List 1

Exercise 1. Calculate the values of the following expressions: $\sin(2\pi)$; $\cos\left(\frac{3}{4}\right)$; $\ln(15)$; $\ln(e^4)$.

Exercise 2. Calculate

a) $6^3 \ln 34 + \sin\frac{\pi}{4}$ b) $4^e + e^4 - 2\sqrt{7}$.

Exercise 3. Create a vector **a** with values from 1 to 10.

Exercise 4. Create a vector **b** consisting of the even numbers 2 to 20. Calculate its length.

Exercise 5. Create a vector **c** of three-digit numbers that are divisible by three. Calculate its length.

Exercise 6. Create a vector **z** with five components where each value is a natural number.

Exercise 7. Create the vectors **z1** and **z2**, which will be determined on the basis of the vector **z**. The vector **z1** is to be a sequence repeated twice, while in the vector **z2** each element is to be repeated three times.

Exercise 8. Create three vectors **w1**, **w2** and **w3** from vector **z**. Vector **w1** is supposed to be just the third element of vector **z**, vector **w2** is supposed to consist of elements from vector **z** except the second element, and vector **w3** is supposed to contain elements of vector **z**, but only greater than 3.

Exercise 9. As **a**, write down a vector consisting of the following elements: 1, 3, 6, 2, 7, 4.

a) Calculate the length of the vector.
b) Find the third element of the vector.
c) As **b**, write the vector **a** without fourth element.
d) Find the sum of the elements of vectors **a** and **b** separately.
e) As **c**, write the elements of vector **a** greater than 4.

Exercise 10. Create a matrix **A**

$$\mathbf{A} = \begin{pmatrix} 2 & 3 & 0 \\ 1 & 2 & 1 \\ -1 & 1 & 1 \end{pmatrix}.$$

a) Calculate the determinant of the matrix **A**.
b) Transpose matrix **A**.
c) Find inverse matrix to **A**.
d) Calculate the square of the matrix **A**.
e) Multiply the matrix **A** and its inverse.
f) Find the main diagonal of matrix **A**.
g) As **b**, write a vector that is the second column of the matrix **A**.
h) Find eigenvectors and the eigenvalues of matrix **A**.
i) As **M** write the matrix **A** after deleting the first row and third column.

Exercise 11. Create an n-element vector. For each element of this vector, a value is to be entered that is the square of a successive natural number, starting with the value 4. Perform the task using a loop.

Exercise 12. Create a 5-element vector consisting of any values. Check if the third item is greater than the average, less than or equal to the average. In response, we should receive information about which is greater: the average or the third element.

Exercise 13. Create a vector with the following elements (2, -3, 6, 8, -1, 4). If the element of the vector is negative, it should be changed into positive and the index of negative elements should be written in another vector.

Exercise 14. Draw a scatter plot of the values 15, 20, 17, 11, 16, where these values are specified for 10, 12, 14, 15 and 20 respectively.

Exercise 15. Draw a graph from task 14, taking into account the different types of graphs presented in the class.

Exercise 16. Add the chart title to the chart from the second task: Car weight depending on the number of kilometers traveled. Also add the title of the relevant axes: Kilometers traveled, Car weight.

Exercise 17. Plot a graph the $\sin x$ for arguments from 0 to 10.

Exercise 18. Plot a graph of the functions $\cos x, \ln x, \frac{1}{x^2+2}$ for arguments 1 through 5 using the plot command.

Exercise 19. Create your own function called Mtrace that determines the trace of squared matrices.

Exercise 20. Create my own function called BTr that, in even-degree square matrices, will sum main-diagonal subblocks of 2x2 dimensions.

Exercise 21. Create my own function called BSum, which in square (even degree) matrices will sum all subblocks of 2x2 dimensions.