

**СЕКЦИЯ 3**  
**ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ И МОДЕЛРОВАНИЕ**  
**ЭКОНОМИЧЕСКИХ ПРОЦЕССОВ В СИСТЕМЕ**  
**ОБОСНОВАНИЯ ЭФФЕКТИВНЫХ**  
**УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ**

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**APPLICATIONS OF FIRSY-ORDER DIFFERENTIAL**  
**EQUATIONS IN ECONOMICAL**

For the creation of an economically developed society, the active promotion of scientific and technological progress, a special role is assigned to higher mathematics. Modern scientists use the methods of mathematical analysis, linear programming, matrix and vector calculus, game theory, regression analysis, etc. To study economic processes, which in turn are components of mathematical modeling. One of the important sections of mathematics, which is of great practical importance, is the section «First-ordinary differential equations».

Consider economic problem, that need to be solved using of first-order differential equation

$$\frac{dN}{dt} - kN = 0$$

where  $k$  is the constant of proportionality.

This first-order equation with separable variables and the general solution of this equation has the form

$$N(t) = ce^{kt}.$$

Problem. What constant interest rate is required if an initial deposit placed into an account that accrues interest compounded continuously is to double its value in 8 years?

The balance  $N(t)$  in the account at any time is governed by

$$\frac{dN}{dt} - kN = 0$$

which has as its solution

$$N(t) = ce^{kt} \quad (1)$$

We are not given an amount for the initial deposit, so we denote it as  $N_0$ .

At  $t = 0 \Rightarrow N(0) = N_0$ , which when substituted into (1) yields

$$N_0 = ce^{k \cdot 0} = c \cdot 1 = c$$

and (1) becomes

$$N(t) = N_0 e^{kt} \quad (2)$$

We seek the value of  $k$  for which  $N = 2N_0$ , when  $t = 8$ .

Substituting these values into (2) and solving for  $k$ , we find

$$2N_0 = N_0 e^{8k}.$$

Then

$$2 = e^{8k} \text{ or } e^{8k} = 2.$$

We obtain

$$e^{8k} = e^{\ln|2|},$$

then

$$8k = \ln |2|$$

And becomes

$$k = \frac{1}{8} \ln |2|.$$

Then substituting  $\ln |2| \approx 0,6931$ , we obtain

$$k = \frac{1}{8} \cdot 0,6931 \approx 0,0866.$$

An interest rate of 8,66 percent is required.