Gymnázium, Brno, Slovanské nám. 7

WORKBOOK

http://agb.gymnaslo.cz

Subject: **Mathematics**

Student: ....

School year: ..../............

Introduction to Functions

In everyday life, many quantities depend on one or more changing variables. For example:

a) Plant growth depends on sunlight and rainfall
b) Speed depends on distance travelled and time taken

A function is a rule that relates how one quantity depends on other quantities

Example 1

We know the equation for the area, *S*, of a circle from primary school:

$S = \pi r^2$, where *r* is the radius of the circle

This is a **function** as each value of the independent variable *r* gives us **one** value of the dependent variable *S.*

Fill the table:

r	1	2	3	4	5	10	20
$S = \pi r^2$							

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Example 2
It is given the set M = {2, 3, 4, 5, 6, 7, 8, 9, 10}

x	2	3	4	5	6	7	8	9	10
y	0	1	0	0	1	0	0	1	0

Find the function:

Example 3
It is given the prism
Find a **function** as each value of the independent variable *a* gives us **one** value of the dependent variable *u*
a.. the side
u… the space diagonal

- We use *x* for the independent variable and *y* for the dependent variable for general cases.
- In general, the value of any function *f*(*x*) when *x* = *a* is written as *f*(*a*).

Example 4
We have $f(x) = \frac{5-x}{x+2} \quad x \epsilon \langle -1; 5 \rangle$
Find f(-1) f(0,6) f(2) f(4,2)

- Function Notation

We normally write functions as: *f*(*x*) and read this as "function *f* of *x*".
We can use other letters for functions, like *g*(*x*) or *y*(*x*).

Repetition:

1. Given *f*(*x*) = 3*x* + 20, find *f*(-4) *f*(10)
2. Given that the height of a particular object at time *t* is

   $h(t) = 50t - 4.9t^2$, find *h*(2) h(5)
3. If $F(t) = 3t - t^2$ for $t \le 2$, find *F*(2) and *F*(3).

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The Graph of a Function

The graph of a function is the set of all points whose co-ordinates (x, y) satisfy the function $y = f(x)$. This means that for each x-value there is a corresponding y-value which is obtained when we substitute into the expression for $f(x)$.

Since there is no limit to the possible number of points for the graph of the function, we will follow this procedure at first:

1. Select a few values of x (at least 5)
2. Obtain the corresponding values of the function and enter them into a table
3. Plot these points by joining them with a smooth curve

Example 1

Graph the function $y = 2x + 1 \quad x \in R$

Domain and Range of a Function

Domain ***D(f)***

The domain of a function is the complete set of possible values of the independent variable in the function.
In plain English, this definition means:
The **domain** of a function is the set of all possible ***x*** values which will make the function "work" and will output real y-values.

When finding the **domain**, remember:

- The denominator (bottom) of a fraction **cannot be zero**
- The values under a square root sign **must be positive**

Range ***H(f)***

The **range** of a function is the complete set of all possible **resulting values** of the dependent variable of a function, after we have substituted the values in the domain.
In plain English, the definition means:

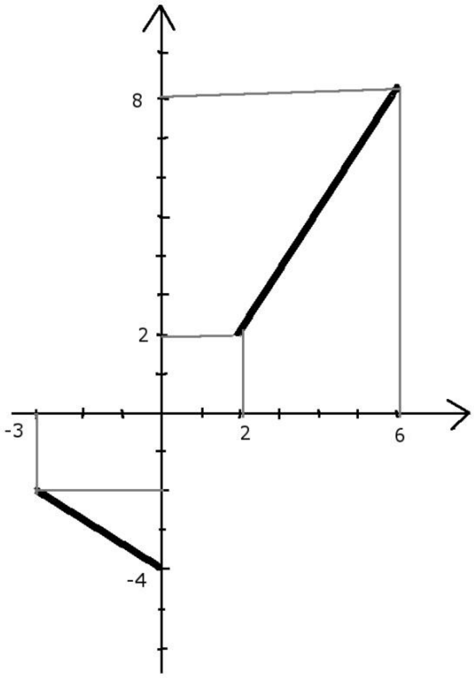
> The **range** of a function is the possible ***y*** values of a function that result when we substitute all the possible x-values into the function.

When finding the **range**, remember:

- Substitute different *x*-values into the expression for *y* to see what is happening
- Make sure you look for **minimum** and **maximum** values of ***y***
- **Draw** a **sketch!** In math, it's very true that a picture is worth a thousand words.

Examples

1. Look at the picture:



- write D(f)
- f(0) = f(4) = f(-3) =
- write H(f)
- find x ∊ D(f), f(x) = -2, x =

  f(x) = 8, x =

2. Find the domain and range for the function

$$f(t) = \frac{1}{t+2}$$

3. Find the domain and range for the function $g(s) = \sqrt{3-s}$

4. Find the domain and range of the function defined by the coordinates:

h(x) = {[−4, 1)], [−2, 2.5], [2, −1], [3, 2]}

Source: http://www.intmath.com/