reliance on imported agricultural inputs, high energy cost, poor guidance, training and oversight; weak role of cooperative and trade union institutions is weak; limited area of agriculture and the high cost of securing agricultural land; small size of agricultural holdings in general, limited use of mechanization and modern technologies; real estate ownership problems, the high cost of labour; absence of direct and indirect support compared to neighboring countries; high cost of transport action is due to the lack of necessary infrastructure; some Lebanese agricultural products suffer from a lack of quality due to several reasons, most notably: the adoption of traditional varieties and patterns; poor guidance and training, poor control; excessive use of agricultural inputs, especially pesticides and fertilizers; absence of traceability and labeling systems, specifications for agricultural commodities are not mandatory; failure to follow good post-harvest transactions (transportation, packaging, storage).

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EXAMPLES OF ECONOMICAL PROBLEMS THAT REDUCE TO SOLVING DIFFERENTIAL EQUATIONS

The most common mathematical models in economics associated with differential equation. The article discusses the connection between the course «Higher mathematics» and «Economics».

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

$$\frac{dN}{dt} - kN = 0 \tag{1}$$

where k is the constant of proportionality.

The problem that needs to be solved in this article is formulated as follows:

Problem 1. A person place \$20 000 in a savings account which payss 5 percent interest per annum, compounded continuously. Find *(a)* the amount in the account after years, and *(b)* the time required for the account double in walue, presuming no withdrawals and no additional deposits.

Let $N(t)$ denote the balance in the account at any time t. Initially, $N(0) = 20\ 000$. The balance in the account grows by the accumulated interest payments, which are proportional to the amount of money in the account. The constant of proportionality is the interest rate. In this case, $k = 0,05$ and Eq. (1) becomes

$$\frac{dN}{dt} - 0,05N = 0$$

This differential equation is both linear and separable. Its solution is

$$N(t) = Ce^{0,05t} \tag{2}$$

At $t = 0$, $N(0) = 20\ 000$, which when substituted into (2) yields

$$20000 = Ce^{0,05\cdot 0} = C$$

With this value of C, (2) becomes

$$N(t) = 20000e^{0,05t} \tag{3}$$

Equation (3) gives the dollar balance in the account at any time t.

(a) Substituting $t = 3$ into (3), we find the balance after three years to be

$$N(3) = 20000e^{0,05\cdot 3} = \$23\,236,68$$

(b) We seek the time t at which $N(t) = \$40\ 000$. Substituting these values into (3) and solving for t, we obtain

$$40000 = 20000e^{0,05t} \Rightarrow 2 = e^{0,05t} \Rightarrow \ln|2| = 0,05t$$

$$t = \frac{1}{0,05}\ln|2| = 13,86 \textit{ years}.$$

Problem 2. A person places \$5000 in an account that accrues interest compounded continuously. Assuming no additional deposits or withdrawals, how much will be in the account after seven years if the interest rate is a constant 8,5 percent for the first four years and a constant 9,25 percent for the last three years?

Let $N(t)$ denote the balance in the account at any time t. Initially, $N(0) = 5000$. For the first four years, $k = 0,085$ and Eq. (1) becomes

$$\frac{dN}{dt} - 0,085N = 0$$

Its solution is

$$N(t) = Ce^{0,085t} \quad (0 \le t \le 4) \tag{4}$$

At t = 0, N(0) =5 000, which when substituted into (4) yields

$$5000 = Ce^{0,085 \cdot 0} = C$$

and (4) becomes

$$N(t) = 5000e^{0,085t} \quad (0 \le t \le 4) \;\; (5)$$

Substituting t = 4 into (5), we find the balance after four years to be

$$N(4) = 5000e^{0,085 \cdot 4} = \$7\,024,74$$

This amount also represents the beginning balance for the last three-year period.

Over the last three years, the interest rate is 9,25 percent and (1) becomes

$$\frac{dN}{dt} - 0,0925N = 0 \quad (4 \le \text{t} \le 7) \tag{6}$$

Its solution is

$$N(t) = Ce^{0,0925t} \quad (4 \le t \le 7)$$

At t = 4, N (4) = $7024,74, which when substituted into (6) yields

$$7024,74 = Ce^{0,0925 \cdot 4} \qquad \Rightarrow \qquad C = 4852,23$$

and (6) becomes

$$N(t) = 4852,23e^{0,0925t} \quad (4 \le t \le 7) \;\; (7)$$

Substituting t = 7 into (7), we find the balance after seven years to be

$$N(t) = 4852,23e^{0,0925 \cdot 7} = \quad \$9\,271,44$$

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SMART TOURISM DEVELOPMENT AS A COUNTRY'S ECONOMY DRIVE FORCE

The term "smart tourism" has been used a lot lately by majority of tourism experts and professionals. However, what does it actual mean? Smartness refers to the use of technological innovations in order to cut