

Teacher's name	Venera Guglielmino	
Date	27/1/2013	
Subject	Math	
Learning Outcomes	Content	<ul style="list-style-type: none"> • Definition of functions. Different types of functions. Functions diagrams. Numerical functions.
	Language	<ul style="list-style-type: none"> • Use of simple present. • <i>One and only one</i> • <i>Let A and B be two sets, consider two sets</i> • <i>If.....then</i>
	Learning skill	<ul style="list-style-type: none"> • To compare and contrast different types of functions by looking at Venn-diagrams • To solve problems by working in groups • To apply the theory by giving practical examples
Personal aim	Be aware of and follow students' pace more. To increase students motivation and interest in study.	
Group profile	The age of students is 14 (1 st year high school). They know enough each other and are used to work in groups quite often. Some of them have difficulties in math, but have a good will to succeed. Most of them work autonomously and ask interesting contextual questions.	
Time	1 hour	
Assumptions	Most students are B1 level.	
Anticipated problems and solutions	The teacher must show the students the needed mathematical notations and symbols. To simplify the theory, the teacher must provide practical examples and graphic representations (diagrams).	
Resources & Materials	http://www.mathopenref.com/function.html http://en.wikipedia.org/wiki/Function_(mathematics) http://rechneronline.de/function-graphs/	

Procedure

Stage	Aim	Procedure	Materials	Interaction	Time
1.Activating prior knowledge	Encourage the communication between teacher and students to produce content language.	Compare and contrast by asking students what is a relation in math and what is the difference between a relation and a function.	Several Venn diagrams. Looking at them, the student should distinguish between a relation and a function.	The students will work in groups of two or three to share and motivate their opinion.	10 minutes

Stage	Aim	Procedure	Materials	Interaction	Time
2.Giving math notations.	Let the students have common specific language and symbols.	The teacher writes on the board the list of needed notations.	A summary of useful math notations and symbols will be hand out to students.	The teacher asks questions and makes examples to check students understanding.	15 minutes

Stage	Aim	Procedure	Materials	Interaction	Time
3. Giving definitions of functions.	Let the students distinguish between <i>injective</i> , <i>surjective</i> and <i>bijective</i> functions.	The teacher writes on the board the main contents.	Cards with graphical examples (Venn diagrams) or graphs). Each card describe just a function.	The students work in pairs to group the functions by type (injective, surjective or bijective). The students motivates their choice.	10 minutes

Stage	Aim	Procedure	Materials	Interaction	Time
4. Consolidating new math vocabulary and content.	Memorize, use and create connections between new contents.	Evaluation of the students through open questions.	Crossword puzzle.	The students write their answers individually. When they finish, check their results with those of one mate.	15 minutes

Stage	Aim	Procedure	Materials	Interaction	Time
5.Plenary session.	Understand the satisfaction level of the students after the lesson.	Questions like these: “Tell me what was new in today’s lesson” or “what was difficult” or “what you would like to find out”.	No specific material is provided.	All class is involved in the discussion.	10 minutes

1. Activity: distinguish between a relation and a function

Work in pairs and find a name for each picture. Distinguish between functions and relations. Check your results within the class.

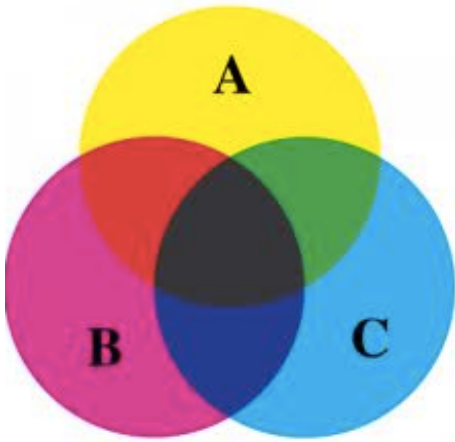


Figure 1

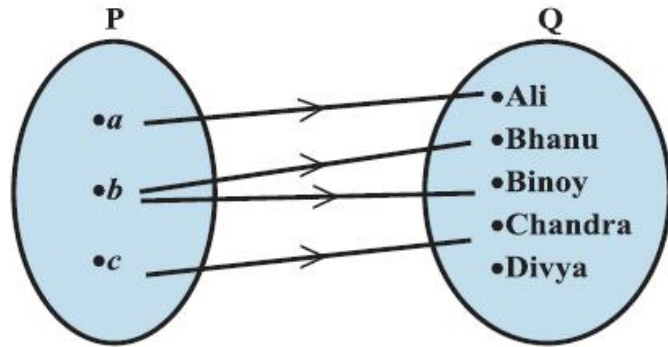


Figure 2

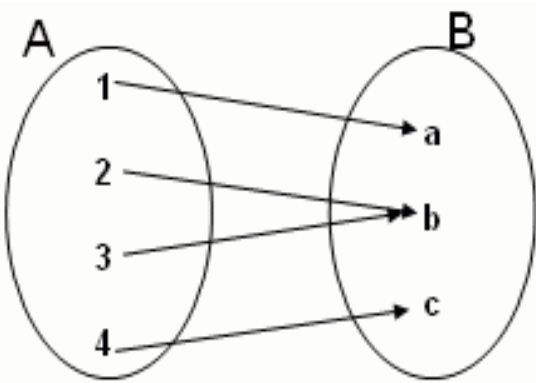


Figure 3

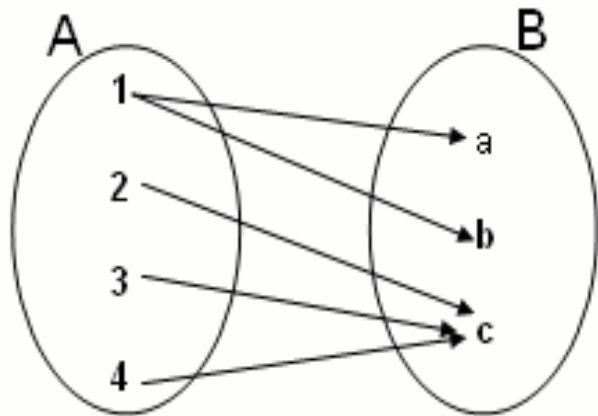


Figure 4

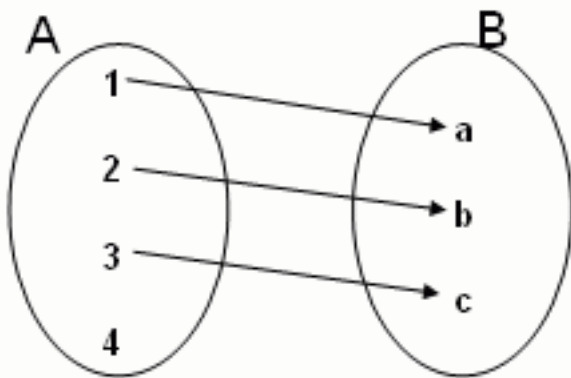


Figure 5

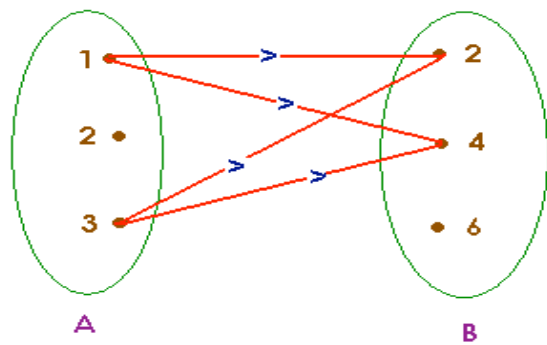


Figure 6

2. Activity: acquiring specific math definitions and symbols

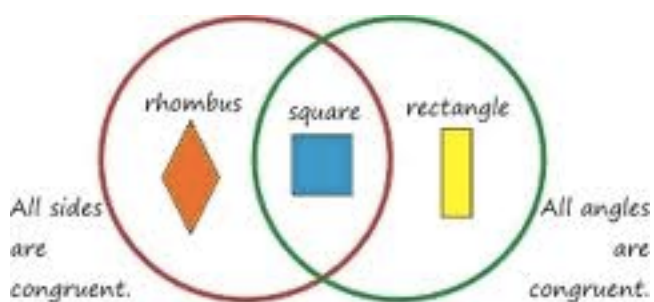
Look at the glossary concerning sets, relations and functions and at the list of Math symbols. Underline the new terms/symbols and discuss in small groups.



GLOSSARY

SETS

INSIEMI

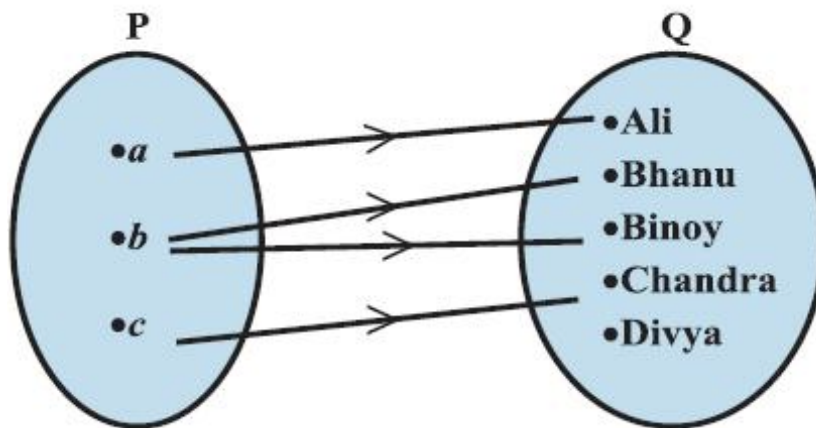


Set	Insieme
Subset	Sottoinsieme
Union	Unione
Intersection	Intersezione
Difference	Differenza
Empty Set	Insieme vuoto
Universal Set	Insieme universe
Complement	Insieme complementare
Membership	Relazione di appartenenza
Member (element)	Elemento (di un insieme)

Cartesian Product	Prodotto cartesiano
Power set	Insieme delle parti
Partition	Partizione di un insieme
Ordered pair	Coppia ordinate

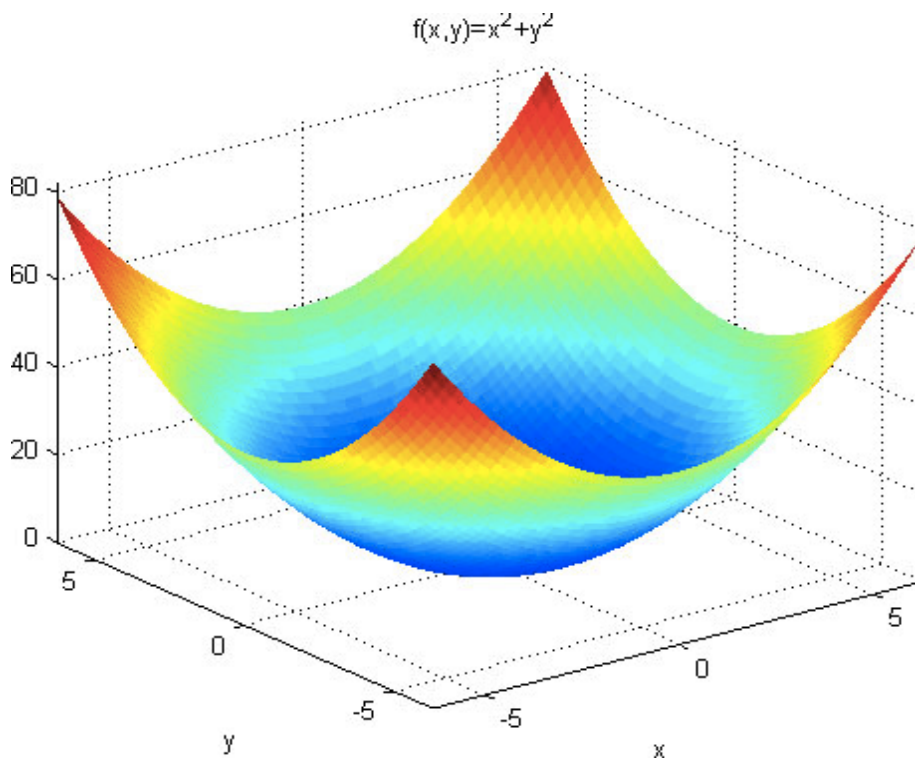
RELATIONS

RELAZIONI



Relation	Relazione
Binary relation	Relazione binaria
Image	Immagine (di un elemento)
Domain	Dominio
Codomain (Range)	Codominio
Inverse relation	Relazione inversa
Reflexive property	Proprietà riflessiva

Symmetric property	Proprietà simmetrica
Antisymmetric property	Proprietà antisimmetrica
Transitive property	Proprietà transitive
Equivalence relation	Relazione di equivalenza
Order relation	Relazione d'ordine
Partial order	Ordine parziale
Total order	Ordine totale
Arrow representation	Rappresentazione sagittale



FUNCTIONS

Function

Injective function (injection)

**Surjective function
(surjection)**

Bijjective function (bijection)

One-to-one correspondence

Inverse function

Composite function

Function composition

Identity function

Image Set

Inverse image (preimage)

FUNZIONI

Funzione

Funzione iniettiva

Funzione suriettiva

Funzione biiettiva (biunivoca)

Corrispondenza biunivoca

Funzione inversa

Funzione composta

Composizione di funzioni

Funzione identica (identità)

Immagine di un insieme

Immagine inversa (controimmagine)

Set Theory Symbols

Symbol	Symbol Name	Meaning / definition	Example
$\{ \}$	set	a collection of elements	$A = \{3, 7, 9, 14\}$, $B = \{9, 14, 28\}$
$A \cap B$	intersection	objects that belong to set A and set B	$A \cap B = \{9, 14\}$
$A \cup B$	union	objects that belong to set A or set B	$A \cup B = \{3, 7, 9, 14, 28\}$
$A \subseteq B$	subset	subset has fewer elements or equal to the set	$\{9, 14, 28\} \subseteq \{9, 14, 28\}$
$A \subset B$	proper subset / strict subset	subset has fewer elements than the set	$\{9, 14\} \subset \{9, 14, 28\}$
$A \not\subseteq B$	not subset	left set not a subset of right set	$\{9, 66\} \not\subseteq \{9, 14, 28\}$
$A \supseteq B$	superset	set A has more elements or equal to the set B	$\{9, 14, 28\} \supseteq \{9, 14, 28\}$
$A \supset B$	proper superset / strict superset	set A has more elements than set B	$\{9, 14, 28\} \supset \{9, 14\}$
$A \not\supseteq B$	not superset	set A is not a superset of set B	$\{9, 14, 28\} \not\supseteq \{9, 66\}$
$\mathcal{P}(A)$	power set	all subsets of A	

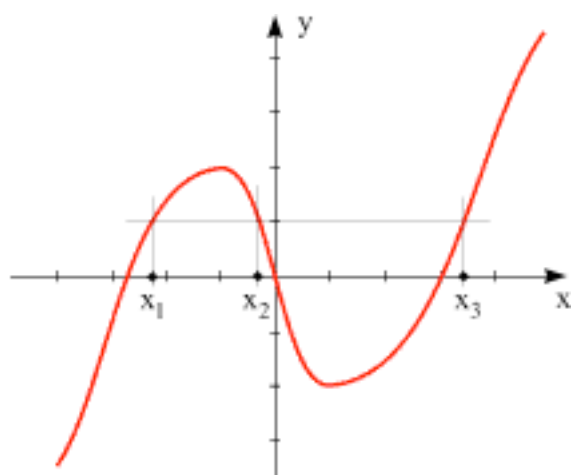
$A = B$	equality	both sets have the same members	$A = \{3, 9, 14\}$, $B = \{3, 9, 14\}$, $A = B$
A^c	complement	all the objects that do not belong to set A	
$A \setminus B$	relative complement	objects that belong to A and not to B	$A = \{3, 9, 14\}$, $B = \{1, 2, 3\}$, $A - B = \{9, 14\}$
$A - B$	relative complement	objects that belong to A and not to B	$A = \{3, 9, 14\}$, $B = \{1, 2, 3\}$, $A - B = \{9, 14\}$
$A \Delta B$	symmetric difference	objects that belong to A or B but not to their intersection	$A = \{3, 9, 14\}$, $B = \{1, 2, 3\}$, $A \Delta B = \{1, 2, 9, 14\}$
$A \ominus B$	symmetric difference	objects that belong to A or B but not to their intersection	$A = \{3, 9, 14\}$, $B = \{1, 2, 3\}$, $A \ominus B = \{1, 2, 9, 14\}$
$a \in A$	element of	set membership	$A = \{3, 9, 14\}$, $3 \in A$
$x \notin A$	not element of	no set membership	$A = \{3, 9, 14\}$, $1 \notin A$
(a, b)	ordered pair	collection of 2 elements	
$A \times B$	cartesian product	set of all ordered pairs from A and B	
$ A $	cardinality	the number of elements of set A	$A = \{3, 9, 14\}$,

			$ A =3$
$\#A$	cardinality	the number of elements of set A	$A=\{3,9,14\}$, $\#A=3$
\emptyset	empty set	$\emptyset = \{ \}$	$C = \{\emptyset\}$
U	universal set	set of all possible values	
\mathbb{N}_0	natural numbers / whole numbers set (with zero)	$\mathbb{N}_0 = \{0,1,2,3,4,\dots\}$	$0 \in \mathbb{N}_0$
\mathbb{N}_1	natural numbers / whole numbers set (without zero)	$\mathbb{N}_1 = \{1,2,3,4,5,\dots\}$	$6 \in \mathbb{N}_1$
\mathbb{Z}	integer numbers set	$\mathbb{Z} = \{\dots,-3,-2,-1,0,1,2,3,\dots\}$	$-6 \in \mathbb{Z}$
\mathbb{Q}	rational numbers set	$\mathbb{Q} = \{x \mid x=a/b, a,b \in \mathbb{N}\}$	$2/6 \in \mathbb{Q}$
\mathbb{R}	real numbers set	$\mathbb{R} = \{x \mid -\infty < x < \infty\}$	$6.343434 \in \mathbb{R}$

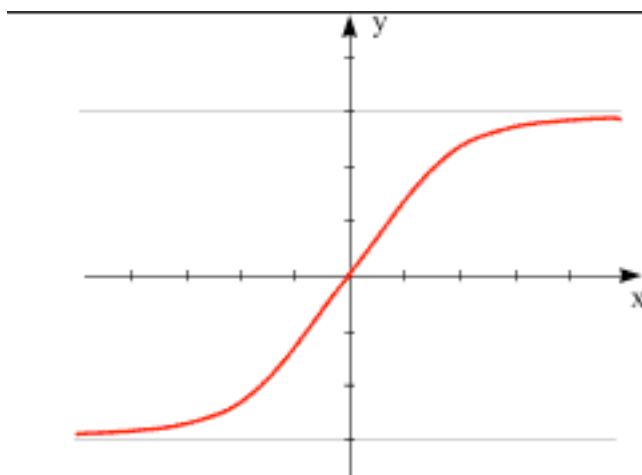
3.Activity: distinguish between different types of functions

Look at the graphs and discuss in pairs which kind of function is described in each picture. Distinguish between injective, surjective and bijective functions.

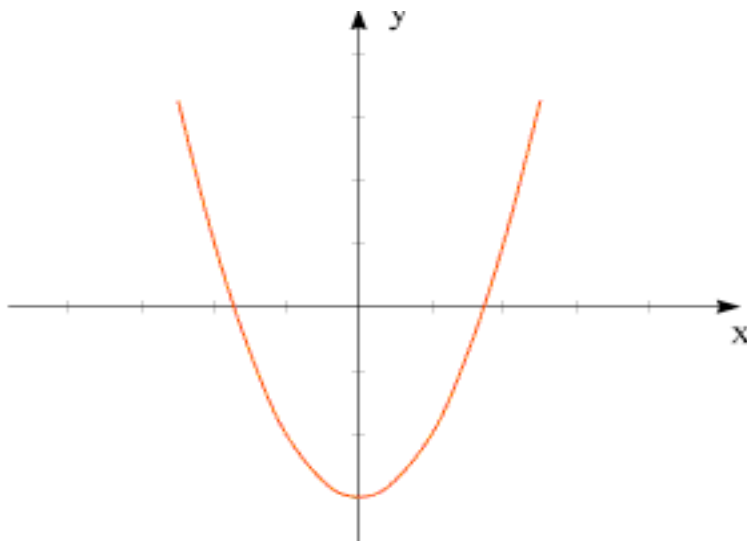
Motivate your answer and share with the class.



Graph 1



Graph 2



Graph 3

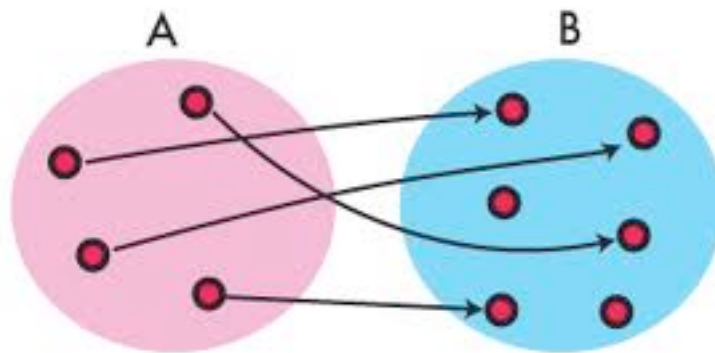


Diagram 1

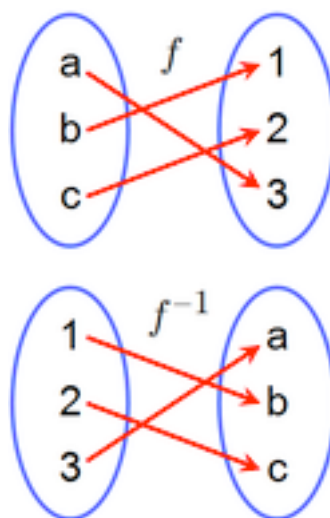
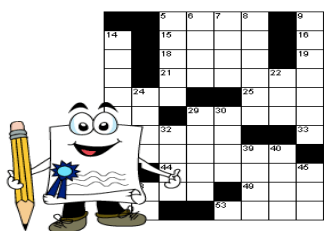


Diagram 2

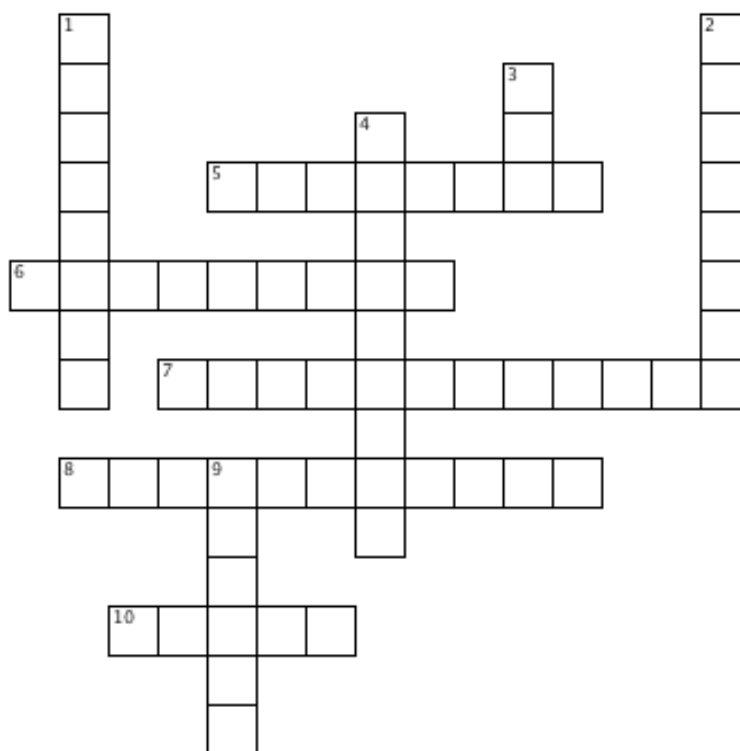
4. Crossword puzzle



Look at the definitions of the crossword puzzle and answer individually.

Check your answer with one mate.

Functions



Across

5. The unique function over a set X that maps each element to itself.
6. Function injective and surjective.
7. Set of objects that belong to set A and set B
8. The number of elements of set A
10. Picture of a function.

Down

1. Relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output.
2. The set of permissible outputs to a given function.
3. A collection of elements.
4. Set of all possible values.
9. The set of all permitted inputs to a given function.

5. Plenary session

The discussion involve the whole class. The teacher asks the following list of questions:

- 1) What was new in this lesson?*
- 2) What was particularly difficult?*
- 3) What activity was the most interesting?*
- 4) Do you prefer working in pairs, in groups or individually?*
- 5) Could you find and collect some material concerning today's lesson?*