

Domain & Range

Student Activity - Answers

7 8 9 10 **11** 12



TI-Nspire



Activity



Student



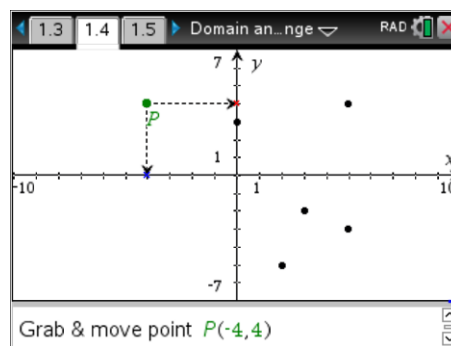
45 min

Introduction

The domain is the set of values D for which the function, mapping or transformation is defined, the range is the image of D under this mapping. This activity aims to help understand this terminology by exploring different representations of the Domain and Range and the different types of mappings. The term 'image' is often used interchangeably with the word 'range'.

Points

Open the TI-Nspire document: "Domain and Range" and navigate to page 1.3. A mapping for 6 points is shown. Grab point P and drag it to each of the mapped points and observe what happens.



Question: 1.

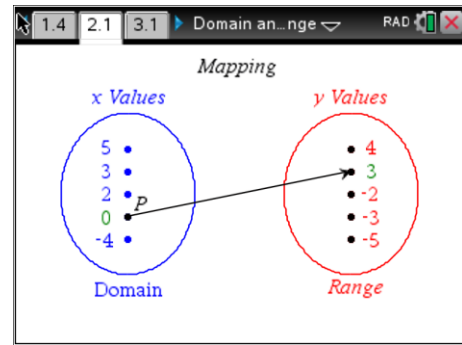
- a) Grab and drag point P to each of the 6 points. As you move from point to point, record the coordinates of each in the table.

x	-4	0	2	3	5	5
y	4	3	-5	-2	-3	4

- b) State the domain and range of the function. Domain: $\{-4, 0, 2, 3, 5\}$
- c) Thinking of each x value as 'input' and each y as 'output'. What input value(s) could produce an output of 4? (Write your answers as coordinates) $(-4, 4)$ & $(5, 4)$
- d) Use your answer to the previous question to fill in the gap:
There are **two (many)** x values that map to a single y value.
- e) Thinking of each x value as 'input' and each y as 'output'. What output value(s) could be produced by an input of 5? (Write your answers as coordinates) $(5, -3)$ & $(5, 4)$
- f) Use your answer to the previous question to fill in the gap:
A single x value maps to **two (many)** y value(s).

Navigate to page 2.1 – **Mapping**

A different mapping representation has been provided on this page. Drag point P to each of the values in the ‘domain’ and observe how they map to a corresponding value in the ‘range’.



Question: 2.

Does each x value map to a unique y value? (Provide evidence to support your answer)

No, $x = 5$ maps onto $y = 4$ and $y = -3$. So a single x value has mapped to two y values.

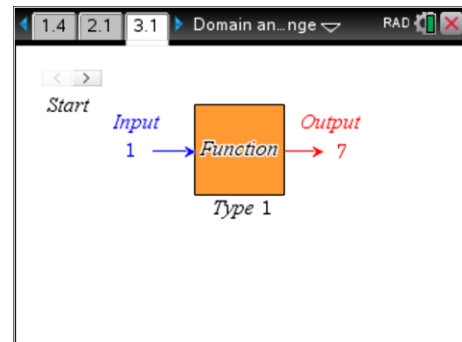
Question: 3.

Is each y value mapped from a unique x value? (Provide evidence to support your answer)

No, $y = 4$ is mapped from $x = -4$ and $x = 5$. So a single y value has been mapped from two x values.

Navigate to page 3.1 – **Function Type 1**

On this page a mystery function maps points in the domain (input) to points in the range (output). Use the slider to see each input and how it maps to the corresponding output. Page 3.2 contains a different mapping (type 2), page 3.3 another (type 3) and page 3.4 a fourth mapping (type 4).

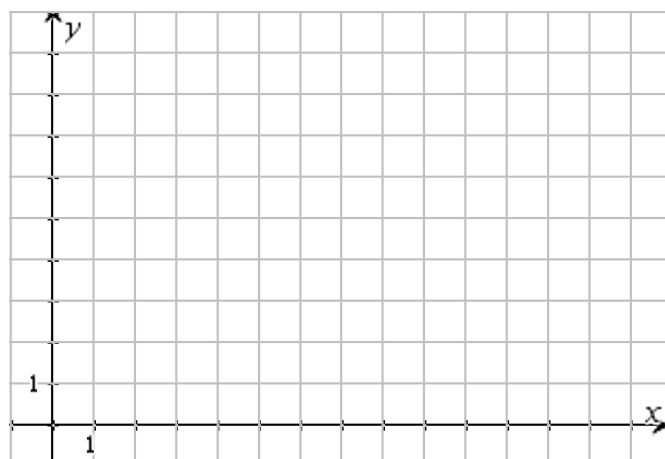


Question: 4.

Record the point mapping as (input, output) , graph all the points and specify the domain and range as lists. Domain = {1, 2, ...9, 12} Range = {1, 2, ... 8, 10}

Page 3.1 - Type 1

Point 1	(1, 7)
Point 2	(2, 3)
Point 3	(5, 4)
Point 4	(3, 9)
Point 5	(6, 2)
Point 6	(4, 5)
Point 7	(8, 6)
Point 8	(9, 8)
Point 9	(12, 1)
Point 10	(7, 10)

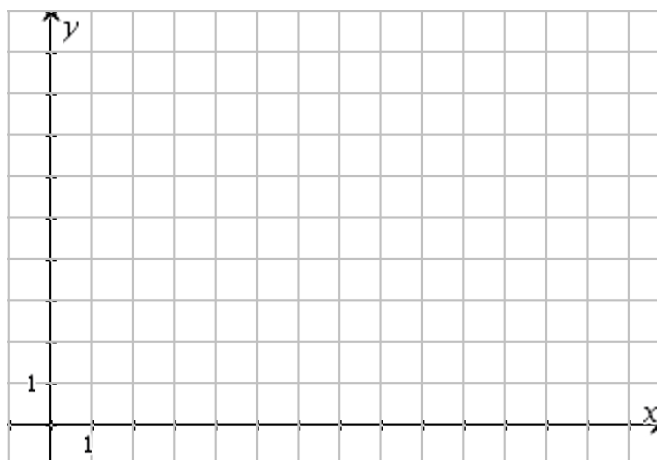


Question: 5.

Record the point mapping as (input, output), graph all the points and specify the domain and range as lists. Domain = {1, 2, ...10} Range = {2, 3, 5, 8, 9}

Page 3.2 - Type 2

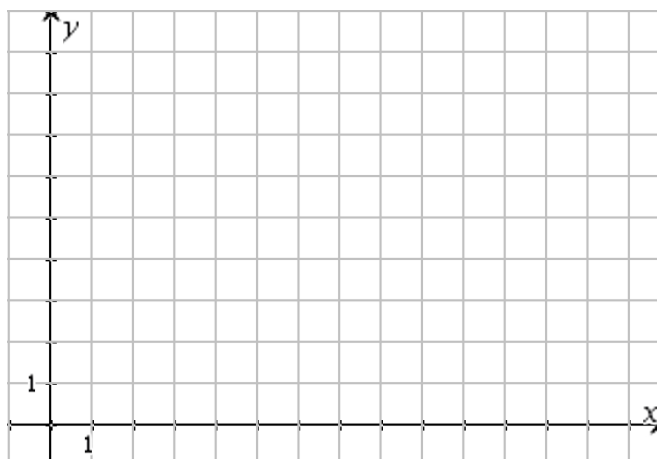
Point 1	(1, 2)
Point 2	(9, 3)
Point 3	(3, 5)
Point 4	(6, 2)
Point 5	(6, 2)
Point 6	(5, 8)
Point 7	(2, 3)
Point 8	(8, 2)
Point 9	(4, 5)
Point 10	(10, 8)

**Question: 6.**

Record the point mapping as (input, output), graph all the points and specify the domain and range as lists. Domain = {1, 2, ... 6, 9} Range = {1, 2, ... 10}

Page 3.3 - Type 3

Point 1	(1, 2)
Point 2	(4, 9)
Point 3	(2, 6)
Point 4	(3, 3)
Point 5	(4, 5)
Point 6	(1, 7)
Point 7	(5, 10)
Point 8	(6, 8)
Point 9	(9, 1)
Point 10	(5, 4)

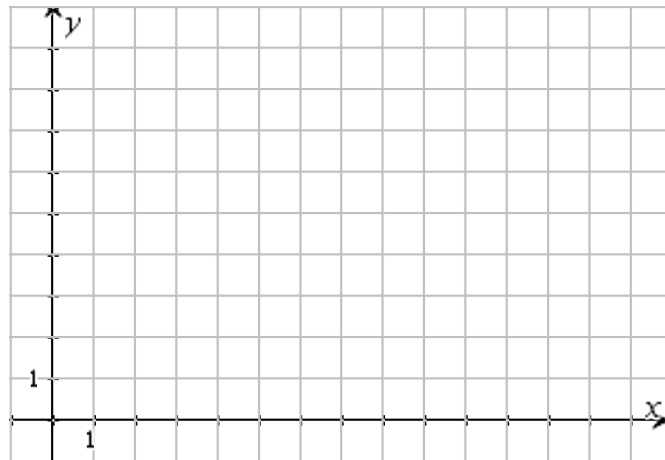


Question: 7.

Record the point mapping as (input, output), graph all the points and specify the domain and range as lists. Domain = {1, 2, ... 5} Range = {1, 2, 4, 5, 8, 9}

Page 3.4 - Type 4

Point 1	(1, 2)
Point 2	(2, 1)
Point 3	(3, 5)
Point 4	(2, 2)
Point 5	(3, 4)
Point 6	(4, 5)
Point 7	(1, 8)
Point 8	(3, 1)
Point 9	(5, 9)
Point 10	(4, 8)

**Question: 8.**

Describe the difference in the types of mappings: Type 1, 2, 3 & 4. Use specific examples to highlight the differences.

Type 1: One to One mapping. All x coordinates produce a unique y coordinate.

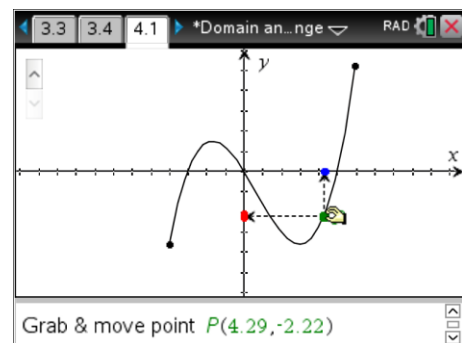
Type 2: Many to One mapping. Example: (3, 5) & (4, 5) ... more than one x mapping to same y .

Type 3: One to Many mapping. Example: (1, 2) & (1, 7) ... one x mapping to more than one y .

Type 4: Many to Many mapping. Example: (1, 2) & (1, 8) one x mapping to more than one y then (3, 5) & (4, 5) many x mapping to one y ; overall many x mapping to many y .

Navigate to page 4.1

A graph is a visual representation of the relationship between x and y . The mappings so far have contained a finite number of discrete points. The graph shown opposite represents infinitely many points. The domain and range in the discrete examples can be specified as a list: {1, 2, ... 5}. For the continuous case the domain may be specified: $\{x : 1 \leq x < 5\}$ or as $[1, 5)$ where '[' means the end point is included and ')' means the end point is not included.

**Question: 9.**

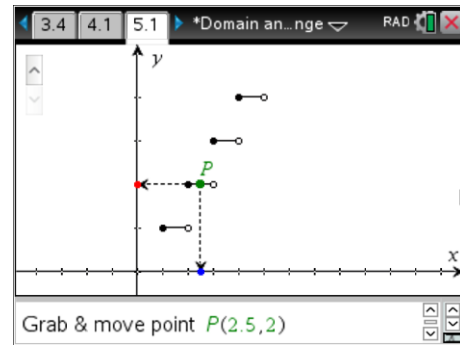
Move point P back and forth along the entire graph.

- What does the highlighted portion along the x -axis represent? **Domain**
- What does the highlighted portion along the y -axis represent? **Range**
- State the domain as an inequality and also in interval notation. $\{x : -4 \leq x \leq 6\}$ or $[-4, 6]$
- State the range as an inequality and also in interval notation. $\{y : -4 \leq y \leq 5\}$ or $[-4, 5]$
- Comparing this function with the different mapping types, what type is this function? Justify your answer by providing examples. **Type 2, Many to One.** $(-3, 0)$, $(0, 0)$ & $(5, 0)$

Navigate to page 5.1

This type of function is often referred to as a 'step' function.

Drag point P to see the domain and range.



Question: 10.

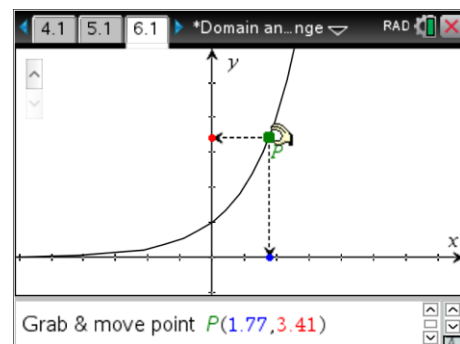
Move point P back and forth along the entire graph.

- State the domain using appropriate notation. $\{x:1 \leq x < 5\}$ or $[1, 5)$
- State the range using appropriate notation. $\{1, 2, 3, 4\}$
- Comparing this function with the different mapping types, what type is this function? Explain how this would change if closed circles appeared on all segment ends.

Currently Type 2, Many to One. $(1, 1), (1.1, 1), (1.2, 1) \dots$ however if closed circles appeared on all segment ends the relationship would be Type 4, Many to Many since $(2, 1)$ & $(2, 2)$ would both be defined producing the additional mapping of one x to many y .

Navigate to page 6.1

Drag point P to see the domain and range.



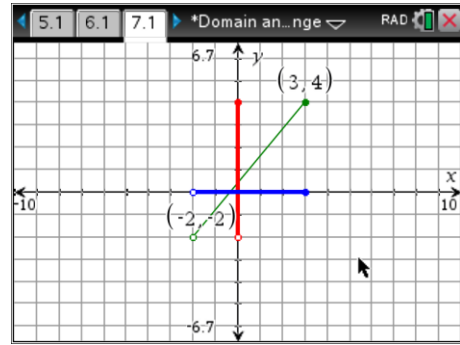
Question: 11.

Move point P back and forth along the entire graph.

- State the domain and range using appropriate notation.
Domain: $x \in \mathbb{R}$ or $(-\infty, \infty)$
Range: $\{y: y > 0\}$ or $(0, \infty)$
- Comparing this function with the different mapping types, what type is this function?
Type 1: One to One

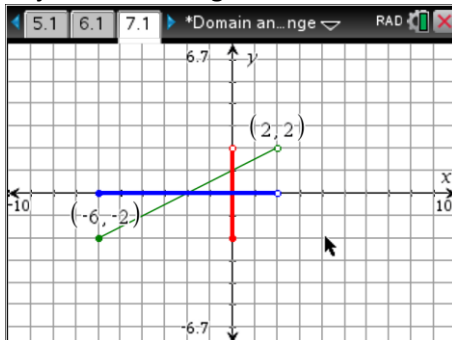
Navigate to page 7.1

Grab and move the end points of the line segment and notice how the domain and range change accordingly.



Question: 12.

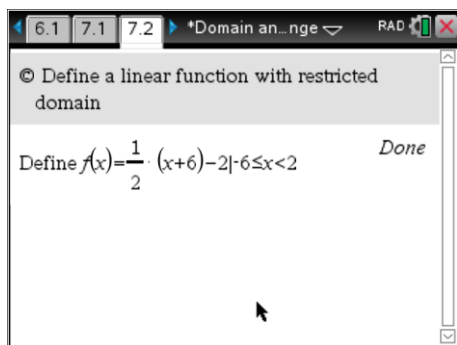
Adjust the line segment so that it has a domain: $[-6, 2)$ and range: $[-2, 2)$.



Question: 13.

Use the calculator application on page 7.2 to define a linear function $f(x)$ to model the line segment, including the restricted domain. Check that your equation is correct by graphing it on the same axis as this interactive content.

- a. Show the function definition including domain restrictions. $f(x) = \frac{1}{2}x + 1 \mid -6 \leq x < 2$



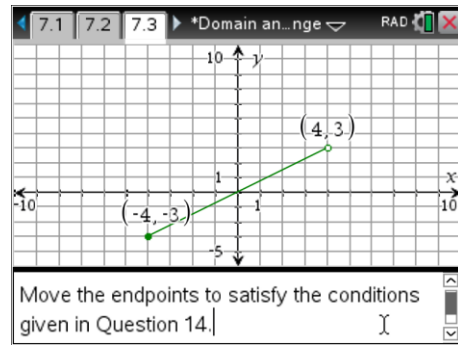
- b. In the calculator application type: $\text{Domain}(f(x), x)$ and record the calculator's result.
 $-6 \leq x < 2$
- c. What information does the calculator return for: $f(2)$?
 undefined



To restrict the domain of a function use the: $|$ symbol. This symbol can be found in the same menu as the inequalities, $<$, $>$; accessed by pressing **Ctrl + =**

Navigate to page 7.3

Grab and move the end points of the line segment. In this example the domain and range are not automatically displayed, these must be read directly from the graph.



Question: 14.

Adjust the end points of the line segment to produce a domain: $(-3, 2]$ and range: $[3]$.

- a. Show the function definition including domain restrictions.

$$f(x) = 3 \mid -3 < x \leq 2$$

- b. What 'type' is this function? **Many to One (Type 2)**