https://doi.org/10.53656/str2024-3s-10-app *Education for Sustainable Development*
Образование за устойчиво развитие

APPLICATION OF THE MATHEMATICAL FUNCTIONS IN THE ECONOMIC ANALYSIS OF THE ENTERPRISE

Prof. Yordanka Angelova,
Vasil Kuzmov, Assist. Prof.
Technical University of Sofia

Abstract. Functions and their graphic presentation are some of the most widely used tools in various economic analyses of a business. After a graph is drawn, it is necessary to interpret it correctly in order to accurately assess the situation of the industrial company. The types of functions presented in the paper are viewed in terms of their application in economic analysis. A study of a particular firm has been made, the obtained data has been presented in table form and the graphic approach has been used to depict their functions. The authors have drawn conclusions and have made recommendations.
Keywords: economic analysis; functions; revenue; costs; profit; trend

1. Nature of the function

The process of managing a firm is related to the manifestation of a number of functions, one of which is the analysis of the economic processes in the course of its activities. The application of functions in economic analysis is a prerequisite for the realization and study of the economic, technical-economic and socioeconomic processes in the firm. It follows that analysis is a subjective human activity of exploring and studying the processes and phenomena of business activities in particular.

Thus, for example, if there are two sets **A** and **B** and the elements of set **A** are denoted by **x**, and the elements of set **B** by **y**, when written it will be in the form of:

$$A \rightarrow x;\ B \rightarrow y$$

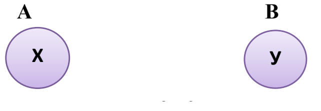


Figure 1. Sets of a function

It is then said that there is a set function when for an element x of the defined area – A, according to a certain rule, is referred to one or several elements y of set B.

In general a function is set in the following way: y = f (x). The main attributes of the main function **y = f (x)** are as follows:

y – dependent variable (value of the function) or just function;

x – independent variable (argument);

A – domain of a function or a domain of the permissible values of the argument;

B – domain of the permissible values of the function (Boyadzhiev, Kamenov 2002; Dimitrova 2002).

There are several types of functions:

– ***one-to-one*** – if to any element x ∈ A corresponds exactly one element y ∈ B

– ***many-to-one*** – if to any element x ∈ A correspond several elements y ∈ B

2. Correspondence of a function

From a mathematical point of view the concept of "correspondence" is also present as "image". Through correspondence it can easily be seen whether a certain image is a function or not. By image is meant any correspondence among the elements of two sets – A and B. There are the following types of images:

– **Surjective** – correspondence where each element y ∈ B is the image of at least (i.e. at most) one element x ∈ A. With surjective all elements of set B are covered.

– **Injective** – correspondence where each element y ∈ B is the image of (at most) one corresponding element x ∈ A;

– **Bijective** – correspondence where each element y ∈ B is the image exactly of one element x ∈ A. With bijective there is surjective, and injective.

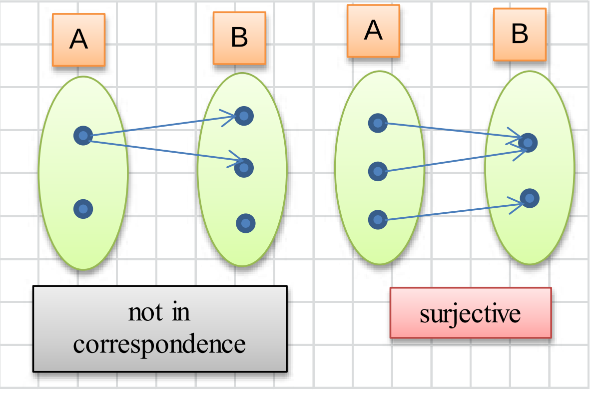


Figure 2. Examples of correspondence of one function

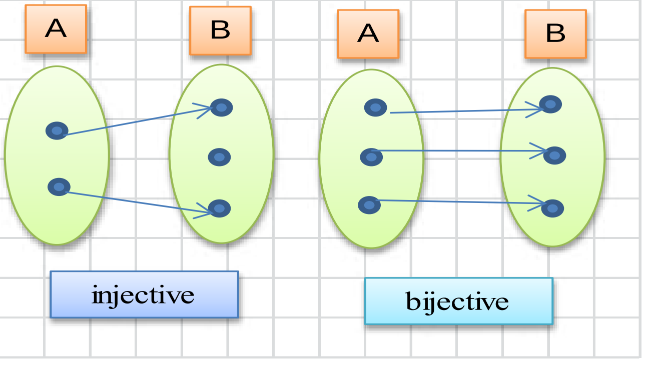


Figure 3. Injective, Bijective

3. Setting of functions (Avramov 2000; Aleksandrova 2017; Boyadzhiev, Kamenov 2002; Chukov & Ivanova 2017).

We can say that a function has been set when its components are known. There are several ways in which a function can be set:

3.1. Analytical setting of a function

– ***Formulaic setting*** – the connection between argument and function is set through a formula, i.e. in the correspondence y = f(x), which is set with a formula, the actions (algorithms), which need to applied to *x* in order to get *y*, are given (written down). With these algorithms we calculate the values of the function at any point in the domain.

$$\textit{Example:}\ \ y = \frac{x^2 - 9x + 3}{x^2 - 4},\ x \neq \pm 2$$

– ***Explicit presentation (explicit function)***– the function is solvable in relation to a certain variable and value *y* can be calculated right away for the defined argument *x*. It is set with the equation y = f(x), i.e. it is solved in relation to *y*. If we take, for example, function:

$$y = x^2$$

then *f(x)* can be expressed by *x*.

– ***Implicit presentation (implicit function)*** – the function is not solvable in relation to any of the two variables, i.e. the definitive equation of the function *y* is not solved in relation to *y* but in relation to:

$$y = f(x,y) = 0$$

For example, if an equation is set for a circle with a radius 1, then: $x^2 + y^2 - 1 = 0$. In many cases it is possible for an implicit presentation to be transformed into an explicit one, for example:

$$x^2 + y^2 - 1 = 0$$

$$\therefore y_1 = \sqrt{1 - x^2}$$

$$\therefore y_2 = -\sqrt{1 - x^2}$$

However, such transformation from implicit to explicit form is not always possible. To make such transformation possible, the definition equation must be transformed from unsolved in relation to *y* to solved in relation to *y*.

Parametric setting – it stands for the possibility when a function through an intermediate argument is presented in explicit form. Such type of setting has an application in economics, geometry, mechanics and other areas. It is written down in the following way:

$$\left| \begin{array}{l} x = \varphi(t), \\ y = \Psi(t), \end{array} \right.$$

where: $\varphi(t)$ and $\Psi(t)$ are given functions of variable *t*, called parameter, which is most often used to denote time.

3.2. Tabular setting – the tabular form is most often used for presenting the different values of the independent variable *x* and the respective values of function y (Aleksandrova 2017; Dellago 2010).

Table 1. Tabular form of setting a function

x	x_1	x_2	x_3	...	x_n
y	y_1	y_2	y_3	...	y_n

– ***verbally*** – function of Dirichlet that is defined as: f(x) is equal to 0 for each irrational value of the argument and to 1 for each rational value, i.e:

$$f(x) = \begin{cases} 0, & \text{if "x" is irrational,} \\ 1, & \text{if "x" is rational.} \end{cases}$$

3.3. Graphical setting of a function

From a mathematical and economic point of view a function can be presented graphically as it is shown in Figure 4. In general, it is important to observe how the object under study changes along the horizontal x-axis where the time factor is most often observed (denoted by *t*). Along the vertical *y*-axis are plotted, for example, volume sold (as number of products) or their value in a specific currency (BGN, EUR, USD, etc.). Graphic presentation of functions is widely used in technical analysis. It is very important to interpret correctly what the plotted function shows in order to make accurate forecasts about the expected fluctuations of currencies or other valuable goods. This is essential for people who trade on the currency market. It is a well-known fact that the environment is highly dynamic and an incorrectly interpreted graph could lead to big financial losses.

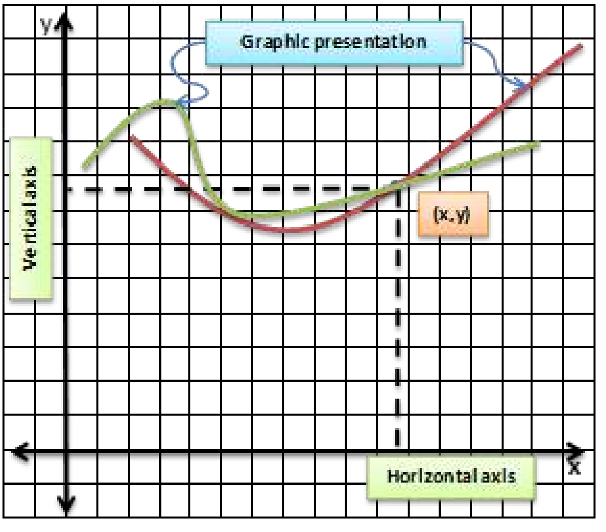


Figure 4. Graphic image of a function

4. Properties of functions (Hristov 2018; Kirkorov, Bonev 1980; Dellago 2010)[1]**:**

4.1. Domain – it consists of the quantity of all arguments for which the function is defined. If we take the domain of real numbers **R** only then can we distinguish between the following intervals:

– *Open interval:*

$$(a,b) = \{x \in R \mid a < x < b\}$$

– *Close interval:*

$$[a,b] = \{x \in R \mid a \leq x \leq b\}$$

4.2. Even and odd function, zero position

If function f(x) is set and is defined within an interval of the (-*l*, +*l*) type, where *l*>0 then for each x of that interval we get:

– *even function* $f(x) = f(-x)$

Even functions are for example: x^2; *x4*; x^{2n}, etc.

– *odd function*

$$f(x) = -f(-x)$$

Odd functions are for example: x^3; x^5; x^{2n-1}, etc.

It is important to point out that most functions are neither even nor odd. There is a theorem which says that each function f(x) can be presented as the sum of an even and an odd function, i.e:

$$f(x) = \varphi(x) + \Psi(x),$$

where: $\varphi(x)$ – even function

$\Psi(x)$ – odd function

– *zero position*

A function y = f(x) has a zero position at x_0, when $f(x_0) = 0$. If we obtain, for example, as the answer to a given function respectively for: $x_1 = -0,5$ and for $x_2 = +0,5$, then the function at x_1 and x_2 has zero positions.

Function $f(x_0) = 0$ is the only function, which is even and odd at the same time, i.e., if it is plotted, its graph is the horizontal axis, which is symmetric to *Oy*, and to the origin *O*.

It is important to be noted that there exist periodic functions, as well as inverse functions with greater application in mathematics rather than in economics but they are not the object of study of the present paper.

4.3. Monotonicity

When there is a difference between:

$\Delta y = f(x_2) - f(x_1)$,

where: x_1 and x_2 are respectively two values of the argument of the domain then there is an increase of function f(x). The difference between x_1 and x_2 is called argument increase. It has the following form:

$\Delta x = x_2 - x_1$

Monotonically increasing function – if x_1 and x_2 are any points of D, for which $x_1 < x_2$, and if

$f(x_1) \leq f(x_2)$ follows from it we say that the given function is monotonically increasing at D.

Increasing (strictly increasing) function – if we have the strict equation $f(x_1) < f(x_2)$, a function is called increasing and also strictly increasing.

According to some authors the types of monotonic functions are (Grifell & Knox Lovell 2015)[2]:

– *Strictly monotonically increasing:*
– *Monotonically increasing:*
– *Monotonically decreasing:*
– *Strictly monotonically decreasing:*

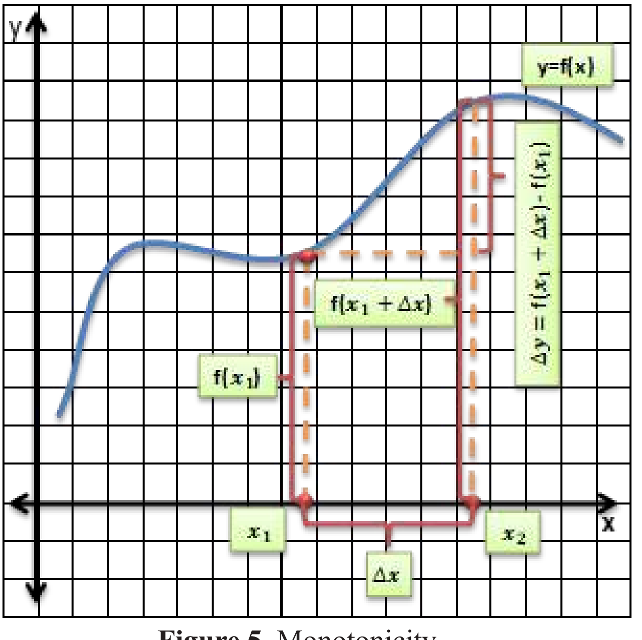


Figure 5. Monotonicity

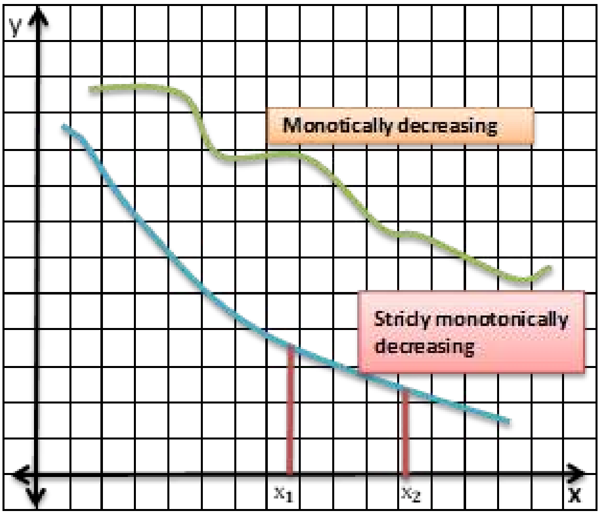


Figure 6. Monotonically decreasing functions

Fig. 6 shows a monotonically decreasing and a strictly monotonically decreasing function with the following characteristics:

– *Monotonically decreasing:*

$f(x_1) \geq f(x_2)$

– *Strictly monotonically decreasing:*

$f(x_1) > f(x_2)$

Fig. 7 shows a monotonically decreasing and a strictly monotonically decreasing function with the following characteristics:

– *Strictly monotonically increasing:*

$f(x_1) < f(x_2)$

– *Monotonically increasing:*

$f(x_1) \leq f(x_2)$

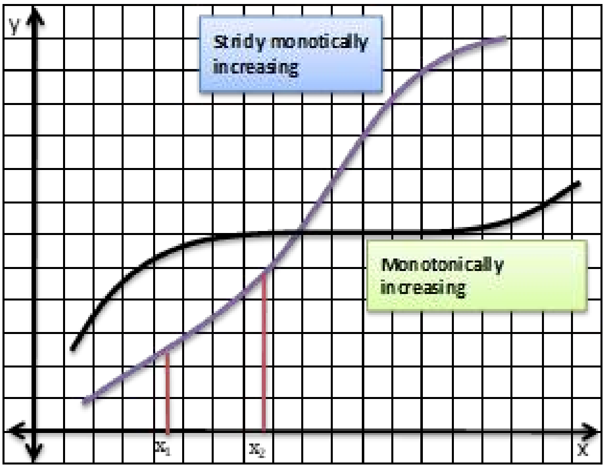


Figure 7. Monotonically increasing functions

Fig. 8 shows all types of monotonic functions – both decreasing and increasing.

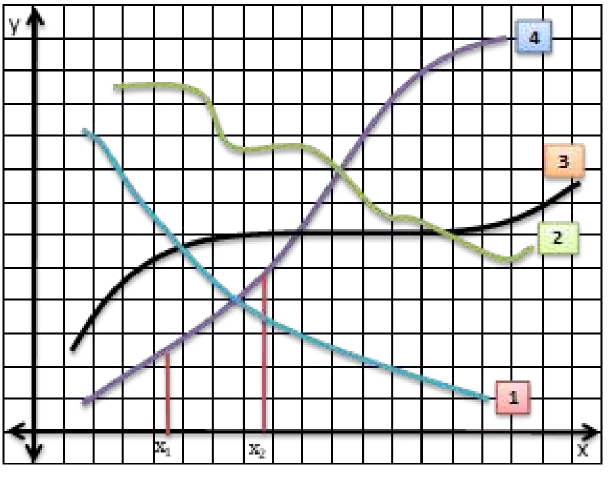


Figure 8. Monotonically decreasing and increasing functions

In Fig. 8 the monotonic functions are as follows:

1 – strictly monotonically decreasing; 2 – monotonically decreasing; 3 – monotonically increasing; 4 – strictly monotonically increasing.

4.4. Extremum, minimum and maximum of a function

We say there is an extremum of a function at a certain point when the value of that function is a maximum or a minimum at that point.

If there is a function f(x), which is set in the interval (a,b) and $x_0 \in (a,b)$, then it is said that function f(x) will have a *maximum* $f(x_0)$ at point x_0, and if there is an environment P of point x_0, for which the following is true:

$$f(x) \leq f(x_0) \mid x \in P.$$

therefore, there will be:

– *a strict maximum*

$$f(x) < f(x_0) \mid x \in P, x \neq x_0$$

– *a minimum*

$$f(x) \geq f(x_0) \mid x \in P$$

– *a strict minimum*

$$f(x) > f(x_0) \mid x \in P, x \neq x_0$$

5. Main functions applicable in economics

5.1. Linear function

The function is set as follows:

$$f(x) = kx + b,$$

where: к – slope coefficient

b – intercept.

If it is given as a simple equation,

$$y = (\pm)\, kx + b,$$

then it can be said that the slope can be both positive and negative. It has a special application in plotting a trend, i.e., if it is set for a group of goods of the type:

$$y = -1{,}2x + 141{,}8$$

we draw the conclusion that there is a negative trend and vice versa if we have the equation

$$y = 1128{,}2x + 36111,$$

the trend (tendency) will be positive.

With such an equation or function the sign of the coefficient is important. Depending on what it is we come to the respective conclusions.

There are special linear functions – such are the *identity function*: y = x, and the *constant function*: y = b

Therefore, on order to say that there is a rising trend, there must be at least two points, which are connected and each following value is greater than the previous one. For a falling trend two or more points must be connected and each following value must be smaller than the previous one.

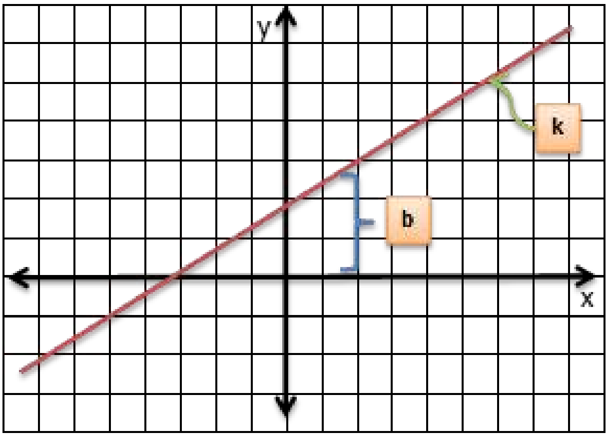


Figure 9. Linear function

The figure above shows that *κ* is the angle between the graph of the function and the horizontal axis (Ox), while b shows the ordinate coordinates of the point where the graph crosses the horizontal axis (Oy).

5.2. Power function

Power x^n is the product of n equal factors:

$$x^n = x.x.x\ldots.x_n,$$

where x is called *basis(base)*, and *n – exponent*. With this function *n* is a random real number. When they accept different values, we get different power functions.

5.3. Exponential function

The exponential function is seen as a function equal to its own derivative. It is denoted by e^x, where *e* is Euler's number with the following value: e = 2.718281828. What is characteristic of it is that it has a proportional rate of change, i.e. if there is a change in the fixed value of the independent variable then there is proportional change (it can be a percentage increase or decrease) in the value of the function itself.

The exponential function has the form of:

$$f(x) = a^x$$

There the real positive number *a* is the *base*, and *x* is the *exponent*.

It is the exponential function that defines the *e* base through a power series with an infinite number of members:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!}$$

It can be defined as:

$$\mathrm{e}^{\mathrm{x}} = \lim_{k\to\infty}(1 + \frac{x}{k})^k$$

An exponential function with base *e* is often written in the following way:

$$f(x)=\exp(x)$$

5.4. Logarithmic function

Graphically it can be plotted as a mirror image of the exponential function at an angle of 45 degrees. The logarithm is written to the base *a* of the number *x* as:

$$\log_a(x)$$

The logarithm of the number *x* to base *a* is such a number to which *a* must be raised in order to obtain *x*.

$$y = \text{loga}(x) \Leftrightarrow \text{ay} = x$$

5.5. Polynomial function

Polynomial function is obtained when the value of a polynom.

A polynom is for example:

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots. + a_1 x + a_0$$

We can draw the conclusion that there are the following types of functions, which can be used in economic and technical analysis: *linear, power, exponential, logarithmic and polynomial*. Each of these has its advantages and disadvantages. The easiest of them to use in economic analysis is the linear function because of its clarity and ease of use. The other types of functions can also be used for interpreting a trend but are more complicated, and the exponential function is more widely used in technical than in economic analysis.

6. Types of functions applicable to economic analysis of an industrial firm

6.1. Costs, revenue, profit

– *function of the revenue:*

R(x) /R – revenue/

– *function of the costs:*

C(x) /C – costs/

– *function of the profit:*

P(x) /P – profit/

In order to calculate the profit we need to write the equation in the following way:

$$P(x) = R(x) – C(x),$$

where: x is the volume of the products.

There is a profit when $P > 0$ ($R > C$) and a loss when $P < 0$ ($R < C$).

Economic analysis makes use of optimization models whose application aims to achieve:

– *maximum value of the profit;*
– *maximum value of the revenue;*
– *minimum value of the costs.*

6.2. Functions of two or more variables

If the variables *x,y* and *z* are given x and y are not related but z is considered to be dependent on them, i.e. to be their function and *z* is defined as an aggregate of the two variables (x,y). Z will be called a function of the two variables *x* and *y*, when a certain value of z corresponds to each pair of numbers (x,y) from set D. It is denoted by:

$$z = f(x,y)$$

For example, if an industrial company produces laptops *(x)* and mobile phones *(y)* it is known that the constant daily costs for *x* and *y* are respectively:

– x = 700 EUR;
– y = 300 EUR.

The variable costs for a unit of production for x and y respectively are:

– x = 120 EUR;
– y = 170 EUR.

Therefore, for the daily production the function of the costs would look as:

$$C(x,y) = 700 + 120x + 300 + 170y = 1000 + +120x + 170y$$

$$\therefore C(x,y) = 1000 + 120x + 170y$$

7. Moving average (Grifell & Knox Lovell 2015**)**[1]

The moving average value has an application in technical analysis rather than in economic analysis.

The moving average is by its nature a statistical function. It includes the average values of a certain series which have been calculated. These average values are values of different subsets of values from a certain set. It is employed mostly in time series for analysis of changing trends.

It can be employed in economic analysis if there is the need to study the average of products sold over a time period *t*. It is also possible to use several moving average functions, each of them set for a particular time period. The crossing point of the moving averages shows the change in the trend.

8. Coefficient of determination in economic analysis

The coefficient of determination is a very important part of an economic or statistic analysis, especially when some relationship between the objects of the analysis is studied or must be found. From the perspective of functions it will refer to the relation and the effect *x* has on *y* or vice versa - the relation and the effect *y* has on *x*.

The coefficient of determination (Kdet=R^2), is equal to the square of the coefficient of correlation and describes the so called explained dispersion. It usually varies within the range of $0 \leq R^2 \leq 1$. Through the coefficient of determination a check is made about the availability of linear relation between *x* and *y*. It shows what part of the Y variation is due to the differences between the values of X, i.e. the impact of the studied factor. If it is multiplied by 100, it expresses the force of the impact of the dependent variable and then we obtain limits in percentage: $0\% \leq R^2 \leq 100\%$. In scientific literature the coefficient of determination is also present as “coefficient of definiteness“. The coefficient of definiteness (determination) and indefiniteness are added to get one (100%). If we have $R^2 = 70$ %, and $K^2 = 30\%$ then we get:

$$R^2 + K^2 = 70\% + 30\% = 100\ \%$$

As limits of the coefficient of correlation are given two scales which are formed from the scales of the coefficient of correlation (R) (Aleksandrova 2017; Kirkorov, Bonev 1980; Grifell, Knox Lovell 2015):

Table 2. Values of the coefficient of correlation (R)

Variant 1R	Interpretation - R	Variant 2R
0 < R < 0,3	*weak correlation*	0 – 0,2
0,3 < R < 0,5	*moderate correlation*	0,2 – 0,4
0,5 < R< 0,7	*significant correlation*	0,4 – 0,6
0,7 < R < 0,9	*high correlation*	0,6 – 0,8
0,9 < R < 1	*very high correlation*	0,8 - 1

Table 3. Values of the coefficient of correlation (R^2)

Variant 1R^2	Interpretation – R^2	Variant 2R^2
0% < R^2 < 9%	*weak correlation*	0% – 4%
9% < R^2 < 25%	*moderate correlation*	4% – 16%
25%< R^2 < 49%	*significant correlation*	16% – 36%
49%< R^2 < 81%	*high correlation*	36% – 64%
81%<R^2< 100%	*Very high correlation*	64% - 100%

The calculations are made in the following way:

If we take as the coefficient of correlation the value of R = 0,3 in order to obtain the coefficient of determination (R^2) we must square the value of the coefficient of correlation and multiply it by 100 in order to obtain the number in %, i.e.:

$$R = 0,3 \Rightarrow R^2 = (0,3)^2 * 100\% = 9\%$$

9. Practical application of the functions in economics. Drawing a trend and its interpretation

The object of study is an industrial company, which produces 2 types of items, respectively “A” – contactors and “B”- relays. The sales of the two products are presented (Angelova, Borisova 2019) in Table 4:

Table 4. Sales of items “A”and “B”

Month	Item		Σ (A+B)
	A [number]	B [number]	
1	100	120	**220**
2	95	130	**225**
3	110	100	**210**
4	125	140	**265**
5	135	130	**265**
6	120	140	**260**
7	120	150	**270**
8	100	140	**240**
9	130	140	**270**
10	135	130	**265**
11	140	150	**290**
12	120	140	**260**
Σ	**1430**	**1610**	**3040**

The total number of products “A” sold for the whole year is 1430 and of “B”1610.

The graph below shows sales of product “A” and the trend is obtained through the use of the different types of functions. In a similar way the graph for product “B” can be drawn.

9.1. Exponential function

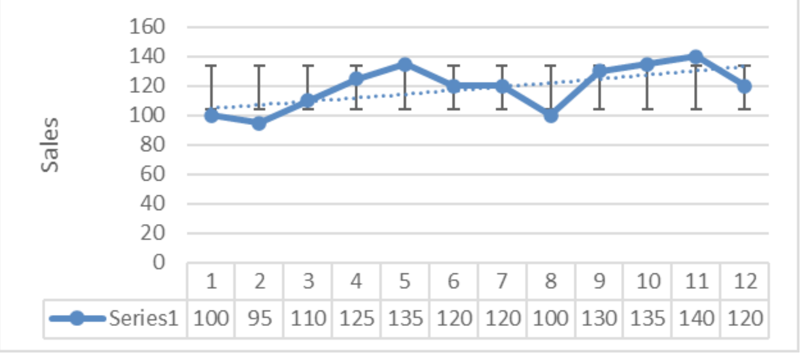


Figure 10. Exponential fuction

$$y = 102{,}66e^{0{,}0218x}$$
$$R^2 = 0{,}3649$$

We have obtained an equation, which is not with a negative sign and that means that the trend is positive, i.e. if the sales have similar values the firm will have a good profit and will not have any losses. There is a moderate correlation between the values.

It is necessary to pay attention to the fact that the values for each month are interlinked with previous months and future periods as in a system there is the impact of both direct and indirect factors. Figure 11 illustrates the impact of the external and internal factors. The ellipsis shows the external environment of the firm. The numbers 1,2 and 3 stand for the volume of sales and the size of the circle demonstrates whether sales have decreased or increased as compared to the previous period. The arrows pointing to the inside of the ellipsis show how external factors penetrate the internal environment of the firm, and the triangles (Δ) denote internal factors. External factors can be, for example political and legal changes, inflation, etc. Internal factors can be problems within the enterprise itself such as: lack of assembly elements for a specific item or an abrupt deterioration of its financial situation, insufficient workforce and as a result of these factors reduction in orders. That is why it is necessary to seek and study a “hidden” relation between the values in order for the enterprise to be able to respond adequately in a certain situation.

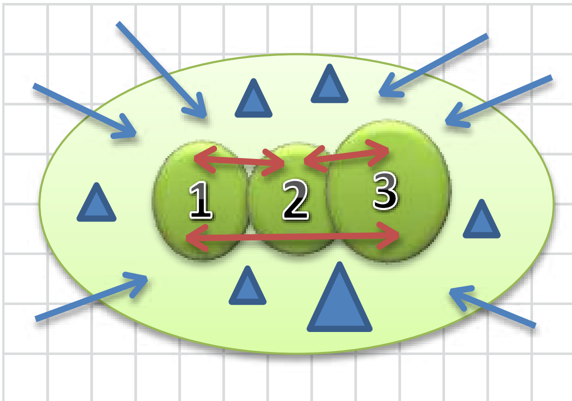


Figure 11. External and internal factors of an enterprise

9.2. Linear function

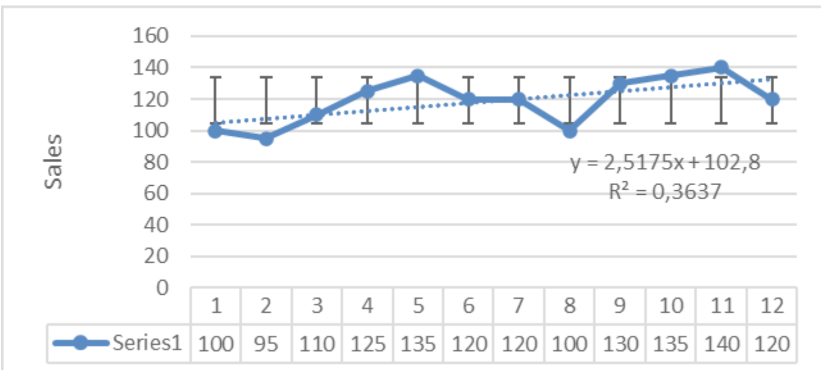


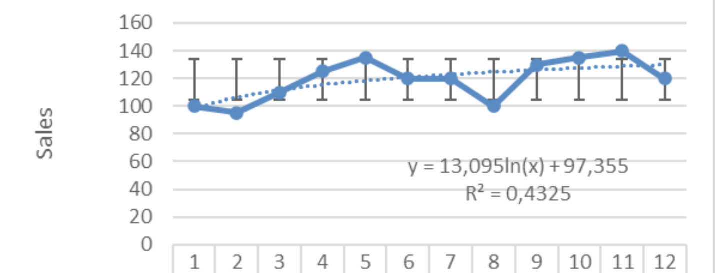
Figure 12. Linear function

$$y = 2{,}5175x + 102{,}8$$
$$R^2 = 0{,}3637$$

With the linear function there is also positive trend with moderate correlation.

The linear function is one of the most widely used functions for interpretation in economic analysis. That advantage is manifested by the fact of the easy calculation and interpretation of the obtained equation and with its graphic image. It is important to note the slope of the line if one is not capable of dealing with equations. In that particular case the line is with a positive slope, therefore, we can come to the conclusion that the trend (tendency) is positive. If we have to come up with a more accurate interpretation we can say that the tendency is moderately positive because as it can be seen from the graph there is not a strictly expressed slope of the line to the *x* axis, i.e. the angle coefficient has a small positive value. The interpretation of the line can be made even as an analogue to the different types of monotonic functions.

9.3. Logarithmic function



	1	2	3	4	5	6	7	8	9	10	11	12
Series1	100	95	110	125	135	120	120	100	130	135	140	120

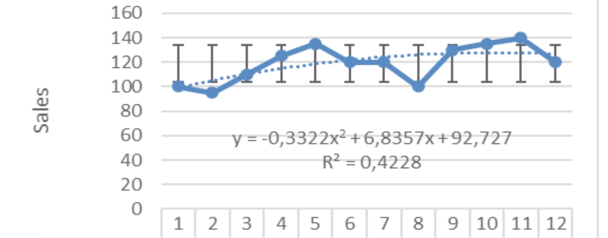
Figure 13. Logarithmic function

$$y = 13{,}095\ln(x) + 97{,}355$$
$$R^2 = 0{,}4325$$

With the logarithmic function we again have a positive trend. The coefficient of determination is within moderate limits.

Here the trend is shown by means of a natural logarythm – ln. It is a logarythm with a base of the number *e* = 2,718 281 828 459 045 235 360 287 471 35… The *e* number is called Napier's number.

9.4.Polynomial function



	1	2	3	4	5	6	7	8	9	10	11	12
Series1	100	95	110	125	135	120	120	100	130	135	140	120

Figure 14. Polynomial function

$$y = 0{,}3322x^2 + 6{,}8357x + 92{,}727$$
$$R^2 = 0{,}4228$$

As this is a polynomial function, respectively the function is obtained through polynoms, which are used for interpolation and extrapolation. In that particular case we also have positive values, the trend is a positive value, and the coefficient of determination is moderate.

9.5. Power function

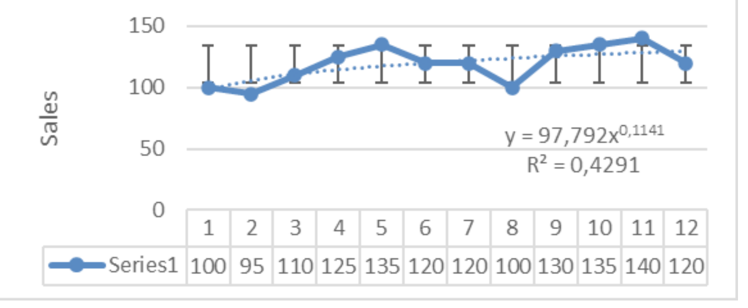


Figure 15. Power function

$y = 97{,}792x^{0{,}1141}$

$R^2 = 0{,}4291$

The power function is with a positive value like the other functions and tendency with the same coefficient of determination, i.e. it is with a moderate value.

With the exponential, logarithmic, polynomial and power functions the way of interpreting them is the same as with the linear function, but unlike the linear function, they are more difficult to interpret in view of the obtained equations and images. They are not straight lines and that further makes their interpretation more difficult. That is why it is recommended that the linear graph is used in economic and technical analyses.

Based on the above data, it can be stated that the determination coefficient is in relatively close limits for the linear and exponential functions – in interval [0,3637; 0,3649] or the average value is 0,3643.

The same inference can be done for the rest of the functions – logarithmic, polynomial and power. The determination coefficient is in the interval [0,4228; 0,4325] with an average value – 0,4281. The deviation between the mean values of the coefficient of determination between the individual functions is 0,0638.

9.6 Moving average[1]

Table 5 shows a moving average plotted on the basis of average values by quarters using the data in Table 4.

Table 5. Average sales of products "A" and "B"

Month	Item		Σ (A+B)
	A	B	
1	0	0	0
2	***102***	***117***	***219***
3	0	0	0
4	0	0	0
5	***127***	***137***	***264***
6	0	0	0
7	0	0	0
8	***117***	***143***	***260***
9	0	0	0
10	0	0	0
11	***132***	***140***	***272***
12	0	0	0
Σ	**478**	**537**	**1015**

On fig. 17 is applied moving average between two periods:

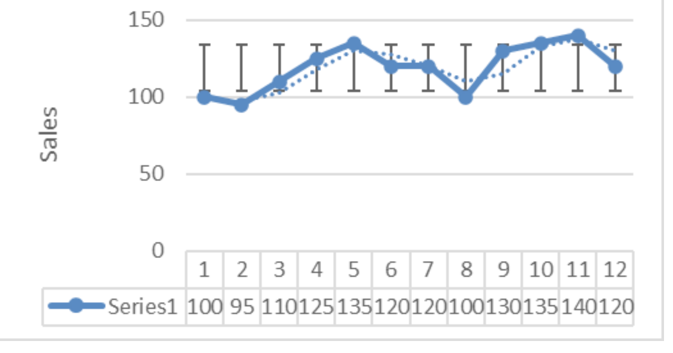


Figure 17. Moving average according to Table 4

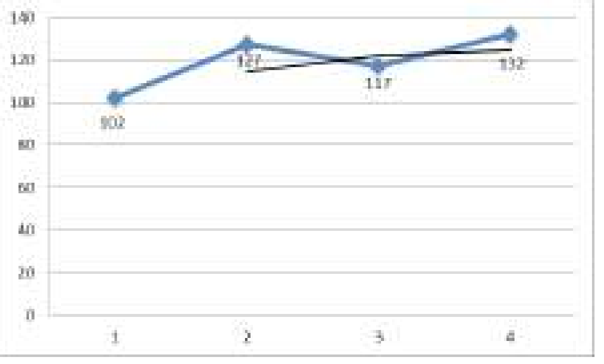


Figure 18. Moving average

Using the moving average plotted in Fig. 16 we can come to the conclusion that there is a change in trend in the third quarter as the graph has a V-imaged bottom. It is further noted that the trend will be positive as there is a slight positive slope between the third and the fourth quarter.

Fig. 17 shows what, with the same average values, a trend will look like if it is plotted using a linear function. It can again be seen that it is positive, both visually, and from the interpretation of the analytically set function.

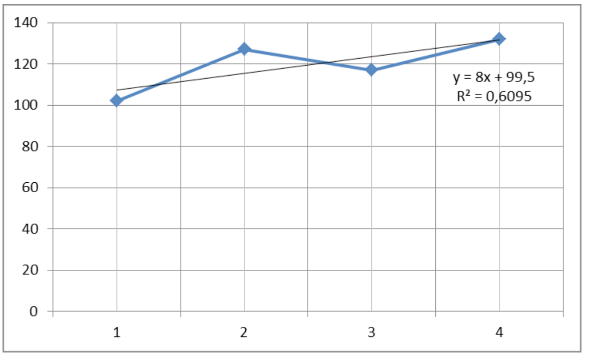


Figure 19. Linear function of the trend at averaged values

$$y = 8x + 99,5$$
$$R^2 = 0,6095$$

10. Recommended research methodology

Based on the mentioned functions, the following methodology can be proposed for performing the analysis:

1) Selection of the object/subject of research;

2) Preparation for data collection, for example – whether it will be interval-grouped data or individual independent quantities, etc.;

3) Before data collection, a control check is made of the selected data collection tools for final processing and analysis;

4) Carrying out a test-check;

5) Carrying out the site survey and data collection;

6) On-site review of the processed data for possible omissions and/or errors;

7) Selection of the type of function to be used according to the available data; (When selecting multiple features, this should be pre-ordered from most significant to least significant.)

8) Entering the data in a given software product;

9) Obtaining a result to be interpreted;

10) Conclusion.

If several functions are used for the same study, it should be monitored what they show, whether the previous one is confirmed or a different result is obtained. As in any one separate field, several functions may indicate approximately the same thing, but one of them gives a more complete picture of the particular study. From an investment point of view, most practitioners prefer, especially when tracking price movements, to apply an exponential function, as it can show the expected trend much more accurately than a linear one.

Conclusion

The authors present six functions and their practical application in economic analysis by means of establishing trends and their interpretation. On the basis of the study that was carried out we can come to the conclusion that the function with the greatest application in economic analysis is the linear one when there are sequential data for a certain period of time t. It is the function that provides clear and accurate picture of the dynamics of the resulting indicator on the basis of more than one period of study. When we deal with averaged values it is appropriate to use the moving average function. We need to point out that with averaged values we can also obtain information about a trend from a linear function.

It is a matter of judgement on behalf of the experts whether to use an exponential, logarithmic, polynomial or power function in their future financial-economic analyses.

Acknowledgements

The authors would like to thank the Research and Development Sector at the Technical University of Sofia for the financial support.

NOTES

1. https://www.matematika.bg/algebra/functions.html.
2. https://bg.wikipedia.org/wiki/Funktsiya#Vidove_funktsii; https://www.matematika.bg/algebra/functions.html.
3. Ibid.
4. https://www.matematika.bg/algebra/functions.html.

REFERENCES

ALEKSANDROVA, M., 2017. *Optimizaciq na investicionniq izbor*. Trakiya-M, UNWE.

ANGELOVA, R. & IVANOVA, D., 2023. Determinants of Firm Competitiveness: Econometric Evidence from the Bulgarian Industry. *Strategii na Obrazovatelnata i Nauchnata Politika – Strategies for policy in science and education*, vol. 31, no. 3s, pp.56 – 68. https://doi.org/10.53656/str2023-3s-4-det.

ANGELOVA Y.; BORISOVA S., 2019. Personel Motivation in Industrial Enterprises Through Bonus System with Additional Remuneration. *Zbornik Radova Book of Proceeding, II International Scientific Conference, Regional development and cross-border cooperation*, pp. 241 – 246. Pirot. ISBN 978-86-900497-1-4. Available at: http://www.konferencija2018.komorapirot.com/pdf/ZbornikFinall.pdf.

AVRAMOV A., 2000. *Visha matematika – 1 /s prilozhenija v ikonomikata i biznessa/*. Veliko Tarnovo.

BOYADZHIEV, L.; KAMENOV O., 2002. *Visha matematika – 2*. Sofia.
CHUKOV, K. & IVANOVA R., 2017. *Finansovo-stopanski analiz*. UNWE.
DELLAGO C., 2010. *Einführung in die Physikalischen Rechenmethoden I + II. Skriptum zur Vorlesung*. Universität Wien;
DIMITROVA, E., 2002. *Sbornik zadachi po visha matematika – vtora chast*. Plovdiv.
GRIFELL, E.; KNOX LOVELL, C.A., 2015. *Productivity Accounting: The Economics of Business Performance*. Cambridge University Press.
HRISTOV, M., 2018. Osobenosti na finansovite i ikonomicheski reformi prez parvite godini na prehoda v Bulgaria. *Sbornik nauchni trudove, XI International Scientific-Applied Conference "Digital Economy and Blockchain Technology"*, pp. 219 – 227. Varna.
KIRKOROV, I. & BONEV, K., 1980. *Visha matematika*. Sofia.
PENEVA, G. & ANDREEV, O., 2023. Assessing Bulgarian SMES' Maturity for Industry 4.0 Implementing – The Case of "Montana Hydraulics" Ltd. *Strategies for Policy in Science & Education-Strategii na Obrazovatelnata i Nauchnata Politika*, vol. 31, no. 3s, pp. 9 – 24. https://doi.org/10.53656/str2023-3s-1-ass.

✉ **Prof. Yordanka Angelova**
✉ **Vasil Kuzmov, Assist. Prof.**
Faculty of Management
Technical University of Sofia
8, Kliment Ohridski Blvd.
1756 Sofia, Bulgaria
E-mail: angelova@tu-sofia.bg
v.kuzmov@tu-sofia.bg