**What is a function – basics?**

**Function** $f$ is a relation in which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the set of inputs $X$ is associated to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the set of outputs $Y$. Each function must have three elements defined:

1. Domain $X$ – a set of inputs, i. e. a set of all arguments of the function

2. Mapping rule $f$ – the way this data is transformed - functional equation

3. Codomain $Y$ – a set of possible outputs

**Video 01**

Functions are: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 3**

 $f:R\rightarrow R$

$$f(x)=x^{2}-1$$



$$g:\left〈0,\infty \right〉\rightarrow \left〈-1,\infty \right〉$$

$g(x)=x^{2}-1$



**Example 1b**

More then 20 000 students enroled in college in Croatia in 2021. Is the mapping in which each student who enroled in exactly one college is asociated with a college:

1. function
2. injection
3. surjection
4. bijection

**Example 4**

Each point on the Earth's surface is associated with a unique combination of two coordinates. On *Google maps* choose the place you want to travel to next summer and read its longitude and latitude.

Convert the values in degrees to degrees, minutes, and seconds.

Longitude \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Latitude \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is the mapping that accompanies each point on the Earth's surface an ordered pair of number coordinates:

1. function
2. injection
3. surjection
4. bijection

**Example 5**

In a port 300 passengers can board one of the 3 ships (A, B or C) that depart at the same time. Each ship has at least 2 passengers.

Is the mapping in which each passenger is associated to a ship:

1. function
2. injection
3. surjection
4. bijection



**Example 6**

The GPS system receives messages about the coordinates of the Nautilus ship every hour during the four-hour voyage.

The last voyage of a ship is given by the table:

|  |  |  |
| --- | --- | --- |
| Time | X coordinate (Northern latitude) | Y coordinate(Eastern longitude) |
| 12:00 | 44.52 | 14.51 |
| 13:00 | 44.52 | 14.62 |
| 14:00 | 44.52 | 14.69 |
| 15:00 | 44.52 | 14.81 |
| 16:00 | 44.52 | 14.89 |

<https://www.geogebra.org/m/shtqu5kq>

a) In which direction did the ship move? What was its course?

From \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) If we know that the total length of the voyage was 24 km, what was the average speed of the ship?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) Did the ship have a steady speed during the voyage? \_\_\_\_\_\_\_\_\_\_

d) When did the ship go the fastest and when the slowest?

The fastest interval \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The slowest interval \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) Determine the speed of the ship in each of the intervals.

|  |  |  |  |
| --- | --- | --- | --- |
| Time | ∆Y coordinate (longitude) | ∆Y coordinate (km) | v (km/h) |
| 12:00 – 13:00 |  |  |  |
| 13:00 – 14:00 |  |  |  |
| 14:00 – 15:00 |  |  |  |
| 15:00 – 16:00 |  |  |  |

f) Try to determine the $Y$ coordinate of the ship in each time interval if the ship moved at a constant velocity of 6 km/h.

|  |  |  |
| --- | --- | --- |
| Time | Y coordinate (Eastern longitude) (real values) | Y coordinate (Eastern longitude) (with constant velocity 6/km/h) |
| 12:00 | 14.51 | 14.51 |
| 13:00 |  |  |
| 14:00 |  |  |
| 15:00 |  |  |
| 16:00 | 14.89 | 14.89 |

g) If 1 knot = 1.85 km/h, what was the average velocity of the ship in knots

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 7 – hydrostatic pressure**

<https://phet.colorado.edu/sims/html/under-pressure/latest/under-pressure_en.html>

a) When the depth increases, the pressure \_\_\_\_\_\_\_\_\_\_.

b) What is the atmospheric pressure (the pressure at 0 m, in pool level)?

\_\_\_\_\_\_\_\_\_\_\_

c) Fill out the table and sketch the graph:

|  |  |
| --- | --- |
| Water depth (m) | Water pressure (kPa) |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |



d) What can you notice about the points? Is there a pattern?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) The hydrostatic pressure formula is:

$$p\_{hyd}\left(h\right)=\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$

$$p\_{hyd}\left(h\right)=\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$

f) Given the saltwater density is $ρ=1 025 kg/m^{3},$ the atmospheric pressure is $p\_{atm}=101 325 Pa$ and $g=9.81m/s^{2}$, determine the hydrostatic pressure at a depth of 40 m?

g) The world record in deep sea diving (without injury) is \_\_\_\_\_ m. With conditions described above ($ρ=1025\frac{kg}{m^{3}}, p\_{atm}=101 325 Pa$,$ g=9.81m/s^{2}$) determine the pressure at the given depth.

h) What is the percent increase in water pressure at depth \_\_\_\_\_ m when compared with atmospheric pressure?