ITC DEGANUTTI a.s. 2009 - 2010

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Titolo del modulo	RELATIONS AND FUNCTIONS
classe (scuola)	3^Aigea
livello linguistico	LOWER INTERMEDIATE
punto del programma (eventuali prerequisiti)	Basi del programma di matematica generale del biennio; introdurre formule e redigere grafici con un foglio di calcolo.
contenuti disciplinari	Connessioni tra matematica e realtà Definizione di funzione come relazione, macchina, equazione Definizione di Dominio, Condominio, Grafico Simboli matematici Glossario matematico Grafici di funzioni lineari e quadratiche Formalizzazione del problema “Opening a new Store” Funzione Profitto Esercizi Uso della terminologia specifica in lingua Inglese per dare definizioni, descrivere grafici ed esprimere idee
numero di ore	10 ore
materiale	Fotocopie Software foglio di calcolo Excel Presentazioni power point
supporti	Lavagna Computer Video proiettore
compresenza	Sì , in parte (con la prof. di Inglese Ilaria De Cillia)

Level: Classe 3^IGEA i.t.c.
NR of STUDENTS 22
SUBJECT: Mathematics
TOPIC: Relations and Functions
PREVIOUS KNOLEDGES:

- Formulas and Graphics with a worksheet

MATERIALS: black board for the language framework; Handout 1:table with cause-effect (1copy for 2Ss); Handout2: table with input-machine-output ((1copy for 2Ss);blackboard to describe linear and quadratic functions like a machine Excel spreadsheet (1for 2Ss); Handout 3: worksheet of math symbols and Glossary(1 for 1S); Handout 4:"Opening a new store" (1 for 1S);
CONTENT AIMS:

- Explain how the real life and Mathematics are closely connected.
- Definitions of Relations and Mathematical Functions with particular attention to linear and quadratic functions;
- Ability to solve a problem expressing the data in a function
- Ability to analyse the graph
- Ability to analyse the results

LANGUAGE AIMS:

- use of the specific terminology giving definitions, describing graphs and expressing ideas.

LESSON 1 (50 min)

Activity	Task	Work type
BRAINSTORMING: speaking Listening: text: "Functions as Relationships". T reads twice the text	Presentation LESSON1- slide1 Ss complete the table with cause-effect (Handout 1); Presentation LESSON1- slide2	TSs laboratory in pairs
Speaking	compare the tables	Ss
Assessment	a new table is written on the board with the more significant relationships. Presentation LESSON1- slide3	T Ss

LESSON 2

Activity	Task	Work type
Listening text: "Functions as Machines". T reads twice the text.	Presentation LESSON2- slide1 match, on the worksheet the machines with their inputs and outputs, choosing in a least (Handout 2); Presentation LESSON1- slide2	in pairs
Speaking Activity	Ss compare the tables	Ss
Assessment Reading and writing Glossary	a new table is written on the board with the most interesting student's results. worksheet of math symbols;	T Ss T Ss

T cuts the tables 1 and 2 making 22 cards which are shuffled and shared to form new groups matching pairs.

LESSON 3

Activity	Task	Work type
Presentation LESSON3- slide1 Listening text: "Functions as Equations" T reads twice the text. (Handout 3)	using a worksheet complete the table with missing output and Draw the graphs of linear and quadratic function with Excel spreadsheet. Presentation LESSON3- slide2-3	Laboratory :in pairs
Speaking	describe the graphs	Ss
Listening text: "Functions definitions and main ideas" Glossary	Fill the gaps (Handout 4)	individual

LESSON 4

Activity	Task	Work type
Problem Solving:"Opening a new store" (Handout 5):	Read the text Ss	TS
Writing	Answer the questions Ss	individual
	Sketch the graph of the function "Net Profit" Ss	individual
Writing Speaking	Everyone interprets and writes 3-4 sentences about the graph, then discuss with others about the results.	Ss

LESSON 5

Activity	Task	Work type
Class Work		individual

LESSON 1 (50 min)

BRAINSTORMING ACTIVITY: Presentation LESSON1 slide 1

We've been studying math functions for long time but now we want to introduce math concept of functions in English to get two results :

- The first one is to assess your ideas about it
- The second one to improve your second language also by learning mathematical terms

I'm going to read the following text, please, pay attention while listening and try to take notes of the effects and causes you hear in the table below.

Handout1

*Functions as Relationships

In the most simplest sense functions are relationships. The world is full of relationships. How good you are at a task- such as playing video games, dancing, or playing basketball- depends on how much time and effort you spend at doing it. How far you run depends on how fast you can run and how long you run at that speed. Buying new shoes depends on your parents having money. Your parents having money depends on their having a job. Your parents having a job depends on how well they do their job and on how well the company is doing financially. Your grade in school depends on how hard you work at school. How hard you work at school depends on your attitude towards school.

Mathematicians and scientists try to discover relationships in nature to understand how things work and make our lives better. Understanding the relationship between petrol, air, and fire is what makes a cargo. Understanding the relationship between heat and bacteria allows us to understand when food is unhealthy. Understanding that electrons flow from a positive pole to a negative pole allows us to have C.D. players, telephones, and T.V.-sets

On the worksheet below, write down at least ten relationships that exist in the real world. Look for connections. What effect has one on the other? How does one depend on the other? Example, getting rid of a headache depends on taking aspirin. In other words, getting rid of a headache is a function of taking aspirin. It could also be viewed in terms of cause and effect. Rain depends on low barometric pressure. In other words, rain is a function of low barometric pressure. When the barometric pressure drops (cause) it rains (effect).

Presentation LESSON1- slide2

Handout 1

Complete now the table with Cause and Effect (10 min.)

Desired Result (Effect)	Depends On (Cause)
1. getting rid of headache	1. aspirin
2. rain	2. low barometric pressure
3.win the match	3.how much time and effort you spend and doing it
4.buy shoes	4.parents have money
5.work hard at school	5.the attitude toward school
6.electrons move from – to + pole	6.to have CDs, telephones, TV-sets

7.makes car go	7.relation ship between petrol, air and fire
8.pass the exames	8.study for ECDL
9.	9.
10.	10.

*

Presentation LESSON1- slide3

Compare the results altogether.

The teacher writes a new table on the board with the most significant relationships (10 min)

LESSON 2 (50 min)

Listen to the following text taking note of the unknown words:

Handout2

*

Functions as Machines

Presentation LESSON2- slide1

Another way to understand a function is as a machine. A machine has an input and an output. There is a relationship that exists between the input and output. The output depends on the input. The machine receives the input and transforms it into the output. For example, a toaster is a machine. When bread is input in the machine the output is toast. A washing machine is a machine. When dirty clothes are input into the machine the output is clean clothes. An oven is a machine. When raw meat is input into the machine the output is cooked meat. Some machines are complex. The human body, for example, is the most complex and sophisticated machine known. Think of the myriad of physical, emotional, mental, social, and spiritual inputs needed to have healthy persons.

Work in pairs and COMPLETE, on the worksheet below, at least ten machines with their inputs and outputs (10 min)

Input	Machine	Output
1.	1. toaster	1. toast
2. dirty clothes	2.	2. clean clothes
3. row meat	3. Oven	3.
4. water	4.	4. ice
5.	5. mill	5. flow
6. wood	6. fire place	6.
7. people	7. love	7.
8. question	8.	8. answer
9. raw material	9. factory	9.
10.	10. video camera	10.

*

Presentation LESSON2- slide2

The teacher gives the student the cards of the first lesson's tables to revise it and forms new pairs.
(10 min)

Worksheet of math symbols

LESSON 3 (50 min)

Presentation LESSON3- slide1

Listen to the following text taking note of the unknown words:

Functions as Equations

Functions can also be expressed using math symbols. If x is the input and y is the output, then the value of y depends on the value of x. The relationship between x and y is determined by the machine, which is also known as the rule or equation. The machine changes or transforms x into y. Therefore, y is a function of x.
The table below illustrates the function $y = x/2$.

Input (x)	Machine (Equation)	Output (y)	Relationship [ordered pair: (x,y)]
6	6/2	3	(6,3)
10	10/2	5	(10,5)
14	14/2	7	(14,7)

Notice that, whatever the value of x the machine turns it into y, by cutting the value of x in half.
What is the value of y when x is 50 or 100?

Handout 3

In the worksheet below, complete the missing items, that is the output or the corresponding ordered pair (5 min):

	Input (x)	Machine (Equation)	Output (y)	Relationship [ordered pair: (x,y)]
Linear function	2	$y = 2x + 3$		
Quadratic function	$\frac{1}{2}$	$y = x^2 + 4$		
Polinomial function	1	$y = x^3 + 2x^2 + x - 1$		
Rational function	-2	$y = \frac{x^2 - 4x - 5}{x - 5}$		

Presentation LESSON3- slide2-3
Using the spreadsheet of Excel draw the linear and the quadratic function of the table and discuss the graphs with the teacher.

Homework

Using a dictionary or web resources answer to these questions to enrich your glossary:

- *What is a spreadsheet?*
- *How does a spreadsheet consist?*
- *What can contain the cells of a spreadsheet?*
- *what does the formula in a cell depend on?*

Functions definitions and main ideas

Glossary

The teacher gives these concepts:

A function is a special kind of relation that pairs each element of one set with *exactly one* element of another set. A function, like a relation, has a domain, a range, and a rule. The rule is the explanation of which elements of the first set correspond exactly to the elements of the second set. A function is defined by its rule; some texts actually make no distinction between the rule of a function and the function itself. If you know the rule of the function you determine the domain and the range of a function.
Symbolically, a function can be illustrated with a simple drawing. Below in the figure are the sets A and B. The points in each set are the elements of the sets. The function f is shown on the left, and the relation g is shown on the right.

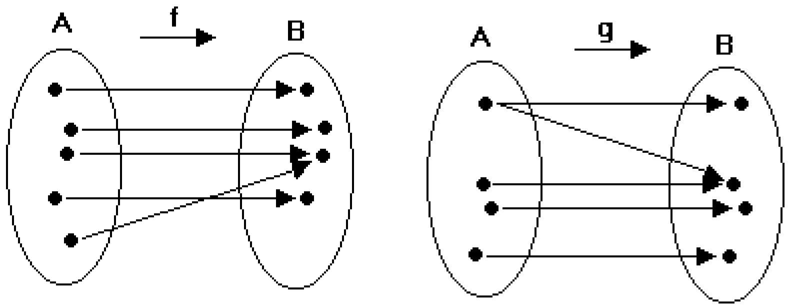

Figure 3.1: On the left, the function f associates the elements of the domain with exactly one element of the range. On the right, the relation g is not a function because it associates the same element of the domain to more than one element of the range.

Handout4

Fill in the following gaps (individual):

A function is a special kind of ______________ that pairs each element of one ___________with *exactly one* element of another set.
A function, like a relation, has a ________, a __________, and a _________.
The rule is the explanation of which elements of the first set correspond exactly to the elements of the second set.
A function is defined by its _________
If you know the __________ of the function you determine the _________ and the range of a function.

The teacher continues the lesson writing the terms and the rules on the board:

As you can see, certain elements of *A* are assigned to more than one element of *B* in the relation *g*. The function *f* assigns each element of *A* only one element of *B*.

Functions are generally denoted by a single letter. The domain of a function is the set of all inputs for which the function assigns an output. The range of a function is the set of all outputs of the function. The inputs, or elements of the domain, are called the independent variable of the function, and the outputs are the dependent variable. This is because the outputs of the functions *depend* on the inputs. If an element is put into a function, and no output can be assigned, then the function is undefined for that element. Such an element is not in the domain of the function.

Let's examine a simple function in what is called "function notation": $y = f(x) = 2x$. The name of the function is *f*. The independent variable is *x*, and the dependent variable is *y*. The rule of the function is $y = 2x$.
$f(x)$, or *y*, is the value of the function at *x*. $f(x)$ is read "*f* of *x*." If for a given input *x* there exists an output *y* that satisfies the rule, then *f* is defined at *x*. If there exists no output *y* that satisfies the rule for a given input *x*, then the function is undefined at *x*. The domain is the set of all *x* for which the function is defined. The range is the set of all *y* that could be taken by the function for some input value of *x*.

function notation $y = f(x) = 2x$
name of the function is *f*.
independent variable is *x*
dependent variable is y
f is defined at x when or a given input x there exists an output y that satisfies the rule
the function is undefined at x when there exists no output y that satisfies the rule

In the example above, $f(x) = 2x$. From this we know that the domain of *f* will consist of any number that can be doubled, which is the set of real numbers. The range will consist of these numbers doubled, which is also the set of real numbers.

The following exemples are given as handouts to the students: they read the text in pairs and underline the unknown words:

LESSON 4 (50 min)

Handout 5

Examples

Many real-life situations can be modelled by a function or by several functions. Take the opening of a new shop for example. A lot of money is required to build a store, decorate it, and stock it with merchandise. All this money must be spent before the store officially opens to the public. If the business is successful, the store's income will exceed its expenses daily, and eventually the store will make back all of the money needed to start it and make an overall profit. Let the initial expenses of the store equal $40,000, and for simplicity's sake, let the daily profit of the store equal $200.
The net profit of the store can be easily modelled by a simple function. Let the function be called *p*. Let the independent variable *x* be the number of days the store is open, and let the dependent variable *y* be the net profit of the store. Then $y = p(x) = -40,000 + 200x$.
For a better comprehension of the text, the teacher writes some questions on the board and the student give the answers.

QUESTIONS

What is the situation?	The opening of a new shop
What is necessary?	A lot of money to build the store and to stock it with merchandise
What is the aim of the director?	The store's income should exceed the daily expenses
What is the data of the problem?	Initial expenses \$40,000; daily profit \$200
What is the independent variable of the problem?	Let y be the net profit of the store
What is the function which models the problem?	The net profit: $y = p(x) = -40,000 + 200x$

The graph of the function looks like this:

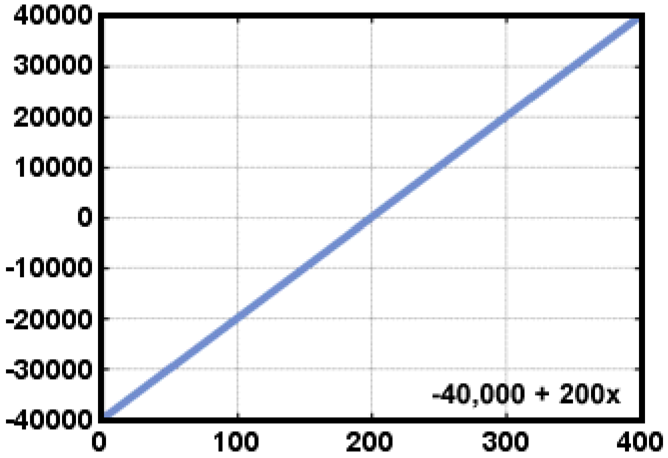

Figure 3.2: The net profit of a store is modeled by a function.

Because the independent variable *x* is the number of days that the store has been open, the domain of the function is the natural numbers (integers ≥ 0). The range of the function is real numbers . This is because with this over-simplified model, the profits are increasing at a constant rate. Theoretically, the profits increase by the minute, so at a given moment in time, the net profit could be any real number greater than -40, 000. With a model like this, it becomes easy to predict when the store will have back its initial investment and begin to make a net profit: after 200 days.

Laboratory's work

Produce a Power Point Presentation with 2 slides:

1- write in a table questions and answers referred to the problem "the opening of a new shop"

2- plot the graph representing the growing of net profit

LEZIONE 1   (vedere presentazione in power point)

LEZIONE 2   (vedere presentazione in power point)

LEZIONE3   (vedere presentazione in power point)

WORKSHEET OF MATH SYMBOLS

Symbol	What it is	How it is read	How it is used	Sample expression
+	Addition sign	... plus ...	Sum of a few values	3 + 5 = 8
*	Multiplication sign	... times ...	Product of two values	3 x 5 = 15 ¬(A * B) = ¬A + ¬B
x	Multiplication sign	... times ...	Product of two values	3 x 5 = 15
·	Multiplication sign	... times ...	Product of two values	3 · 5 = 15
-	Subtraction sign Minus sign	... minus Negative...	Difference of two values negative number	3 - 5 = -2
x	Cross product sign	... cross ...	Product of two sets	**A X B**
^	Carat	... to the power of ...	exponent	2 ^ 5 = 32
$\sqrt{\ }$	square root symbol	The square root of ...	Algebraic expressions	$\sqrt{4} = \pm 2$
/	Slash	... divided by .. ... over ...	Division	3/4 = 0.75
÷	Division sign	... divided by ...	Division	3 ÷ 4 = 0.75
%	Percent symbol	... percent ...	Proportion	0.032 = 3.2 %
:	Colon	... such that ... ... it is true that ...	Symbol used in defining a set	$S = \{x : x < 3\}$
|	Vertical line	......it is true that ...	Symbol used in defining a set	$S = \{x \mid x < 3\}$
( )	Parentheses	...quantity... ...list... ...set of coordinates... ...open interval	Denotes a set of coordinates, or an open interval	(x,y,z) (3,5)
{ }	Curly brackets	... the quantity ... ... the set ...	Denotes a quantity or a set	E = {2, 4, 6, 8, ...}
=	Equal sign	... equals ...	Indicates two values are the same	-(-5) = 5 $2z^2 + 4z - 6 = 0$
≠	Inequality sign	... is not equal to ...	Indicates two values are different	$x \neq y$
<	Inequality sign	... is less than ...	Indicates value on left is smaller than value on right	3 < 5 $x < y$
≤	Inequality sign	... is less than or equal to ..	Indicates value on left is smaller than or equal to value on right	$x \leq y$
>	Inequality sign	... is greater than ...	Indicates value on left is larger than value on right	5 > 3 $x > y$
≥	Inequality sign	... is greater than or equal to ...	Indicates value on left is larger than or equal to value on right	$x \geq y$
| |	absolute value sign	The absolute value of ...	Distance of value from origin in number line, plane, or space	| -3 | = 3
∀	Universal quantifier	For all ... For every ...	Logical statements	∀ x : x < 0 or x > -1
⟹	logical implication symbol	... implies ... If ... then ...	Logical statements	A ⟹ B
⟺	logical equivalence symbol	... is logically equivalent to .. ... if and only if ..	Logical statements	A ⟺ B

$\in$	Element-of symbol	... is an element of	Sets	*a* $\in$ A
$\notin$	Not-element-of symbol	... is not an element of a set ...	Sets	*b* $\notin$ A
$\varnothing$	Null symbol	The null set The empty set	Sets	$\varnothing$ = { }
$\mathbb{N}$, ***N***	bold *N*	The set of natural numbers	Number theory Set theory	$\mathbb{N}$ = {0, 1, 2, 3, ...}
$\mathbb{Z}$, ***Z***	bold *Z*	The set of integers	Number theory Set theory	$\mathbb{Z}$ = {0, 1, -1, 2, -2, 3, -3, ...}
$\mathbb{Q}$, ***Q***	bold *Q*	The set of rational numbers	Number theory Set theory	$\mathbb{Q}$ = {*a*/*b* | *a* and *b* are in $\mathbb{Z}$}
$\mathbb{R}$, ***R***	bold *R*	The set of real numbers	Number theory Set theory	What is the cardinality of $\mathbb{R}$?

GLOSSARY

Cartesian Product	The set of all possible ordered pairs (a, b) composed of elements taken from the two sets, A and B.
Dipendent variable	The output variable of a function; the variable whose value depends on the input, or independent variable.
Domain	The set of all inputs for which a function or relation is defined
Equation	A statement of equality between two expressions.
Function	A relation which assigns exactly one element in its range for each element in its domain.
Horizontal line test	The test by which it is shown whether a function is a one-to-one function or not, and therefore whether its inverse is a function.
Independent variable	The variable of a function which does not depend on the other variable -- it is the input
Input	The number or value that is entered, for example, into a function machine. The number that goes into the machine is the input.
Many to one function	A function is many-to-one if each element in its range is paired with more than one element from its domain.
One to one function	A function is one-to-one if each element in its range is paired with exactly one element from its domain.
Output	The number or value that comes out from a process. For example, in a function machine, a number goes in, something is done to it, and the resulting number is the output
Range	The set of all outputs of a function or relation
Relation	A rule that associates the elements of one set with those of another set. A relation can also be thought of as all of the ordered pairs which satisfy the rule.
Undefined	A function is undefined at a given value of its independent variable if for that value, there is no output--this occurs when a particular input creates a situation in which there is division by zero, or an even root of a negative number, for example.
Vertical line test	The test by which a relation is either shown to be a function or not. The graph of a function does not intersect with a vertical line more than once.
Cartesian coordinate system	A system in which ordered pairs of real numbers of the form (x, y) represent the locations of points from two perpendicular

	axes that intersect at origin. The first member of the ordered pair (x, y) is called the x-coordinate or abscissa. The second member of the pair (x, y) is called the y-coordinate or ordinate.

Le parti in rosso vanno cercate sul vocabolario