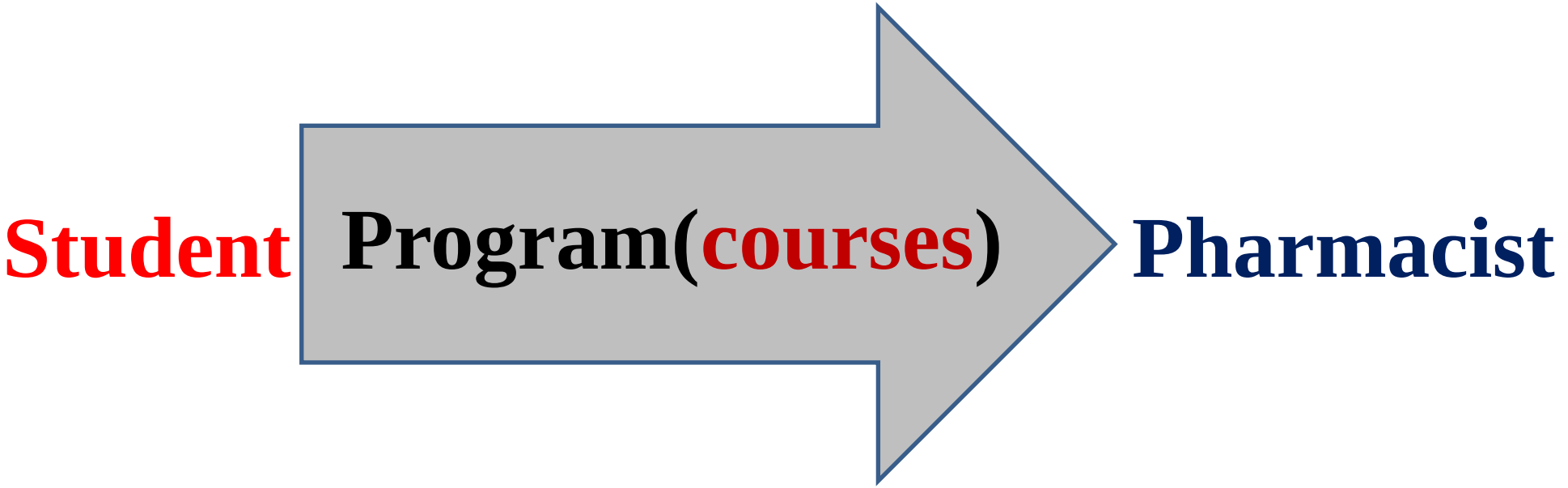
# Dr. Mohamed Husien Eid

## Mathematics Department

## Faculty of Engineering – Shoubra

## Benha University




## Scientific Approach: المنهج العلمى

# To create new يبدع

| | |
|---|---|
| Invent | يخترع |
| Innovate | يبتكر |
| Discover | يكتشف |
| Clarify | يوضح |
| Specify | يصف |
| Refine | يهزب / ينقح |
| Develop | يطور |

# Intended Learning Outcomes (ILO's)

1. **Knowledge and Understanding**
2. **Intellectual Skills**
3. **Professional and Practical Skills**
4. **General Skills**

# Course Aims

- Provide the students the concepts of Functions and Algebra of Matrices and their applications in pharmacy.
- Apply mathematical techniques for modeling, solving and analyzing real problems.

# Contents

## Calculus

- **Functions of single variable**
- **Differentiation**
- **Integration**
- **Application:**

  **Rate of change of concentration of drug in blood**

# Algebra

- **Matrices**
- **Linear Systems**
- **Applications:**

1. **Dilution problem**
2. **Matrix of Chemical Compounds**
3. **Curve Fitting**

# Weighting of assessments

- **Final-semester exam** **60 Marks**

**(Minimum Pass Mark : 24)**

- **Mid-semester exam** **20 Marks**
- **Quizzes** **10 Marks**
- **Assinments** **10 Marks**

**Total** **100 Marks**

# List of References

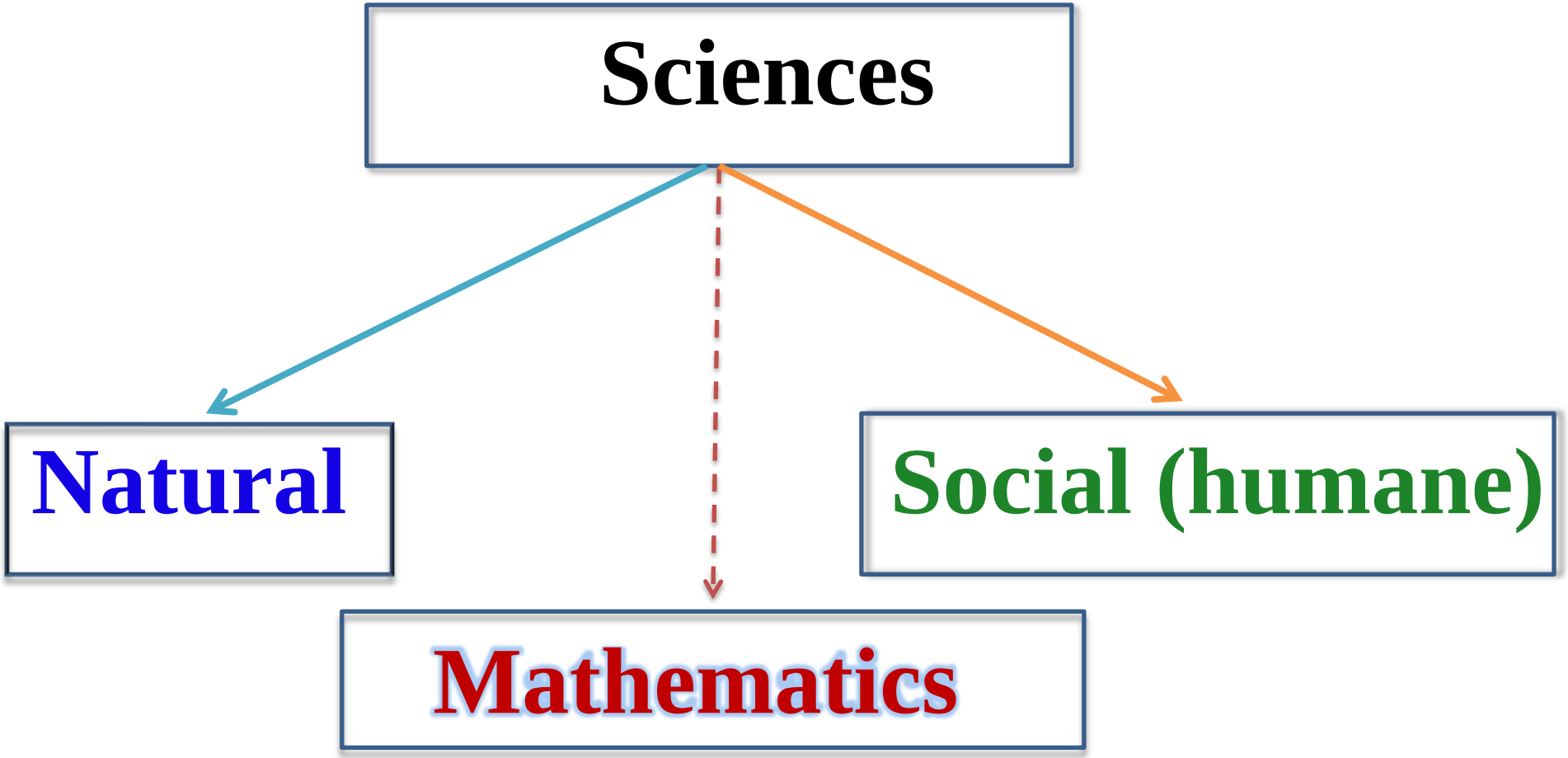
## 1- Course Notes

- Lectures In Mathematics For Pharmacy Students,

Mohamed Eid, Benha University

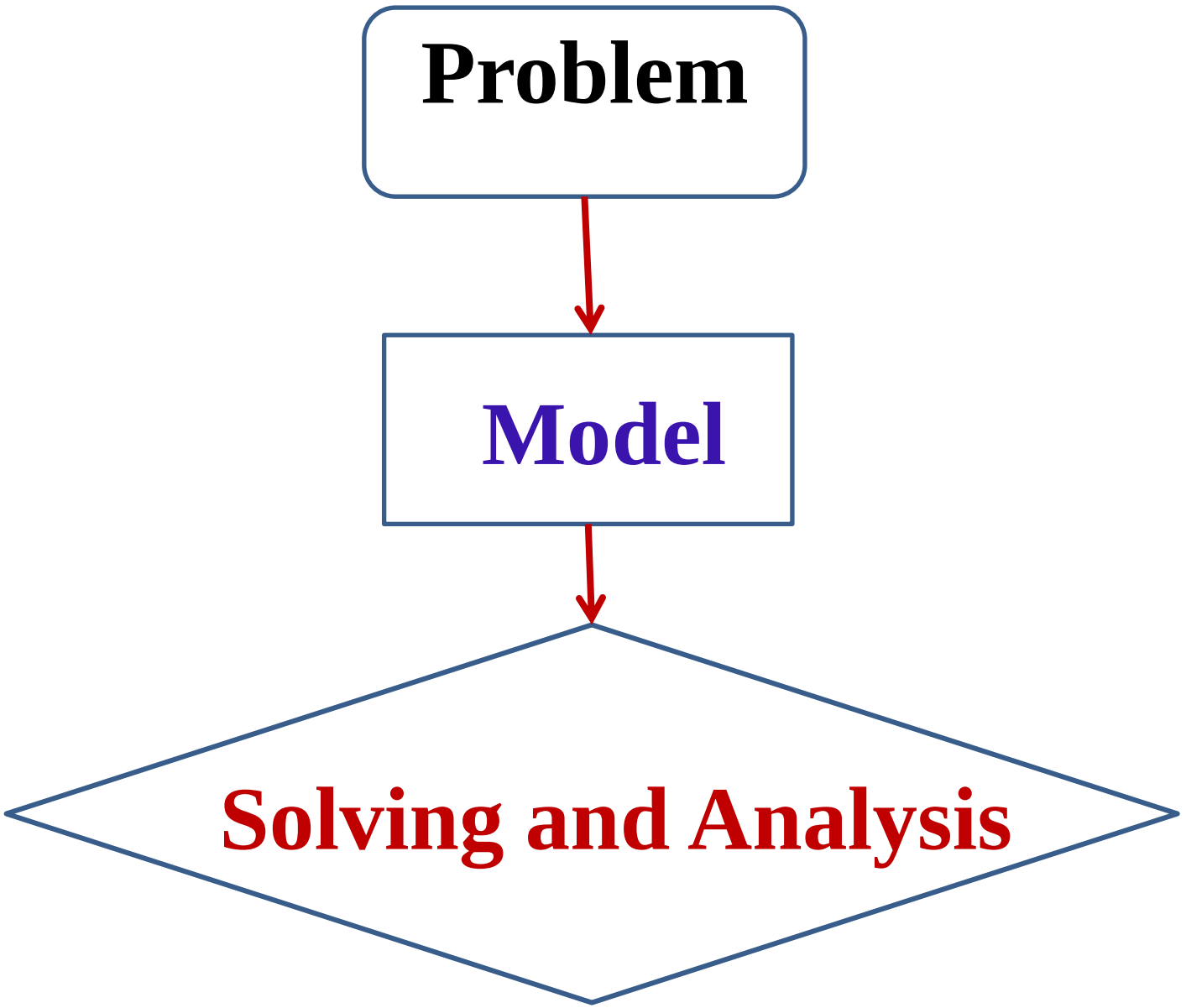
# 2- Text Books

- "Calculus", 6th Edition, James Stewart, Thomson Brooks / Cole, U.S.A, 2008.
- "The Theory of Matrices", 2nd Edition, P.Lancaster and M.Tismenetsky, Academic Press, London, New York, 1985.




Mathematics is the science of modeling and treatment problems and phenomena via explicit criteria

# Mathematics



# Rate of Change

**Example1:** An amount of sugar (100 gm) in solution is decomposed in a chemical reaction into other substance through the presence of acids, and the rate at which the reaction takes place is proportional to the mass of sugar still unchanged.

Write the mathematical model.

Find the time at which all amount is decomposed

تتحلل كمية من السكر (100 جم) في محلول في تفاعل كيميائي إلى مادة أخرى من خلال وجود الأحماض،

و معدل التغير يتناسب مع كتلة السكر المتبقية.

The original amount of sugar is 100 gm.

Assume that **x** is the amount of sugar converted at time t.

Then **100 – x** is the amount still unchanged

Then $\frac{dx}{dt} = k(100 - x)$, K is constant, k =1

Then $\frac{dx}{x - 100} = -dt$

Then $\ln(x - 100) = -t + c$

Then $x - 100 = e^{-t+c} = C.e^{-t}$

The decomposition starts when $t = x = 0$

Then $0 - 100 = C.e^{0} = C$

Then $x = 100 - 100e^{-t}$

Then $x(t) = 100(1 - e^{-t})$

is the mathematical relation.

(Increasing relation)

From $x(t) = 100(1 - e^{-t})$

| t / minute | x / gm |
|---|---|
| 0 | 0 |
| 1 | 63.2 |
| 2 | 86.5 |
| 4 | 98.2 |
| 5 | 99.99 |

All amount of sugar is converted when x = 100 gm, t approaches infinity

# Example 2: Mixing Solution

A tank contains 100 liters a brine solution containing 20 kg of salt. At time t = 0, fresh water is poured into the tank at rate 4 liters per minute while the well mixture leaves the tank at the same rate.

Determine the amount of salt in the tank at any time t.

خزان يحتوي على 100 لتر محلول ملحي يحتوي على 20 كجم من الملح. في الزمن t = 0، يتم سكب المياه العذبة في الخزان بمعدل 4 لتر في الدقيقة بينما الخليط المخفف يخرج بنفس المعدل.

If $S$ is the amount of salt in kg at any time

The concentration in kg in liter is $S/100$

Then $\frac{dS}{dt} = -4\frac{S}{100} = -0.04\,S$

Then $S(t) = e^{-0.04t+k} = m.e^{-0.04t}$

At $t = 0$, $S(0) = 20 = m.e^{0}$. Then $m = 20$

Then $S(t) = 20e^{-0.04t}$

is the mathematical relation.

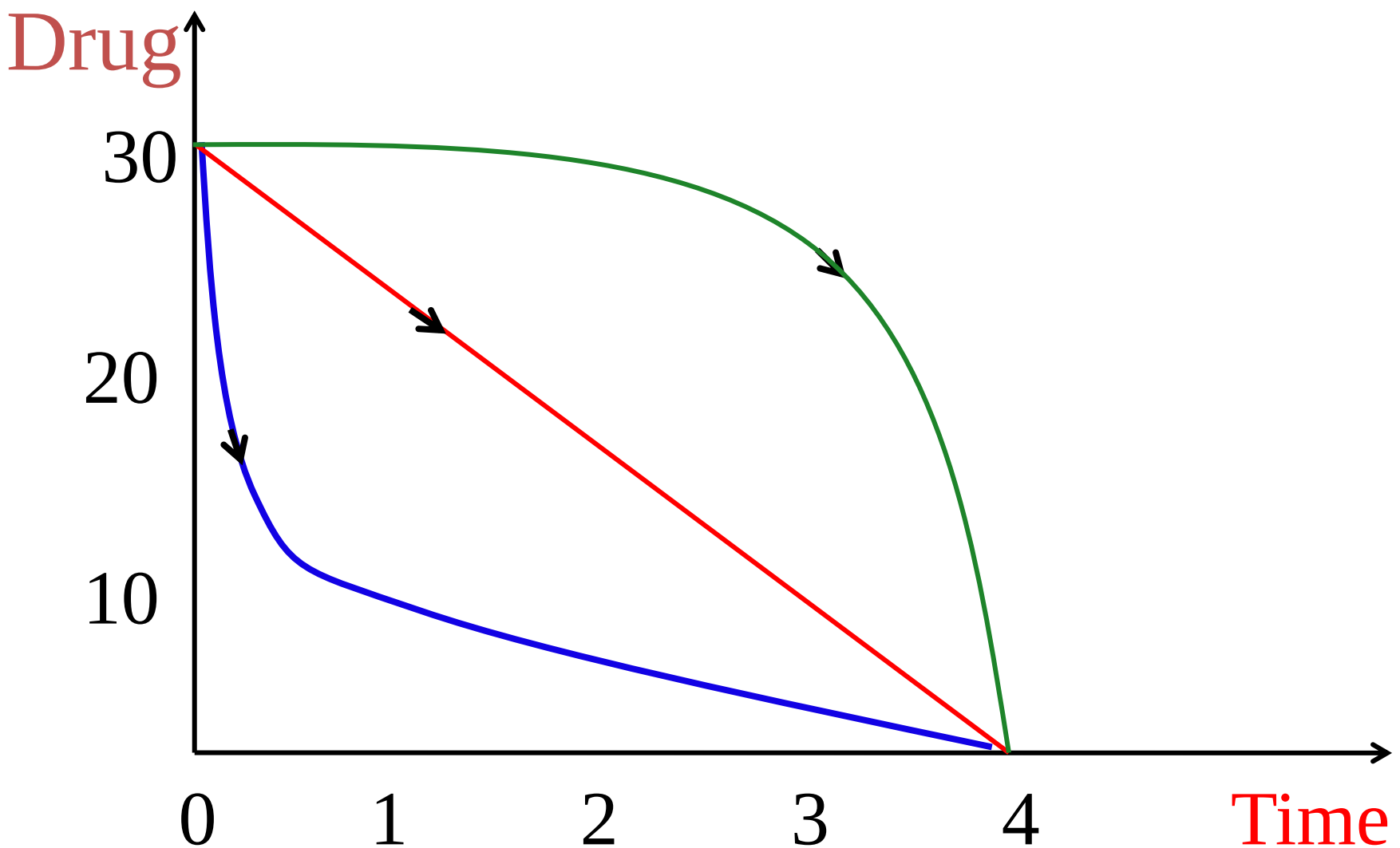
(Decreasing relation)

From $S(t) = 20e^{-0.04t}$

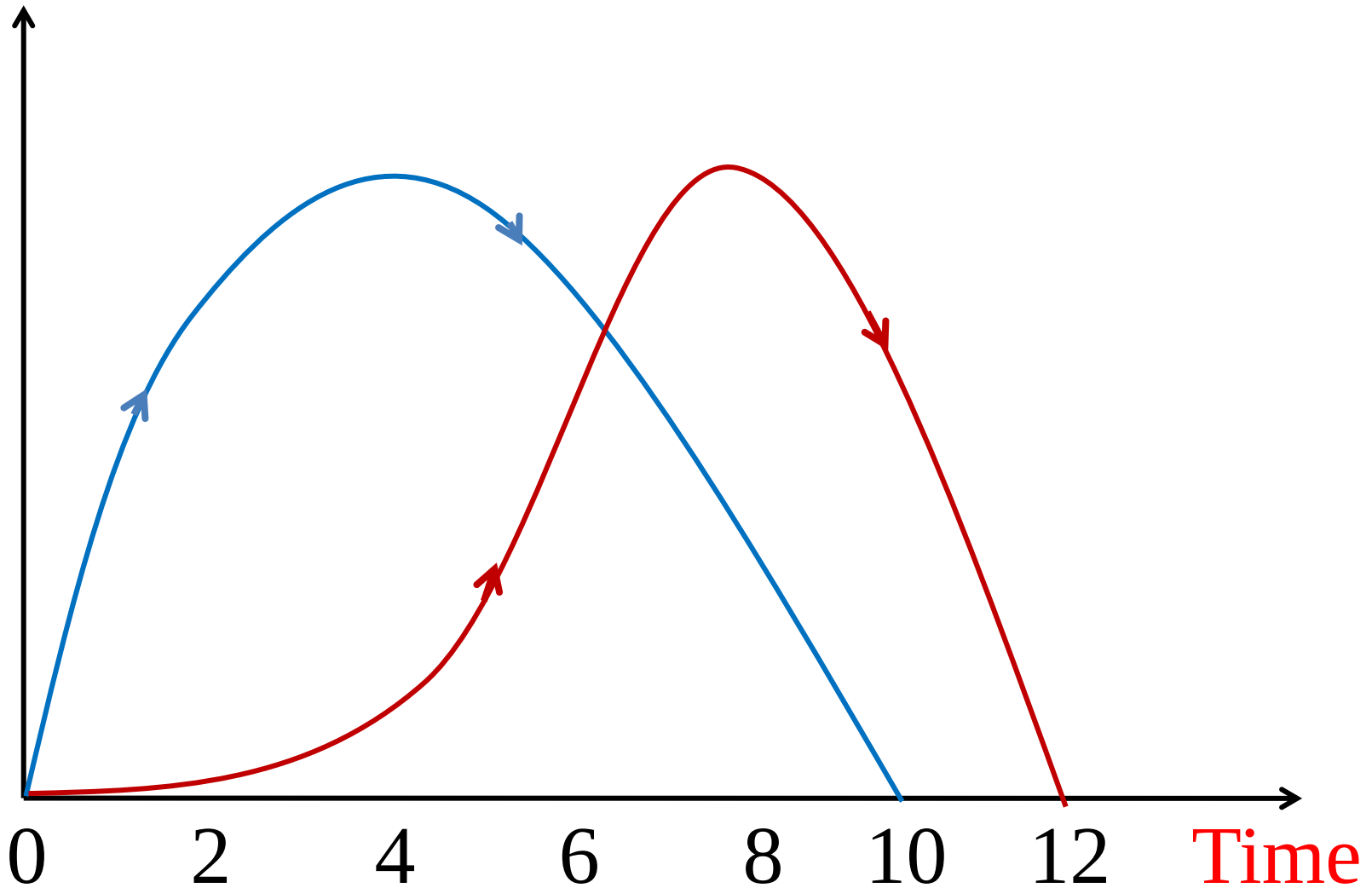
| t / minute | S / Kg |
|---|---|
| 0 | 20 |
| 1 | 19.22 |
| 2 | 18.46 |
| 10 | 13.4 |

The amount of salt in solution is 0 when t approaches infinity

# Rate of Change of Concentration



# Effectiveness of Drug



# Dilution

## Example

A drug is available in two forms:

The 1st of concentration 1 mg / tablet

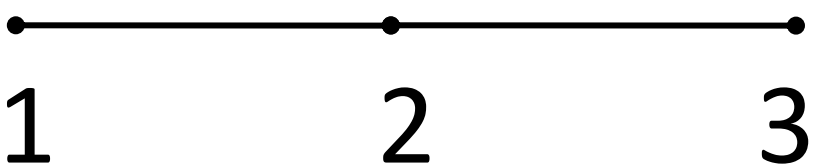
The 2nd of concentration 4 mg / tablet

How to prepare a number of tablets (say 10) of concentration 3 mg / tablet ?

# Properties of Chemical Compounds

$CH_2 = CH - CH_3$

- The molecular graph:




- The matrix:

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

Write a brief summary of this lecture and what you want from this course.

أكتب نبذه مختصرة عن هذه المحاضرة

و ما تريده من هذا المقرر.

# Thank You

$1 \times 9 + 2 = 11$

$12 \times 9 + 3 = 111$

$123 \times 9 + 4 = 1111$

$1234 \times 9 + 5 = 11111$

$12345 \times 9 + 6 = 111111$

$123456 \times 9 + 7 = 1111111$

$1234567 \times 9 + 8 = 11111111$

$12345678 \times 9 + 9 = 111111111$

$123456789 \times 9 + 10 = 1111111111$