**FUNCTIONS**

**How can we predict the revenues of a company? How can we calculate the costs that our company has?**

In many cases, sales or costs are difficult to calculate, but we can simplify this task considerably by the introduction of mathematical functions that replicate how our company works and use that data to develop a better strategy for our businesses.

To start with, let's say that a mathematical function is like a black box usually named "f(x)" that with certain inputs (independent values) it creates an output (dependent value). In the example below we can see how this firm through this function is getting the revenues of a company as an output using X as a discount of the original price P and the demand q.

**input**  
x  
(demand, price, discount)**⇒**

**function**  
f:**⇒**

**output**  
f(x)  
(revenue of the company)

If we analyze the black box we can realize that the function could be something like: revenue = (price-% discount) \* demand. For simplicity, we'll call the revenue R, the % discount d, the price p and the demand x, then we have:

R = (1- d) \* p \* x

If the discount is 20% and the price 5 the function may look this way:

R = (1-0.20) \* 5 \* x = 4x  
Hence, the function is f(x) = 4x

In this example we can see 2 different concepts. As we can all see in the function 4 is a constant because it is never going to change independently of the demand but x is a variable and depending on how demand varies its value is going to change and consequently it is also going to change the output of the function.

i Can we see a function graphically?

Although there are many types of functions, in this case we are going to analyze 3 of them. Please, check out each of them to learn how they behave and the pattern they follow.

**Linear functions**

In a linear function each term is either a constant or the product of a constant and (the first power of) a single variable.

The mathematical formula follows the following pattern:

y=f(x)=ax+by=f(x)=ax+b

**Quadratic functions**

The mathematical format for a quadratic function is the following:

y=f(x)=ax2+bx+c,a≠0y=f(x)=ax2+bx+c,a≠0

Or it can also be represented in the following mathematical format:

y=ax2+bx+c=a(x+b2a)2−b2−4ac4ay=ax2+bx+c=a(x+b2a)2−b2−4ac4a

**Exponential functions**

The mathematical format for a exponencial function is the following:

y=f(x)=bxy=f(x)=bx

where b>0 in this base.

Now that you know how these functions work, please select a value for a and b and click on the view button in order to see how curves are built and click on the info button for further information:

a: -5

b: -5

i

**Linear functions**  
f(x) = ax + b

−10010−15−10−5051015

i

**Quadratic functions**  
f(x) = ax2 + bx

−10010−15−10−5051015

i

**Exponential functions**  
f(x) = ax + b

−10010−15−10−5051015

**Exercise**

Top of Form

A startup owner starts his business with debts €100,000. After operating for five years, he has accumulated a profit of €50,000. Write a linear rule for "Profit" as a function of "Time", i.e. write it in the form y = ax + b , where "y" is Profit and "x" is Time.

Please, choose the option

Y = 100,000 - 30,000 \* x

Y = -100,000 + 30,000 \* x

Y = -100,000 + 50,000 \* x

Bottom of Form

Looking at the graph: What will the result to the function be in the sixth year?

Please enter the result and click on the check button.



Check

Chart, line chart

Description automatically generated

Text

Description automatically generated with low confidence

Chart, line chart

Description automatically generated

Graphical user interface, application

Description automatically generated

**EQUATIONS**

**An equation is a mathematical statement that asserts the**equality or inequality of two expressions.

It can be an **equality** like **x + 2 = 5**, where x + 2 equals to 5.

Or inequalities like:

* **x + y > 3** where x+y is more than 3
* **3x + 5 < 10** where 3x +5 is less than 10.

**Graphical user interface, text, application

Description automatically generated**

**Graphical user interface, text, application, email

Description automatically generated**

**Graphical user interface, application

Description automatically generated**

**Chart

Description automatically generated**

The fuel car is less costly as long as you drive less than 450 miles, it is equally costly if you drive exactly 450 miles and more costly if you drive more than 450 miles.

**Graphical user interface, application

Description automatically generated**

**Chart, funnel chart

Description automatically generated**