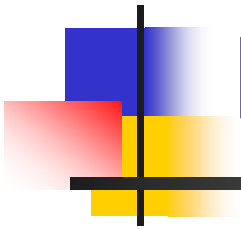
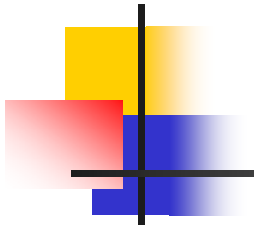


# MP 221 Engineering Analysis II

Dr. Mohamed Omar Abdelgawad



# Lecture outline

- Know your instructor
- Why do we study mathematics?
- Course outline
- General advice

# Know your instructor

- Dr. Mohamed Omar Abdelgawad
  - B.Sc from Assiut University (1998)
  - M.A.Sc from Concordia University, Canada, in 2003.
  - Ph.D from University of Toronto, Canada, 2008
  - Assistant professor in Mechanical Engineering Department, Assiut University since 2010.
- Office: 2nd floor – Heat laboratory
- E-mail: mogawad@aun.edu.eg (put MP221 in the subject line of your e-mail)
- Website: www.assiutmicrofluidics.com

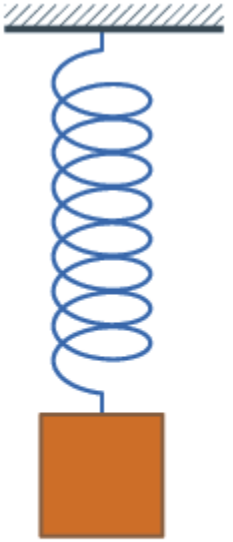
# Why do we study mathematics?

- No one invented mathematics
- Mathematics was developed to describe different physical phenomena.
- Scientists say ”math is the grammar and vocabulary of science”

# Example: modeling of mechanical vibrations

- Vibration of any system can be presented by differential equations:

$$m\ddot{x} + kx = 0$$

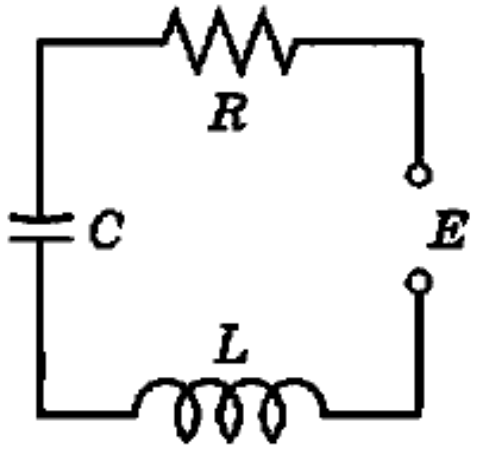


- You have to solve this differential equation to find the displacement as a function of time.

$$x = A\cos(t) + B\sin(t)$$

# Example: analysis of electric circuits

- The current in an RLC electric circuit can be found by solving a differential equation:




$$L\ddot{I} + R\dot{I} + \frac{1}{C}I = \dot{E}$$

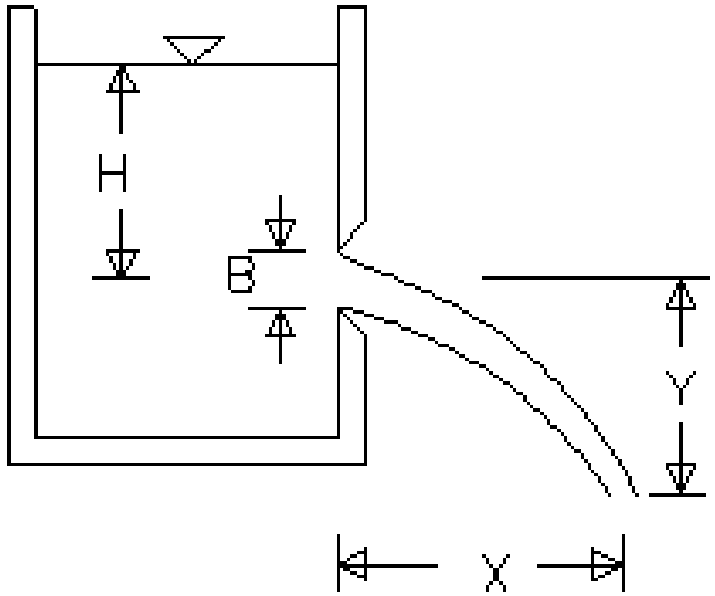
- The solution is:

$$I = Ae^{s_1 t} + Be^{s_2 t}$$

# Example: Fluid mechanics

- Liquid discharge from a tank is governed by a differential equation:

$$\frac{dH}{dt} = k\sqrt{H}$$




- Which yields:

$$H = \frac{1}{4}k^2 t^2 + C$$

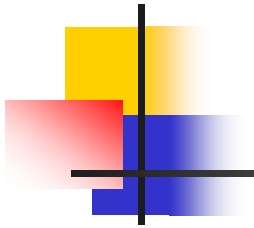
# Example: Fourier series

- Fourier series were introduced by Joseph Fourier for the purpose of solving the heat equation

$$\frac{\partial}{\partial x}\left(k\frac{\partial T}{\partial x}\right)+\dot{q}=\rho c\frac{\partial T}{\partial \tau}$$

- The heat equation was only solvable for heat sources in the form of a sine or a cosine wave.
- By introducing Fourier series, any function can be represented by sine and cosine waves.

$$f(x) = a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx)$$



# Example: The Manhattan Project

- Many of the math handbooks of integrals and transforms were produced during the Manhattan project which developed the first atomic bomb

# Course outline


Adobe Acrobat Document

# تحذير

- "من غشنا فليس منا" صحيح مسلم
- "صن لسانك عن الشر و شفتيك عن التكلم بالغش" سفر المزامير 13:34
- سيعاقب الغش أو النسخ بأقصي عقوبة ممكنة

# General Advice

- Do not take older students' advice for granted
- Work hard
- Do not fear the unknown
- Success is not only about high marks
  - Participate in student activities
  - Join a sport team
  - Volunteer

# Any questions or suggestions?