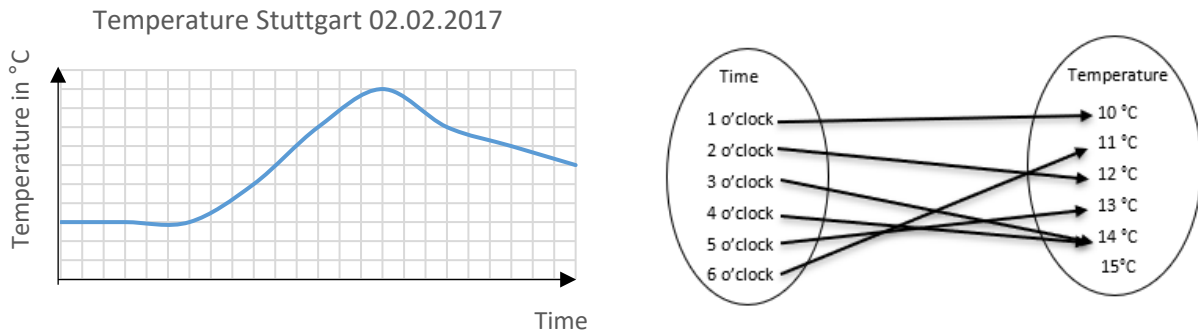


Temperature

For a school project, you are collecting and analyzing temperature data. You display your results as an arrow diagram and as a temperature-time graph.

Here you can see the two different representations that show the temperature in relation to time.



Today you'll discover how to identify unique mappings and functions. To do this, you will examine the relationship between temperature and time in arrow diagrams and graphs.

This material is provided by the [FunThink Team](#), responsible institution: Ludwigsburg University of Education



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Scan the QR code and open the GeoGebra application "Tasks Temperature".
Note: You only need GeoGebra for tasks 1 and 2.



Task 1: Exploring table and graph

The table shows the temperature at certain times on a summer day.

Create a suitable **temperature-time graph** by moving the points (x) in the graph to the correct position. (GeoGebra)

time	0	3	6	9	12	15	18	21	24
temperature in °C	15	16	17	20	23	25	22	20	15

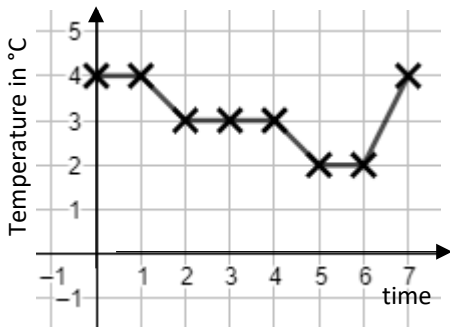
Task 2: Add missing values and correct wrong values

Something went wrong when recording the temperature on a winter day. Some values are missing in the table and some values are wrong in the graph.

Compare the table and the graph. Fill in missing values in the table and correct missing values in the graph. (GeoGebra)

time	0	3	6	9	12	15	18	21	24
temperature in °C	-4			0			1		-2

Task 3: Which form of representation works best?



time	0	1	2	3	4	5	6	7
temperature in °C	4	4	3	3	3	2	2	4

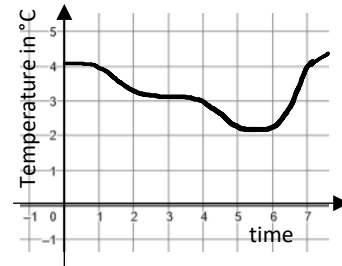
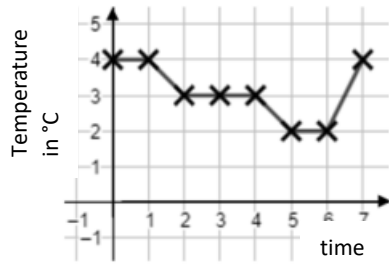
a) Answer the questions below using the table and graph above. Which representation do you use to answer the questions?

Question	Answer	Representation used	
		Table	Graph
What is the temperature at 4 o'clock?			
At what time is it 2°C?			
How does the temperature change between 6 and 7 o'clock?			
In what period of time does the temperature decrease?			

b) Ask your own question that you can answer better with the table.

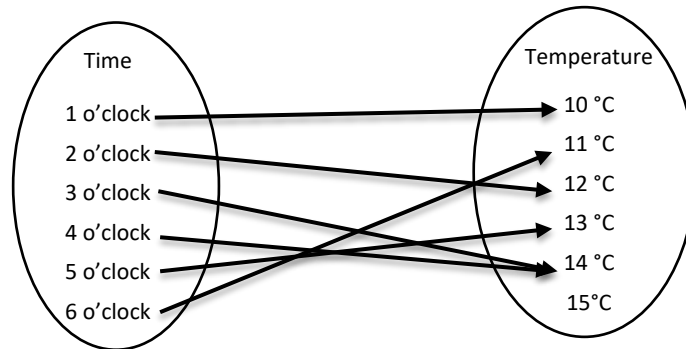
c) Ask your own question that you can answer better with the graph.

d) Here you see two different graphs. Both graphs show the same data. Which graph displays the relationship between temperature and time better? Provide reasons!



Task 4: Examine arrow diagram

Darya measured the temperature one afternoon. She wrote down the data she collected in an arrow diagram.



a) Use her representation to answer the following questions:

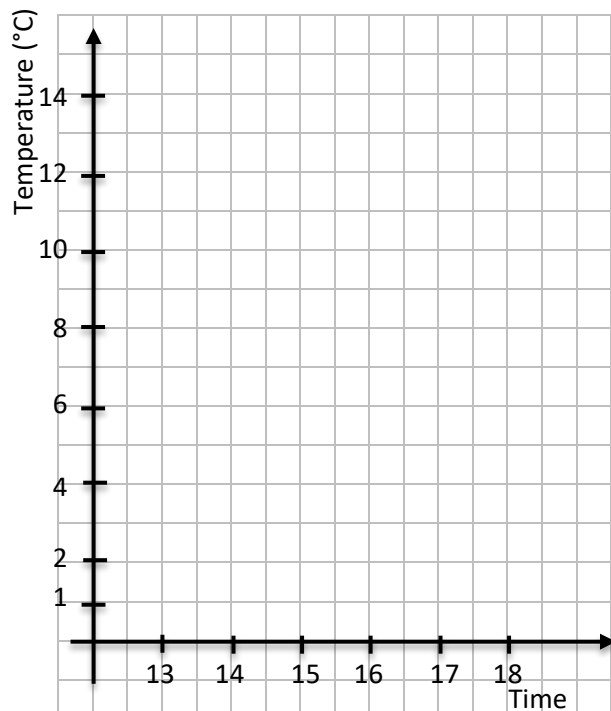
① What temperature was measured at 1 o'clock?

② When was the temperature below 13°C?

③ How does the temperature change between 1 o'clock and 3 o'clock?

b) Ask your own questions that can be answered using the arrow diagram.

c) Transfer Darya's data into the coordinate system.



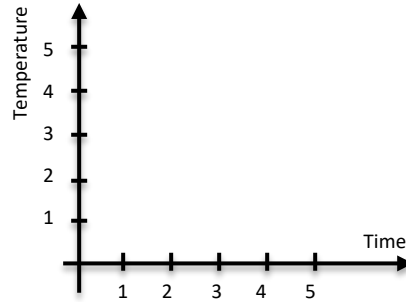
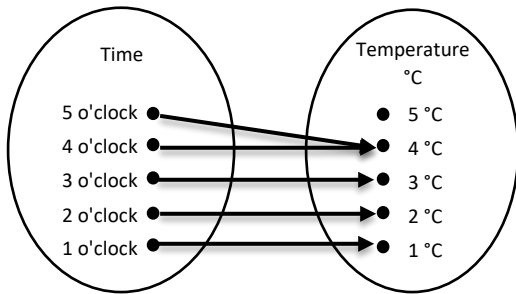
Scan the QR code and open the GeoGebra application "Temperature".



Research assignment 1: Mapping of time → temperature

Temperature was measured between 1 o'clock and 5 o'clock and plotted in a coordinate system and arrow diagram.

- a) Set the pattern in the arrow diagram in GeoGebra. Draw the matching graph in the coordinate system.

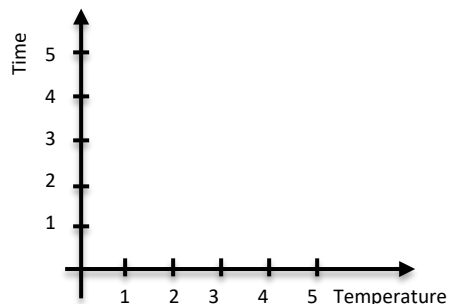
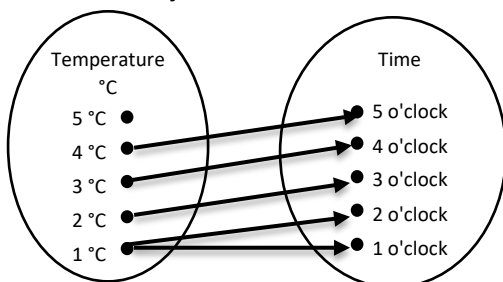


- b) Is it possible to measure several temperatures in one place at one time? Provide reasons!

Research assignment 2: Mapping of temperature → time

Here the mapping is the other way around. Each temperature is assigned a time.

- a) Set the pattern in the arrow diagram in GeoGebra and draw the matching graph in the coordinate system.



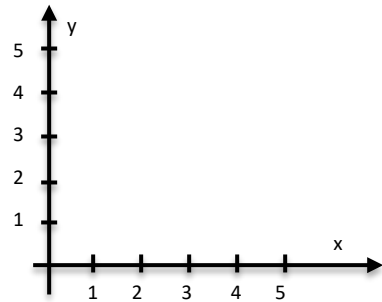
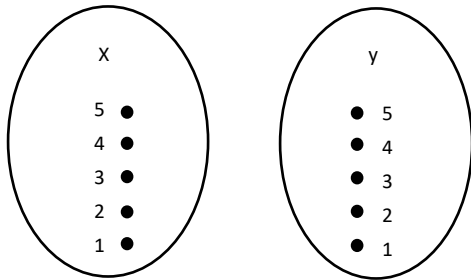
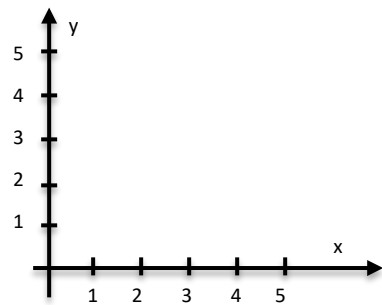
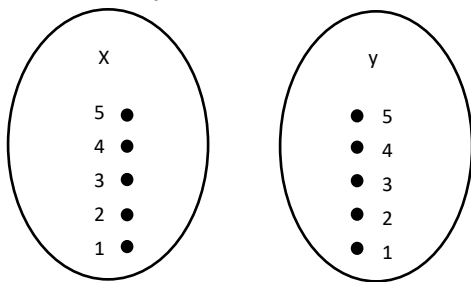
- b) Can the same temperature be measured at different times? Provide reasons!

c) Can there be a temperature that is not measured at any time of day? Provide reasons!

Research assignment 3: Unique mappings

Instead of temperature and time, the variables are now called x and y . The quantity x is assigned to the quantity y .

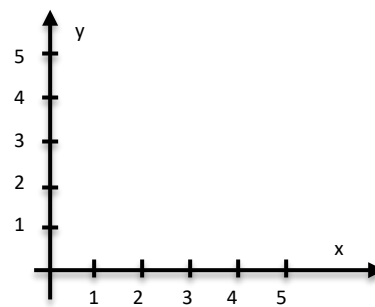
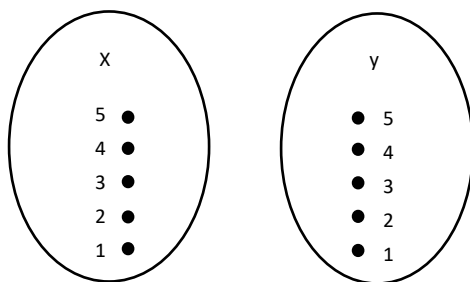
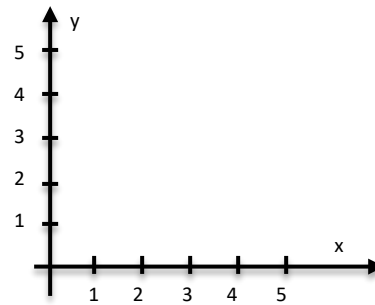
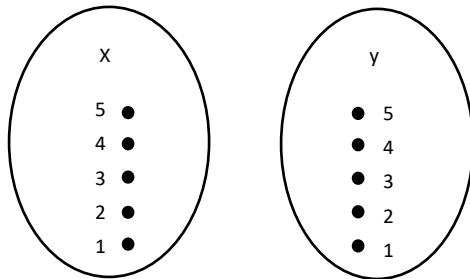
a) Find two **unique mappings** in GeoGebra. Sketch them in the arrow diagram and in the coordinate system.



b) When is a mapping unique? Describe your observations.

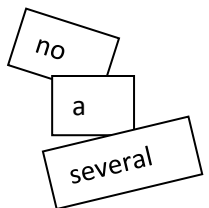
Research assignment 4: Non-unique mappings

- a) Find two **non-unique mappings** in GeoGebra. Sketch them in the arrow diagram and in the coordinate system.



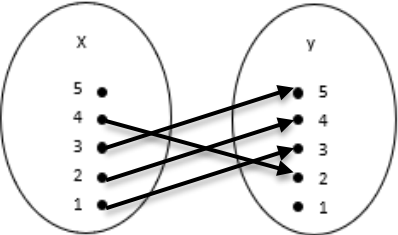
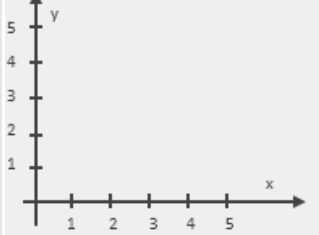
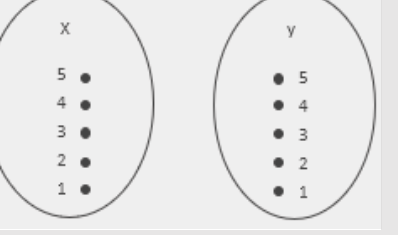
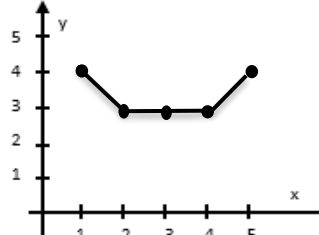
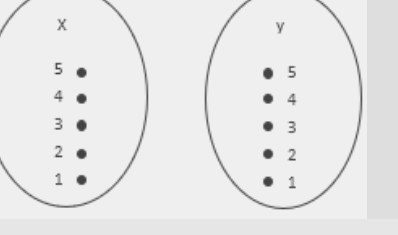
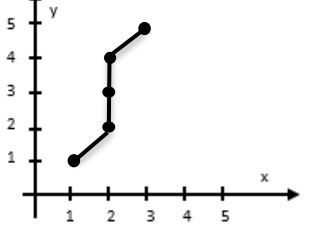
- b) When is a mapping non-unique? Fill in the gaps:

- (1) A mapping is non-unique if an x-value is assigned _____ y-value(s).
 (2) A mapping is non-unique if an x-value is assigned _____ y-value(s).



Research assignment 5: Non-unique and unique mappings

a) Fill in the missing information in the gray fields. Check your solution in GeoGebra.

Arrow diagram	Coordinate system	Mapping
		Unique mapping? Yes / No Explanation:
		Unique mapping? Yes / No Explanation:
		Unique mapping? Yes / No Explanation:

b) When is a mapping unique and a function? When is a mapping non-unique? Explain using time and temperature.

My explanation:

Research assignment 6: Is the mapping a function? (without GeoGebra)

a) Decide whether the mapping represents a function or not. Give reasons!

	Is the mapping a function?	Explanation:
① I measure the temperature. I assign a time to the temperature.		
② I fill water into a container. I assign the fill level to the amount of water.		
③ I measure my pulse (heartbeat). I assign the pulse beats per minute to the time.		

b) Find other mappings. Decide whether they are unique or non-unique.

Unique mappings:

Non-unique mappings:
