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## REVIEW OF HANDBOOK “HIGHER MATHEMATICS” (ОГЛЯД-ПРЕЗЕНТАЦІЯ НАВЧАЛЬНОГО ПОСІБНИКА “ВИЩА МАТЕМАТИКА”)

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*Розглядаються особливості побудови навчального посібника з вищої математики (англійською мовою) як основної складової методичного забезпечення процесу навчання математичним дисциплінам студентів спеціальностей “Менеджмент зовнішньоекономічної діяльності” та “Міжнародна економіка” в умовах кредитно-модульної системи організації навчального процесу.*

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The Handbook “Higher Mathematics” is the main component of the methodical complex supporting International Project “Partnership in International Business”, that has started at the University since 1999.

This project is aimed at students majoring in “Management of Foreign Economic Activities” and “International Economics” which study the mathematical courses in English. That result in necessity of writing the handbook “Higher Mathematics”, which meets the requirements of the curricula for corresponding field of professional training students doing their Bachelors Degrees.

The handbook contains more than amplex material for the first semester of four-part mathematical course subject to the credit-module organization teaching process at the University.

Our goal was to write a handbook that prepares students to succeed in advanced Mathematics courses, such as Probability Theory and Mathematical Statistics, Mathematical Programming and Operation Research.

We believe that Higher Mathematics achieves this goal because of its successful blending of two elements: content and pedagogy. We present comprehensive, in-depth, and precise coverage of the topics of higher mathematics into a framework of tested

teaching strategy combined with carefully selected pedagogical features.

This handbook was developed from dual concerns we have as educators: appropriate level of the material and the ability of students to master that material.

As teachers we are concerned with some things. First, whether the course material corresponds the right level, not too high, and not too low? Second whether the students are prepared to work at the level needed for this course? Third, which criteria can adequately determine the proper level? Finally, do we provide sufficient preparation students for the next course?

Three criteria have been used to determine the level of the handbook: topical coverage, which can range from partial to comprehensive; depth of coverage, which can range from an overview to an in-depth treatment; and ease of use, which includes the structure of the presentation, reading level, use of examples, a hast of pedagogical elements, and ancillary materials.

The Higher Mathematics handbook is organized into 9 chapters starting with standard topics in mathematics and ending with chapter summary, involving examples of the module tests.

The handbook covers basic areas of Linear Algebra, Vector Algebra, Analytic

Geometry, Differential Calculus, Integral Calculus, Ordinary Differential Equations, Infinite and Power Series and Differential Calculus (several variables).

Each chapter of the handbook begins from the Learning Objectives that help the students to determine the main concepts of this chapter. As example we reduced the Learning Objectives for Chapter 1. Linear Algebra.

- Learning Objectives
- Your study of this chapter will enable you to do the following:
1. Define the key attribute of the matrix theory: definition, classification, sum and difference, scalar multiplication and matrix product.
  2. Define the term of determinant and know the algorithm for its computing.
  3. Explain the difference between the matrix and the determinant.
  4. Find the necessary condition for matrix to be nonsingular.
  5. Give examples of the matrices applications.
  6. Describe the general form of a system of linear equations and the nature of their solution.
  7. Apply different methods for solution of system of the linear equations.

This handbook concentrates on notions, definitions, formulas and results. It also focuses emphasizes on concepts and methods with application in many fields of economics. In formulating theorems and results sometimes all assumptions are not explicitly stated.

Numerous examples and solved problems are used to amplify each new concept in order to facilitate student's comprehension of the new material.

Each chapter is accompanied by an extensive set of exercises, which contains an ample set of problems of a routine computational nature to help the students master new techniques, followed by an extensive set of applications – oriented problems in the form of mini-case applications to test his or her mastery of these topics covered. Examples of mini-case application are introduced below.

Mini-Case Applications (Chapter 1  
“Linear Algebra”).

1. A simple economy consists of two sectors: agricultural (A) and transportation (T). The input-output matrix for this economy is given by

$$A = \begin{matrix} & \begin{matrix} A & T \end{matrix} \\ \begin{matrix} A \\ T \end{matrix} & \begin{bmatrix} 0,4 & 0,1 \\ 0,2 & 0,2 \end{bmatrix} \end{matrix}$$

a) Find the gross output of agricultural products needed to satisfy a consumer demand for 50 million (grn.) worth of agricultural product and 10 million (grn.) worth of transportation.

b) Find the value of agricultural products and transportation consumed in the internal process of production in order to meet the gross output.

2. Mr. N. wishes to produce three types of pendants: type A, type B, and type C. To manufacture a type-A pendant requires 2 minutes on machine I, and II and 3 minutes on machine III. A type – B pendant requires 2 minutes on machine I, 3 minutes on machine II, and 4 minutes on machine III. A type – C pendant requires 3 minutes on machine I, 4 minutes on machine II, and 3 minutes on machine III. There are 3,5 hours available on machine I; 4,5 hours available on machine II; and 5 hours available on machine III. How many pendants of each type should the company make in order to use all the available time?

3. A simple economy consists of three sectors: agriculture (I), manufacturing (II), and transportation (III). The input-output matrix for this economy is given by

$$A = \begin{matrix} & \begin{matrix} I & II & III \end{matrix} \\ \begin{matrix} I \\ II \\ III \end{matrix} & \begin{bmatrix} 0,1 & 0,3 & 0,2 \\ 0,1 & 0,4 & 0,2 \\ 0,4 & 0,1 & 0,2 \end{bmatrix} \end{matrix}$$

a) If the units are measured in million of dollars, determine the amount of agricultural products consumed in the production of \$ 120 million worth of manufactured goods.

b) Determine the dollar amount of manufactured products required to produce \$ 300 million worth of all goods in the economy.

c) Which sector consumes the greatest amount of agricultural products in the production unit goods in that sector? The least?

4. Publishing Company publishes a deluxe leather edition and standard edition of its Daily Organizer. The company's marketing department estimates that  $x$  copies of the deluxe edition and  $y$  copies of the standard edition will be demanded per month when the unit prices are  $p$  dollars and  $q$  dollars, respectively, where  $x, y, p$  and  $q$  are related by the following system of linear equations:

$$\begin{cases} x + 5y = 1000 & (70 - p) \\ 3x + y = 1000 & (40 - q) \end{cases}$$

Determine the monthly demand for the deluxe edition and the standard edition when the unit prices are set according to the following schedules:

a)  $p=50$  and  $q=25$ ; b)  $p=45$  and  $q=25$ ; c)  $p=45$  and  $q=20$ .

Mini-case applications (Chapter 8  
"Differential Calculus (several variables)")

Economic theory holds that as interest rates go down firms are able to invest more in capital equipment. Monthly figures for the interest rate and levels of new capital investment in millions of grivnas are shown in the table.

Month	Interest Rate, %	Capital Investment
January	10	10
February	9,5	11
March	9	12
July	7,5	16
August	7	17
September	6,5	18
October	6	19
November	5,5	20
December	5	21

a) Identify the depended variable.  
b) Calculate the regression model.  
c) Plot the date and the regression line. Does the model support the theory lower interest rates are associated with higher levels of investment?

2. A popular financial theory holds that there is a direct relationship between the

risk of an investment and the return it promises. A stock's risk is measured by its  $\beta$ -value. Shown here are the returns and  $\beta$ -values for 12 fictitious stocks suggested by the investment firm of Mr. N. do these data seem to support this financial theory of a direct relationship?

Stock	Return (%)	$\beta$ -value
1	5,4	1,5
2	8,9	1,9
3	2,3	1,0
4	1,5	0,5
5	3,7	1,2
6	8,2	1,8
7	5,3	1,3
8	0,5	-0,5
9	1,3	0,5
10	5,9	1,8
11	6,8	1,9
12	7,2	1,7

Investors typically view return as a function of risk.

- a) Calculate the regression model and interpret the results.
- b) Plot the scatter diagram and the regression line.

Each chapter of the text also ends with a chapter summary that includes key terms and key ideas, and a set of cumulative review exercises.

Besides the final part of handbook involves the examples of module tests of discipline “Higher Mathematics” developed accordingly requirements to credit module system of the organization study process in the university.

Fragment of the suggested test is written as follows.

Module Test 3,

Time – 75 minutes, 25 questions

Problem Solving Directions:

Solve the problems and choose the best answer

1. The indefinite integral of

$$\int \frac{3x + 5}{x^2 - 4x + 5} dx$$

is equaled to

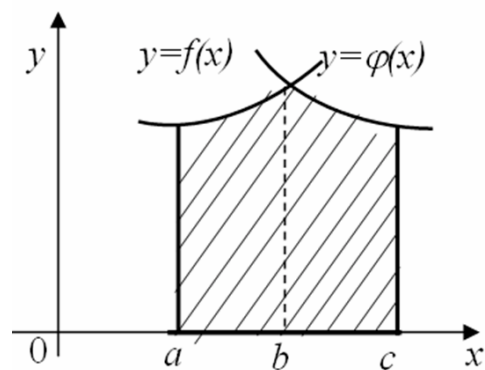
A)  $\frac{3}{2} \ln|x^2 - 4x + 5| + 11 \arctg(x - 2) + C ;$

B)  $\frac{3}{2} \arctg|x^2 - 4x + 5| + \frac{11}{2} \arctg x + C ;$

C)  $3 \ln|x^2 - 4x + 5| + \frac{11}{2} \ln\left|\frac{x}{x-1}\right| + C ;$

D)  $3 \arctg|x^2 - 4x + 5| + \frac{11}{2} \ln\left|\frac{x-3}{x-1}\right| + C .$

2. If the region bounded by the curve  $y=f(x)$ ,  $x$ -axis, and the lines  $x=a$  and  $x=b$  and the curve  $y=\varphi(x)$ ,  $x$ -axis, and the lines  $x=b$  and  $x=c$ , (see the Figure) the area of the region is equaled to



A)  $S = \int_a^b f(x) dx - \int_b^c \varphi(x) dx ;$

B)  $S = \int_a^b \varphi(x) dx - \int_b^c f(x) dx ;$

C)  $S = \int_a^c f(x) dx + \int_a^c \varphi(x) dx ;$

D)  $S = \int_a^b f(x) dx + \int_b^c \varphi(x) dx .$

3. The volume of the solid generated by revolving the area bounded the graph of  $y=f(x)$  about the  $x$ -axis between  $x=a$  and  $x=b$  is given by

A)  $V = \int_a^b f^3(x) dx ;$

B)  $V = \pi \int_a^b f(x) dx ;$

C)  $V = \pi \int_a^b f^2(x) dx ;$

D)  $V = \int_a^b f^2(x) dx .$

4. The general solution of the differential equation  $y'' - 6y' + 9y = 0$  is the following:

A)  $y = c_1 e^{3x} + c_2 e^{3x}$  ;

B)  $y = c_1 e^{-3x} + c_2 e^{-3x}$  ;

C)  $y = e^{3x} (c_1 + c_2 x)$  ;

D)  $y = c_1 e^{2x} + c_2 e^{3x}$  .

5. An expression for the  $n$ th term of the given series  $1 + \frac{4}{5} + \frac{8}{10} + \frac{16}{17} + \dots$  is the following:

A)  $\frac{2n}{2n+1}$

B)  $\frac{n^2}{n^2+1}$

C)  $\frac{2^n}{n^2+1}$

D)  $\frac{2^n}{n^2+3}$

6. Use the Comparison Test to show that series  $\sum_{n=1}^{\infty} \frac{1}{1+2^n}$  converges. What of the given series can we chose for comparison, if

A)  $\sum_{n=1}^{\infty} \frac{1}{n^3}$

B)  $\sum_{n=1}^{\infty} \frac{1}{2^n}$

C)  $\sum_{n=1}^{\infty} \frac{1}{n}$

D)  $\sum_{n=1}^{\infty} \frac{1}{n^2}$

7. What is the test can we chose for the determining converges or diverges of the series

$\sum_{n=0}^{\infty} \frac{n^n}{n!}$  ?

A) *D'Alembert's Test*

B) *Integral Test*

C) *The Root Test*

D) *Comparison Test*

The handbook provides solid foundation of concepts and manipulative skills for those students whose mathematical background is strong enough to enable them to survive a tough course.

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**Резюме.** Ничуговская Л.И. ОБЗОР-ПРЕЗЕНТАЦИЯ УЧЕБНОГО ПОСОБИЯ “ВЫСШАЯ МАТЕМАТИКА” (НА АНГЛИЙСКОМ ЯЗЫКЕ). Рассматриваются особенности построения учебного пособия “Высшая математика” как основной составляющей методического обеспечения процесса обучения математическим дисциплинам студентов специальностей “Менеджмент внешнеэкономической деятельности” и “Международная экономика” в условиях кредитно-модульной системы организации учебного процесса.

**Summary.** Nichugovskaia L. REVIEW OF HANDBOOK “HIGHER MATHEMATICS”. This article deals with the main features of constructing a handbook “Higher Mathematics” as a basic component of methodical provision of teaching process of Mathematical subjects in English for students majoring in “International Management” and “International Economics” in the conditions of credit and module system.

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