MATHEMATICS FOR PHARMACY STUDENTS

Year 2019/2020

Lecturer, coordinator: János Karsai Ph.D, associate professor

Teacher of practices:

Dávid Mezőfi, Assistant professor

Dániel Papvári, MSc student

Hours

Fall semester, 2+2 hours/week

Goals

To teach the mathematical concepts and methods needed for the later professional work of the students, to improve the students' logical and visual thinking, ability for creative problem solving.

Teaching method

The theory is illustrated by practical applications. The geometrical, physical, etc. meaning is emphasized. Computer applications and experiments are applied.

Expected knowledge

A good level of knowledge of the standard high school mathematics is needed.

Topics: Sets and logic, real numbers, and its properties, absolute value, operations on fractions, powers, logarithm; equation and inequalities: graphical interpretation and solving; linear and quadratic equations; vectors and coordinate systems; concept of functions, elementary functions and their properties: linear, quadratic, trigonometric exponential and logarithmic functions. Knowing some informatics is useful but not expected.

To estimate the preliminary knowledge the students write an anonym test on the first lecture. In the lack of an acceptable level of knowledge, the students should attend consultations organized regularly.

Detailed program, the main topics of the lecture:

Basic concepts: Percentage, mixture problems; sets, numbers, intervals, relations, functions. Elementary properties of functions: domain, range, graph, even/odd functions, periodicity, boundedness, monotonity, concavity, maxima and minima. Compositions, one-to-one functions, inverse function.

Elementary functions in the life sciences: Arithmetical and geometrical growth, power functions, exponential and logarithmic functions, trigonometric functions.

Graphical study of functions and practical processes: elementary and logarithmic transformations, logarithmic plots.

Applications of Calculus in life sciences: Intuitive concept of limits; Continuity Instantaneous growth rate, derivative: definition, general and geometrical meaning, equation of the tangent line. Second derivative, acceleration and concavity. Differentiation rules. Applications: Relation between the growth and concavity and the derivatives, graphical and numerical study. Find maxima, minima and the maximal growth rate. Investigation processes in Pharmacy.

Antiderivative, indefinite integral: inversion of differentiation, understanding vector fields. simple integration methods and rules

Definite integral: geometric meaning (area under curve), and formal definition. Elementary properties and rules. The integral mean value. Simple numerical methods of integration. Area function, Newton-Leibniz formula. Applications in Pharmacy

Functions of several variables: graphical methods, partial derivatives and their geometrical meaning. Local minima and maxima. Curve fitting with the least square method, linear regression.

Differential equations in Pharmacy: basic properties, vector fields, initial value problems, equilibria. Autonomous systems. Graphical study. Solution in case of separable right hand sides. Linear equations, exponential decay. Logistic equations. Some external effects and their meaning in life sciences. Equations of drug elimination, dosing, infusion, population dynamics.

Practice:
Exercises, practical problems concerning the theoretical topics (see the topics of the lecture).

Literature, handouts

- http://www.model.u-szeged.hu/kurzus-3-1-mathematics_for_pharmacy_students.html
  Login needed (login name and password will be given on the lecture)
- Karsai J., *Problems in mathematics, exercises in Mathematica*
- Karsai J.*, Mathematics lecture illustrations for pharmacy students in Mathematica*
- Karsai J., *test problems from the previous years and sample exam sheets*
- Krisztina Boda and János Karsai: *Mathematics Exercises and problems*
- János Karsai et al: *Exercises for the Mathematics practical for Pharmacy students*
- Tibor Asztalos: *Mathematics for 1st year Pharmacy students*

Conditions

- ***Attending the lectures and practices is obligatory (See the general regulations). In case of more than 3 absences the student is not evaluated, the course is uncompleted.***
- Students must not use any tools, such as handouts, notes, calculators during the tests and exams.
- Students must turn off calculators and mobile phones before starting the tests.
- Using illegal tools is followed by disciplinary process, and the result is failed.
- *The exam is based on the lectures and practicals. The printed and electronic lecture notes and handouts are only additional materials.*
- All the information and handouts can be found on the webpage
  http://www.model.u-szeged.hu/kurzus-3-1-mathematics_for_pharmacy_students.html
- Teachers and demonstrators regularly give consultations.
- Students have to prepare and study for the classes, test and exams. Students are responsible for the consequences of missing the preparation.

Essential-Knowledge-Criterion

Students must know the following topics correctly.

- Percentage, mixture problems (including arithmetic!)
- Algebraic operations (fractions, powers, solving equations)
- Identities of logarithms, working with logarithmic and exponential
- Straight lines, equations and graphing
- Graphs of power, exponential and logarithmic functions
- Definition and graphical meaning of derivative
- Definition and graphical meaning of indefinite and definite integral

If any error occurs concerning them

- in the tests: the point is zero of the problem, where it happened;
- in the exam: the result is “failed” independently of the previous achievement. The knowledge of them does not mean automatically „passed”.

Evaluation of practice

Continuous evaluation: Knowledge is tested steadily in the form of quizes and homeworks. Activity on the classes is also evaluated. Ten quizes will be written, maximal points are 100. Homeworks and evaluation of activity (good solutions, working at blackboard) are evaluated by max. 20 points in the semester.

Tests: twice in a semester (end of October, first week of December) students (all together) write a 100 minutes long test (100 point each).

The first test is separated into a “fundamental” and “advanced” part (50-50 points). The minimal score of the “fundamental” part is 70% (35 points). Students who do not reach this level can repeat this part ONLY ONCE during the semester. Normal 5-level grading is done at the end of the semester.

Final practical grade: is summed from the results of the tests (max. 50+50+100 points), quizes (max. 100 points) and activity (max. 25 point). In the case of failed "fundamental" test, the final mark is also failed. Otherwise, the result is (test1+test2+quize)/3 %, maximum 300/3 %, and the mark is given as follows:

failed:	points < 150
passed:	150 ≤ points < 185
acceptable:	185 ≤ points < 220
good:	220 ≤ points < 255
very good:	255 ≤ points

Students having result between 40% and 50% can write ONE common corrective test including all the topics. Minimum level is 60%.

Evaluation of theory: *Colloquium in the exam term*

The exam has an **introductory** and **main** part:

Introductory part: written problem solving, 20 minutes, minimum level is 75%. *Solving mixture problem is obligatory!*
Contents:

1. mixture problem
2. plotting of elementary functions
3. elementary transformation of functions
4. logarithmic plotting

Main part: written, 90 minutes

Contents:

1. Comprehensive working-out of a theoretical topic (Series A, 40 points)
2. Comprehensive working-out of a theoretical topic (Series B, 40 points)
3. Formulation of a definition or theorem, practical problem (10 point)
4. Formulation of a definition or theorem, practical problem (10 point)

Evaluation: failed under 50 points or if the result of topic 1 or 2 is under 10 points. Otherwise, the mark is calculated as for the practical mark.

Repeating exams: In case of failing, the complete exam (both the introduction and main part must be repeated.

Szeged, September 1, 2019

János Karsai PhD