

**Content module 4.** Differential calculus of one variable function.*Theme 1. Differentiating the one variable function.*

Tasks that lead to the concept of the derivative. Definition of a derivative, its geometric meaning. Properties and rules for calculating derivatives. Table of derivatives.

Differentiating of implicitly given function, parametrically defined function and power-exponential function. Derivatives of the higher order. Differential, its properties, geometric meaning. Application of differential to approximate calculations. Higher order differentials.

*Theme 2. Application of the derivative.*

Theorems by Fermat, Rolle, Lagrange and Cauchy. Lagrange formula (of finite increments). L'Hopital's rule.

Conditions of monotonicity of functions. Extremums. Convexity and concavity of the function graph. Asymptotes. The general scheme of function investigation.

**Content module 5.** Integral calculus of one variable function.*Theme 1. Indefinite integrals.*

The anti-derivative and indefinite integral, the relation between them. Basic properties of indefinite integrals. Methods of integration. Table of indefinite integrals.

Integration by parts in the indefinite integral. Decomposition of the rational fractions into the sum of the simplest fractions. Integration of rational fractions.

Integration of rational functions of variables  $\sin x$  and  $\cos x$ .

Integration of linear and rational functions of irrationalities.

*Theme 2. Definite integral.*

Problems that give rise to the concept of a definite integral. Definition of the definite integral, its properties. Formula by Newton-Leibnitz.

Methods of calculation of the defined integrals. Area of planar figure.

Finding the areas of planar figures in polar coordinates. Calculation of arc length. Calculation of body volumes. Calculation of areas of the revolution surfaces.

The concept of improper integrals of the first and the second kinds. Signs of convergence.

**Content module 6.** Differential calculus of function of several variables.*Theme 1. Differential calculus of function of several variables.*

The sequence of points in  $\mathbb{R}^n$  and its limit. The relationship between the limit in  $\mathbb{R}^n$  and the limits of particular point coordinates. The limit of function in  $\mathbb{R}^n$ . Continuity of function of several variables. Partial derivatives, their geometric meaning.

Derivatives of composite and implicitly given functions. Geometric applications of derivatives of the function of several variables: tangent plane and normal to the surface, tangent straight line and normal plane to the line in space. Differential, its properties and application to approximate calculations.

Derivatives of the higher orders. Schwartz theorem. Higher order differentials. The extremum of the function of several variables. Necessary and sufficient conditions of extremum. The conditional extremum of the function of several variables. The largest and smallest value of a function in a closed domain.