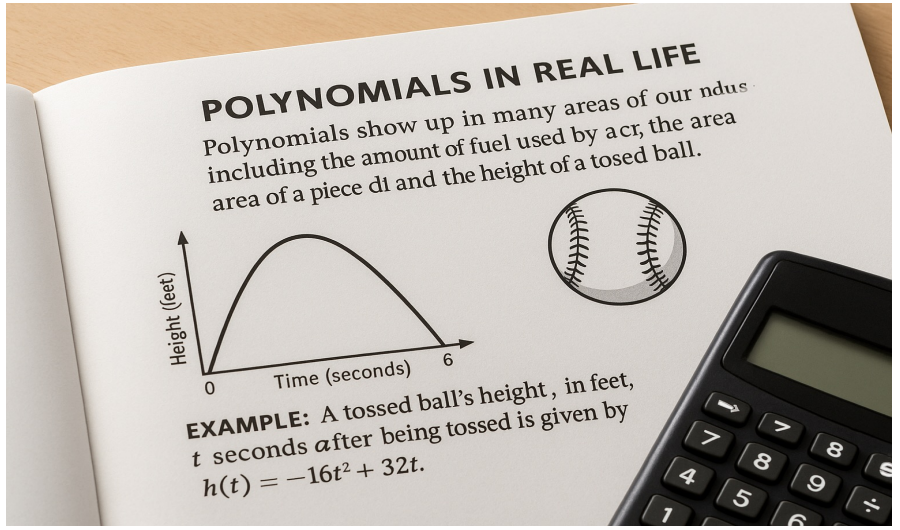
# Week 4 (Pre-calculus)

- Quadratics and their graphs
- Exponential and Logarithmic Functions

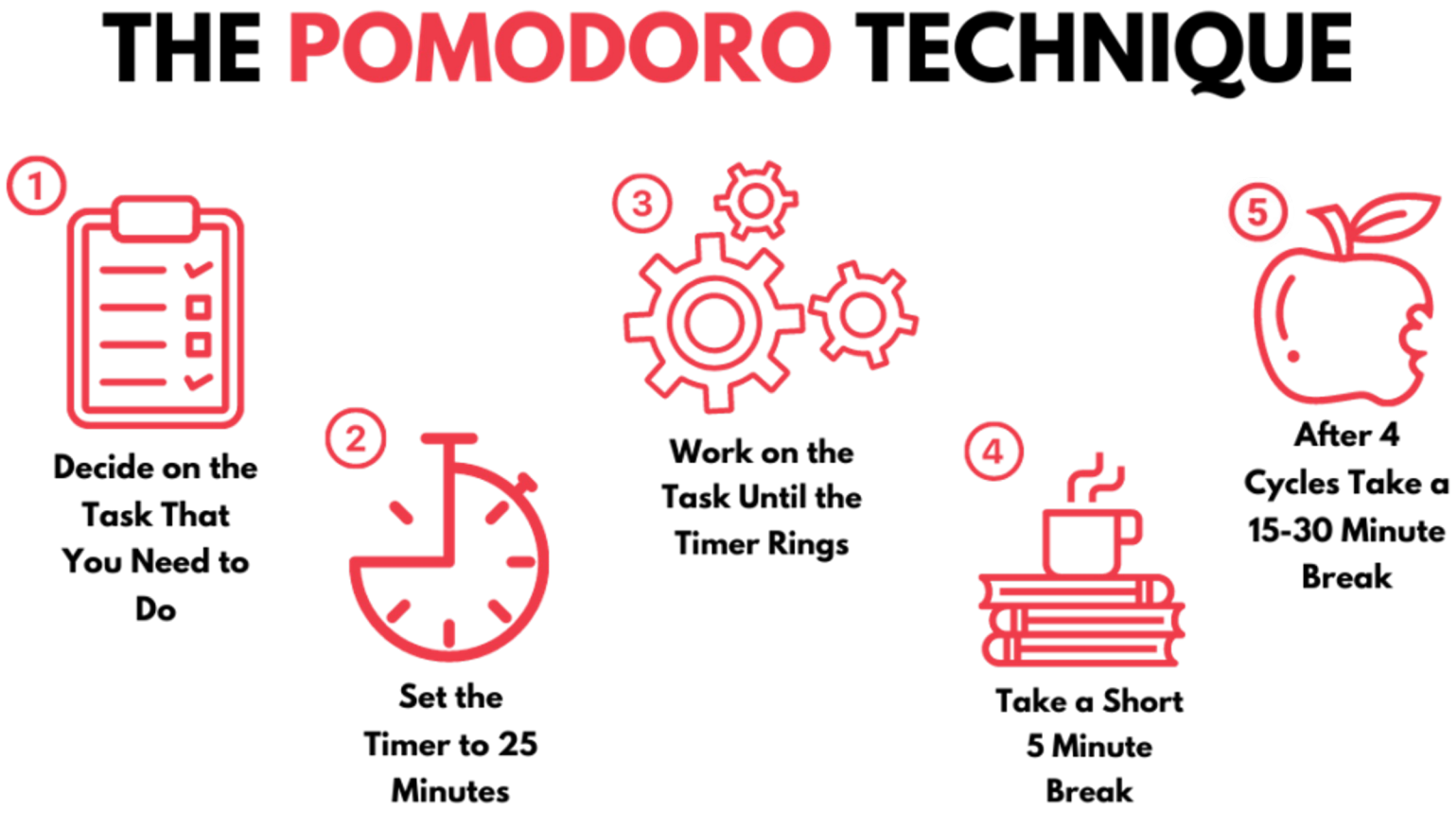


# Week 5 – Week 6

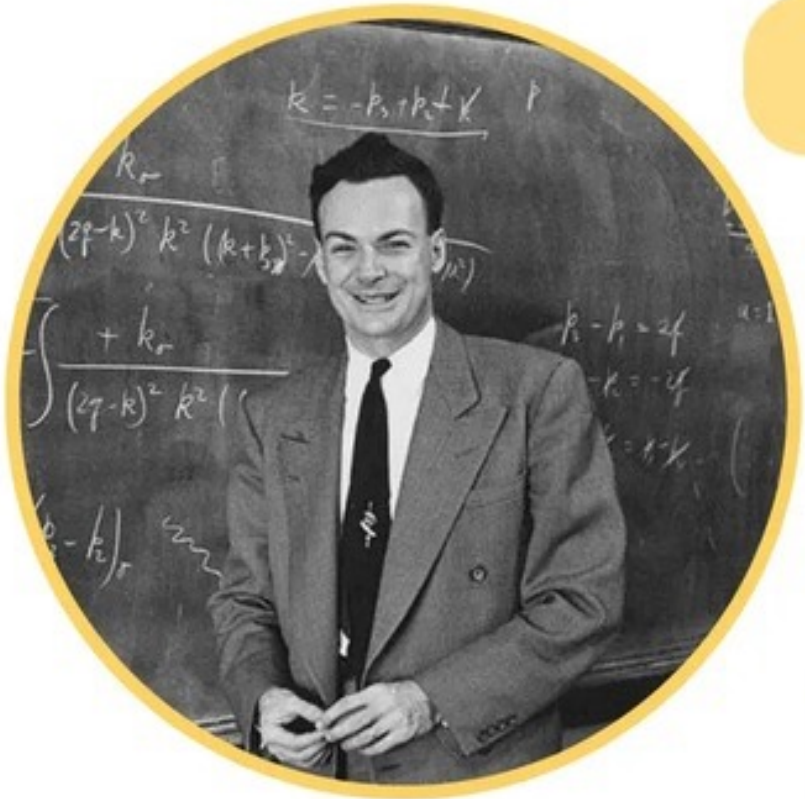
- **Polynomial Functions**
- **Composite Functions**



The **Pomodoro Technique** is a **time management method** that helps you work efficiently by breaking tasks into short, focused intervals with regular breaks. It was developed by **Francesco Cirillo** in the late 1980s.



# Feynman Technique



1. Choose a concept
2. Teach it to yourself or someone else
3. Identify gaps in your knowledge
4. Review the material and simplify it

Product Fish

# Utilize Technology Wisely

- Use digital tools and apps to help you study, but don't let them distract you.
- Online resources like Khan Academy, Coursera, or AI can supplement your learning.

# Seek Help When Needed

- Don't hesitate to ask teachers, professors, or peers for clarification when you're stuck.
- Utilize available resources such as tutoring services or office hours.