

Class notes

Introduction to Functions

Relations, correlation, functions, domain, and
range

Subject

Algebra I

Student

Student Name

Teacher

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Today's lesson

Agenda

- 1 **Relations** Tables, graphs, mapping diagrams
 - 2 **Correlation & Variables** Independent and dependent variables
 - 3 **Identifying Functions** The vertical line test
 - 4 **Domain & Range** Inequality and interval notation
-

Section 1

Relations

Ordered pairs, tables, graphs, and mapping diagrams

What Is a Relation?

Relation

a coordinate
 (x, y)

A set of ordered pairs (x, y) . Each pair links a value from the domain to a value from the range.

all x vals

all y vals

a list with no repeats

For example:

x is related to y in this way



x	1	2	3	4
y	5	6	7	8

→ $(1, 5)$ $(2, 6)$ $(3, 7)$ $(4, 8)$

Domain and Range

When talking about functions, we like to talk about two properties of them: **domain** and **range**.

1. The **domain** is the set of all x values (input)

x	1	2	3	4
y	5	6	7	8

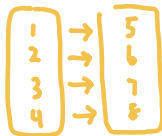
 → (1,5) (2,6) (3,7) (4,8)

2. The **range** is the set of all y values (output)

Three Ways to Show a Relation

Representation	How
① Table	write each x above its y
② Graph	plot each ordered pair as a point
③ Mapping diagram	arrow from each domain value to its range value

x	1	2	3	4
y	5	6	7	8



Example

Represent as a Table

Relation: $\{(-7, 1), (-3, 0), (-2, -1), (4, 7), (6, 4)\}$

domain $\rightarrow$

range $\rightarrow$

x	-7	-3	-2	4	6
y	1	0	-1	7	4

$(-7, 1)$ $(-3, 0)$ $(-2, -1)$ $(4, 7)$ $(6, 4)$

Question 1

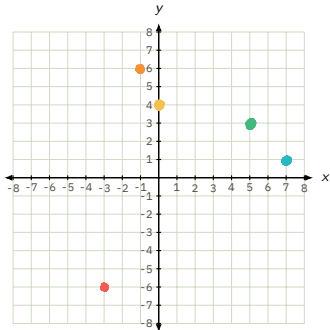
Table Practice

Relation: $\{(-1, -2), (0, -3), (0, 2), (6, -2), (7, -7)\}$

x	-1	0	0	6	7
y	-2	-3	2	-2	-7

Example

Represent as a Graph



Relation:

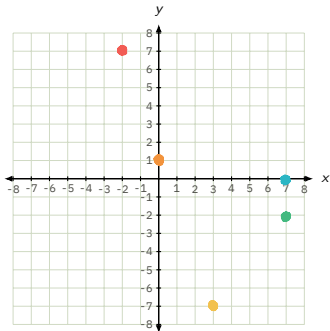
$$\{(-3, -6), (-1, 6), (0, 4), (5, 3), (7, 1)\}$$

To find domain & range:

$$\begin{array}{l} \text{range} \rightarrow \\ \text{domain} \rightarrow \end{array} \begin{array}{c|ccccc} x & -3 & -1 & 0 & 5 & 7 \\ \hline y & -6 & 6 & 4 & 3 & 1 \end{array}$$

Question 1

Graph Practice



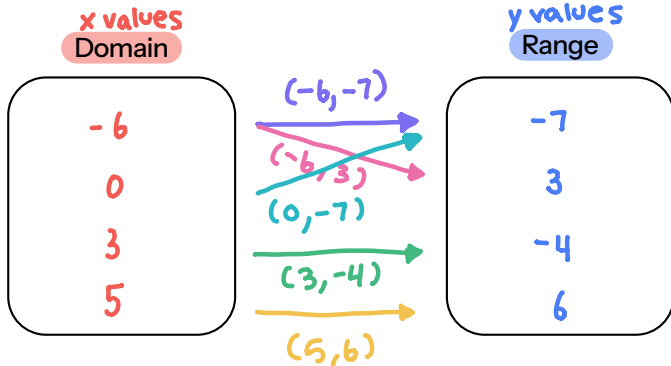
Relation:

$$\{(-2, 7), (0, 1), (3, -7), (7, -2), (7, 0)\}$$

Example

Represent as a Mapping Diagram

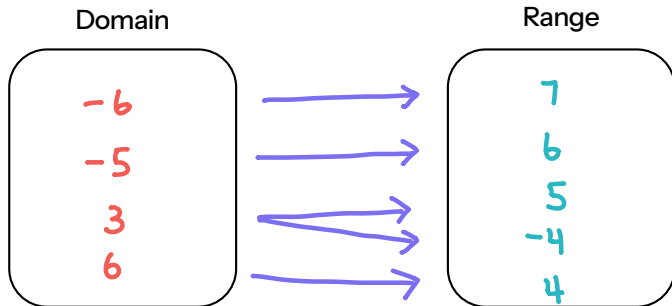
Relation: $\{(-6, -7), (-6, 3), (0, -7), (3, -4), (5, 6)\}$



Question 1

Mapping Diagram Practice

Relation: $\{(-6, 7), (-5, 6), (3, 5), (3, -4), (6, 4)\}$



Section 2

Correlation & Variables

How two quantities move together

Correlation & Variables

Independent & Dependent Variables

The **independent variable** changes on its own. The **dependent variable** responds to it.



it "depends" on the independent

「changes」 v/s 「is changed」

Correlation & Variables

Positive correlation	as one variable increases, the other <u>increases</u>
Negative correlation	as one variable increases, the other <u>decreases</u>
No correlation	<u>the variables have 0 relationship</u>



Age vs Reading Lvl.

- as age $\uparrow$, lvl $\uparrow$
- as age $\downarrow$, lvl $\downarrow$



Age vs Cavities

- as age $\uparrow$, cavities $\downarrow$
- as age $\downarrow$, cavities $\uparrow$



Age vs Happiness

- people are happy and unhappy at all ages

Example

Speed & Stopping Distance

The speed of a car and the distance traveled to complete a stop after the brakes are applied.

Type of correlation	positive
Justification	as speed $\uparrow$, time to stop $\uparrow$ bc momentum
Independent variable	speed (thing that changes)
Dependent variable	breaking dist. (thing that is changed)



breaking dist.



Question 1

Correlation Practice

The number of students present in class and the number of empty chairs.

Type of correlation	negative
Justification	as students $\uparrow$ empty seats $\downarrow$
Independent variable	students
Dependent variable	empty seats

n=1 student



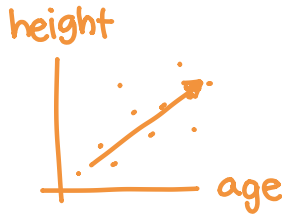
n=3 student



Question 2

Correlation Practice

Age (up to 12 years old) and height.



Type of correlation	positive
Justification	as age $\uparrow$ height $\uparrow$ (up to puberty)
Independent variable	age
Dependent variable	height

Question 3

Correlation Practice

The circumference of your head and your IQ.



Type of correlation	none
Justification	smart ppl have small heads too
Independent variable	head circumference
Dependent variable	IQ



Section 3

Identifying Functions

Ordered pairs, tables, and the vertical line test

What Is a Function?

Function

A relation where **every** input (domain value) is paired with **exactly one** output (range value).

✗ NOT a FUNCTION

x	1	2	1	3	4
y	2	0	3	1	5

one input = multiple output

✓ IS a FUNCTION

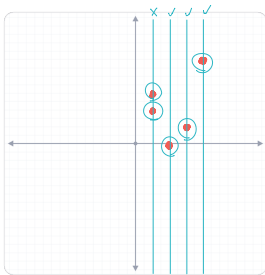
x	1	2	3	4
y	1	0	1	2

each input → 1 output

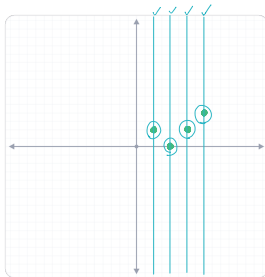
The Vertical Line Test

Vertical Line Test

If a vertical line crosses a graph more than once, the graph is **not** a function.



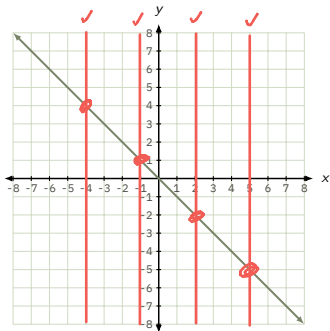
x	1	2	1	3	4
y	2	0	3	1	5



x	1	2	3	4
y	1	0	1	2

Example

Function or Not?



Is this relation a function?

yes!

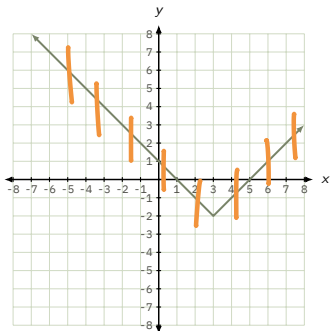
Why or why not?

passes v. line

test

Question 1

Function or Not Practice



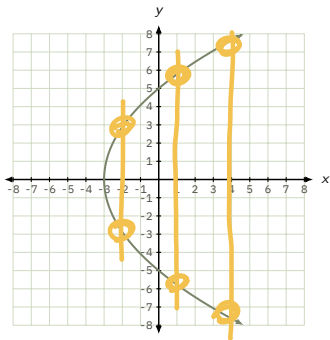
Is this relation a function?

yes!

Why or why not?

Question 2

Function or Not Practice



Is this relation a function?

No!

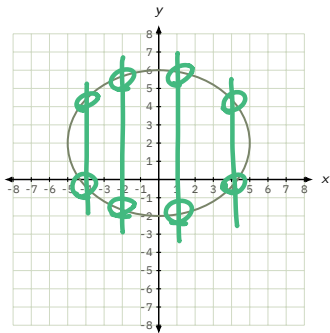
Why or why not?

v. lines are

crossed 2x

Question 3

Function or Not Practice



Is this relation a function?

no!

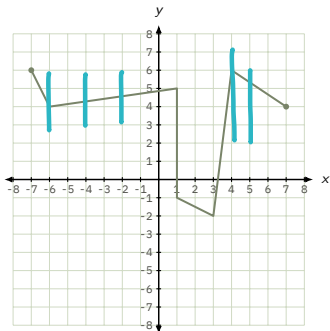
Why or why not?

v lines cross

2x

Question 4

Function or Not Practice



Is this relation a function?

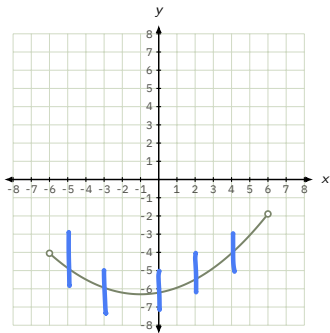
no!

Why or why not?

$x=1$ is a vertical
line

Question 5

Function or Not Practice



Is this relation a function?

YES!

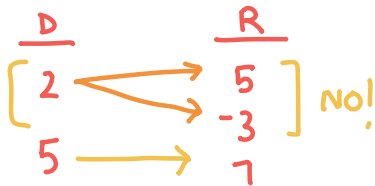
Why or why not?

only crosses

line $1x$

Example

Domain, Range & Function



Relation: $\{(2, 5), (2, -3), (5, 7)\}$

Domain

$\{2, 5\}$

Range

$\{5, -3, 7\}$

Function?

No! B/c $(2, 5)$ $(2, -3)$

Questions 1–3

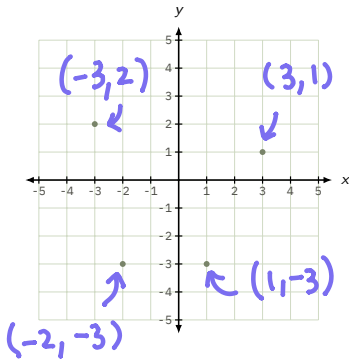
Domain, Range & Function Practice

Relation	Domain	Range	Function?
$\{(8, 5), (6, 5), (7, 2)\}$	$\{8, 6, 7\}$	$\{5, 2\}$	✓
$\{(6, 4), (8, -4), (9, 10)\}$	$\{6, 8, 9\}$	$\{4, -4, 10\}$	✓
$\{(9, 9), (9, 8), (9, 7)\}$	$\{9\}$	$\{9, 8, 7\}$	✗



Example

Domain, Range & Function



Domain

$\{-3, 3, 1, -2\}$

Range

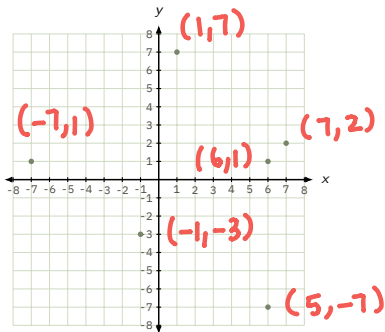
$\{2, 1, -3\}$

Function?

yes!

Example

Read the Graph



Domain

$\{-7, 1, 6, 7, -1, 5\}$

Range

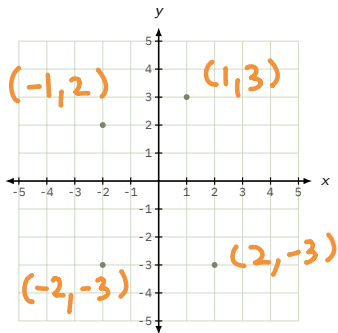
$\{1, 7, 2, -3, -7\}$

Function?

yes!

Question 1

Reading Graphs Practice



Domain

$\{-1, 1, 2, -2\}$

Range

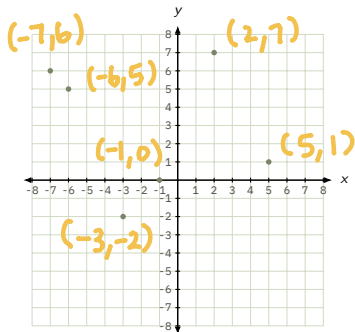
$\{2, 3, -3\}$

Function?

yes!

Question 2

Reading Graphs Practice



Domain

$\{-7, -6, -1, 2, -3, 5\}$

Range

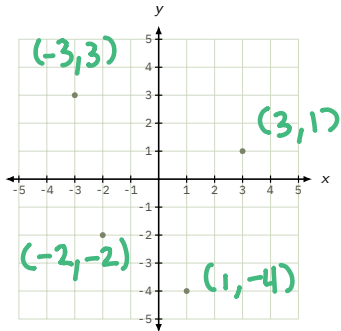
$\{6, 5, 0, 7, 1, -2\}$

Function?

yes!

Example

Range of the Function

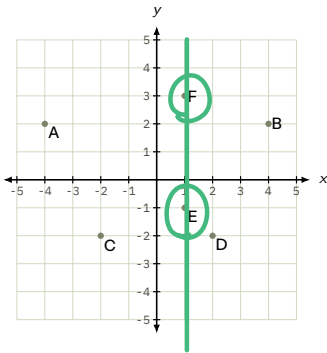


What is the range of the function shown?

$\{3, 1, -4, -2\}$

Example

Remove a Point to Make a Function



Which point, when deleted, makes the relation a function?

F or E

Example

Passing Yards by Receiver

Receiver	Yards
Galindo	30
Hemphill	42
Harle	5
Carrillo	12
Segovia	10
Jenkins	12

Domain

here!

Range

{30, 42, 5, 12, 10}

Functional relationship?

yeah!

Question 1

Functional Relationship Practice

Height	Shoe size
5'10"	9
5'11"	9.5
5'9"	8.5
6'1"	12
5'11"	10
6'0"	11.5

Domain

//

Range

{ 8.5, 9, 9.5, 10, 11.5, 12 }

Functional relationship?

no!

Section 4

Domain & Range

Reading continuous graphs

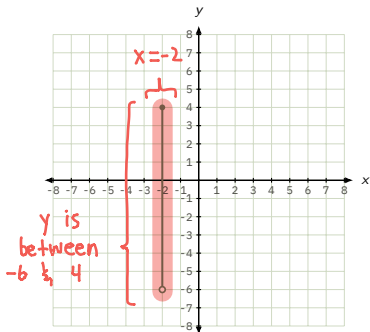
Domain & Range from a Graph

When a graph is continuous, write domain and range with **inequality notation**.

Domain	the <u>x (input)</u> values a graph covers
Range	the <u>y (output)</u> values a graph covers

Example

Function, Domain & Range



Function?

no!

Domain

$$x = -2$$

Range

can combine to

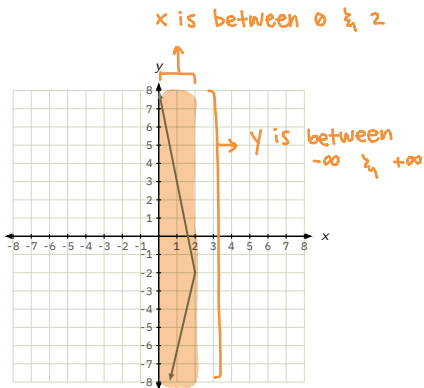
$$-6 < y \leq 4$$

$$y > -6$$

$$y \leq 4$$

Question 1

Function, Domain & Range Practice



Function?

NO!

Domain

combine to

$$0 < x \leq 2$$

$$x > 0$$

$$x \leq 2$$

Range

combine to

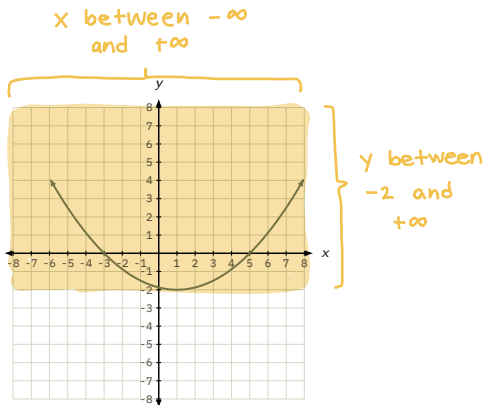
$$-\infty < y < +\infty$$

$$y > -\infty$$

$$y < +\infty$$

Question 2

Function, Domain & Range Practice



Function?

yes!

Domain

combine to

$$-\infty < x < +\infty$$

$$x > -\infty$$

$$x < +\infty$$

Range

combine to

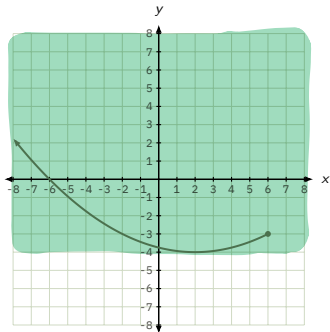
$$-2 \leq y < +\infty$$

$$y \geq -2$$

$$y < +\infty$$

Question 3

Function, Domain & Range Practice



Function?

yes!

Domain

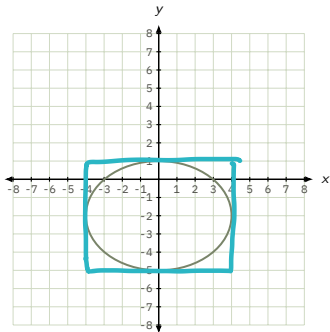
min max
 $-\infty < x \leq 6$

Range

min max
 $-4 \leq y < +\infty$

Question 4

Function, Domain & Range Practice



Function?

no!

Domain

min

max

$$-4 \leq x \leq 4$$

Range

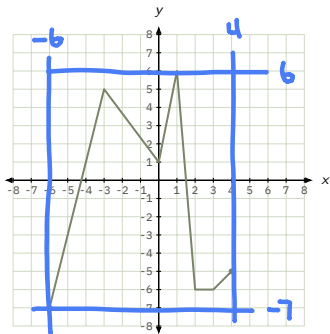
min

max

$$-5 \leq y \leq 1$$

Question 5

Function, Domain & Range Practice



Function?

yes!

Domain

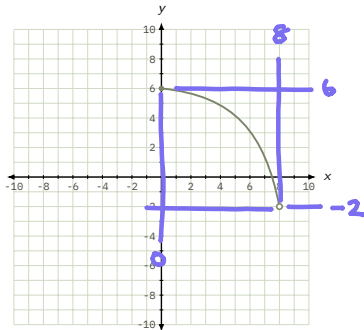
$$-6 \leq x \leq 4$$

Range

$$-7 \leq y \leq 6$$

Example

Domain & Range in Inequality Notation



Domain

$$0 \leq x < 8$$

Range

$$-2 < y \leq 6$$

Interval Notation

Symbol	Meaning	Matches
$[]$	endpoint included	$\leq, \geq$, closed dot
$()$	endpoint not included	$<, >$, open dot
$-\infty, \infty$	no end in that direction	always $()$

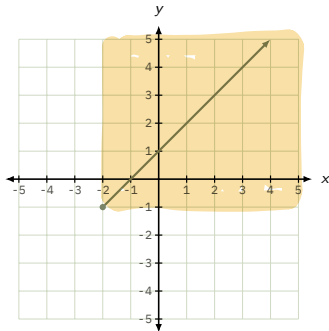
$$\begin{aligned} & [\text{min} , \text{max}) \\ 3 < x < 5 & \rightarrow (3, 5) \\ x \leq 10 & \rightarrow (-\infty, 10] \end{aligned}$$

Inequality to Interval

Inequality	Interval
$-2 \leq x < 5$	$[-2, 5)$
$x > 3$	$(3, \infty)$
$x \leq -1$	$(-\infty, -1]$
all real numbers	$(-\infty, \infty)$

Example

Domain & Range in Interval Notation



Domain

$$x \geq -2$$

$$[-2, +\infty)$$

Range

$$y \geq -1$$

$$[-1, +\infty)$$

Interval Notation Practice

Write each in interval notation.

$$\begin{array}{l} \text{min} \qquad \qquad \text{max} \\ 1. \quad 1 \leq x \leq 7 \\ \qquad [1, 7] \end{array}$$

$$\begin{array}{l} \text{min} \qquad \qquad \text{max} \\ 2. \quad -4 < x < 0 \\ \qquad (-4, 0) \end{array}$$

$$\begin{array}{l} \text{min} \\ 3. \quad x \geq -6 \\ \qquad [-6, +\infty) \end{array}$$

$$\begin{array}{l} \text{max} \\ 4. \quad y < 2 \\ \qquad (-\infty, 2) \end{array}$$

$$\begin{array}{l} \text{min} \qquad \qquad \text{max} \\ 5. \quad -5 < y \leq 3 \\ \qquad (-5, 3] \end{array}$$

$$\begin{array}{l} 6. \quad \text{all real numbers} \\ \qquad (-\infty, +\infty) \end{array}$$

Interval Notation Practice

Write each as an inequality in x .

7. $\overset{\text{min}}{[0, \overset{\text{max}}{8})}$
 $0 \leq x < 8$

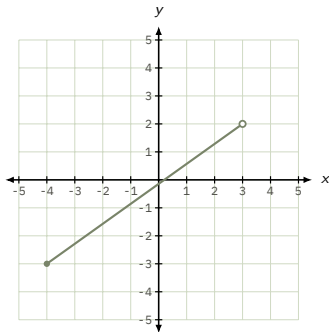
8. $\overset{\text{min}}{(-\infty, \overset{\text{max}}{4}]}$
 $-\infty < x \leq 4$
 $x \leq 4$

9. $\overset{\text{min}}{(-3, \overset{\text{max}}{\infty})}$
 $-3 < x < +\infty \rightarrow x > -3$

10. $\overset{\text{min}}{[-1, \overset{\text{max}}{1}]}$
 $-1 \leq x \leq 1$

Question 11

Interval Notation Practice



Write the domain and range in interval notation.

Domain ^{min} ^{max}
 $-4 \leq x < 3$

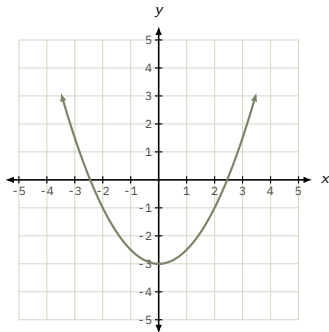
$[-4, 3)$

Range ^{min} ^{max}
 $-3 \leq y < 2$

$[-3, 2)$

Question 12

Interval Notation Practice



Write the domain and range in interval notation.

Domain $-\infty$ to $+\infty$

$(-\infty, +\infty)$

Range -3 to $+\infty$

$[-3, +\infty)$
