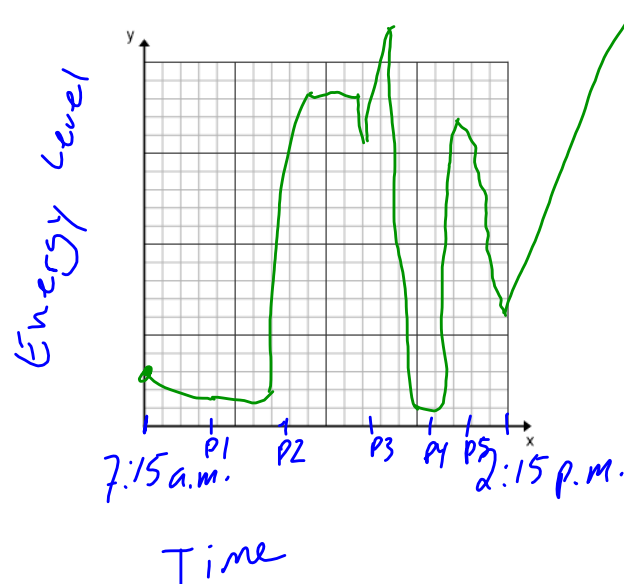


4-6 Notes: Relations and Functions

Lesson Objective: Understanding the difference between functions and relations as well as the different properties they both have.

Example: Draw a picture on the graph representing your energy-level throughout the school day. Label each axis.



Important things to take-away from this example and the graph:

- There are two axes that make-up a graph. The horizontal axis is the x-axis, and the vertical axis is the y-axis.
- Each axis represents a variable.
2 axes = 2 variables.
- It's important to label your axes and put in a scale as well.
- Independent variable is on the x-axis and it does not rely on the dependent variable.
- Dependent variable is on the y-axis and it relies on the independent variable (x).
- The origin is the center point (0,0).

What is a Relation? - a collection or set of coordinate points (x, y) .

Example of a relation:

$\{(-2, -1), (-1, 0), (6, 3), (-2, 1)\}$
 (x, y)

Independent Variable - x is the independent variable

Dependent Variable - y is the dependent variable

Domain - The set of all the x -values of a relation.

Range - The set of all the y -values of a relation.

EXAMPLE .

Model your walking speed during 4 minutes between classes with a graph.

independent variable

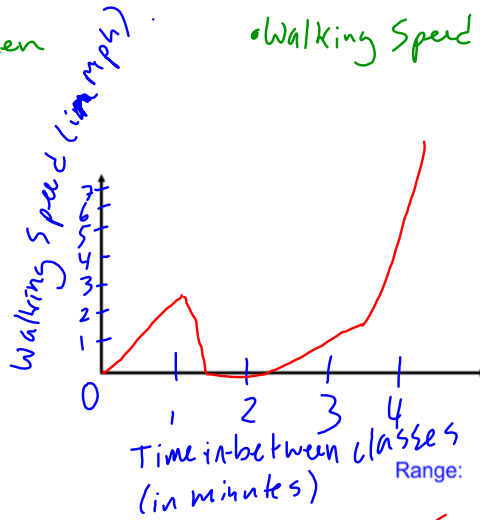
dependent variable

- Time in-between classes

- Walking Speed

Why?

Walking speed depends on how much time you have in between classes.



Domain:

Range:

- Time in-between classes
- Domain values are $\{0, 1, 2, 3, 4\}$

- Walking Speed
- Range values are $\{0, 1, 2, 3, 4, 5, 6, 7\}$

EXAMPLE ~~X~~

Model age and shoe size with a graph.

independent variable

dependent variable

Why?



Domain:

Range:

Example: The cost of shipping a package is based on the weight

independent variable

dependent variable

Why?

|



Domain:

Range:

Examples: For each relationship, identify the independent variable and the dependent variable.

A. The temperature of a carton milk and the length of time it has been out of the refrigerator.

B. The number of cars on the freeway and the level of exhaust fumes in the air.

C. The temperature of a pot of water as it is heated.

D. The relationship between the cooking time for a 2-pound roast and the temperature of the oven.

E. The distance from a Ferris wheel rider to the ground during two revolutions.

Function:

Tell whether each table of values (relation) represents a function. Give the domain and range of each relation.

Table A

| Input | Output |
|-------|--------|
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |

Table B

| Input | 1 | 0 | 1 |
|--------|---|---|---|
| Output | 1 | 2 | 5 |

Table C

| Input | 1 | 2 | 3 | 4 | 5 | 6 |
|--------|---|---|---|---|---|---|
| Output | 0 | 0 | 0 | 0 | 0 | 0 |

Make a mapping diagram for each table.

Relation A

Relation B

Relation C

Find the domain and range of each relation. Which of the three relations are functions?

Relation A

Relation B

Relation C

Domain:

Domain:

Domain:

Range:

Range:

Range:

Function?

Function?

Function?

EXAMPLE

Determine if the relation is a function.

$$\{(11, -2), (12, -1), (13, -2), (20, 7)\}$$

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

TRY

Use a mapping diagram to determine whether each relation is a function.

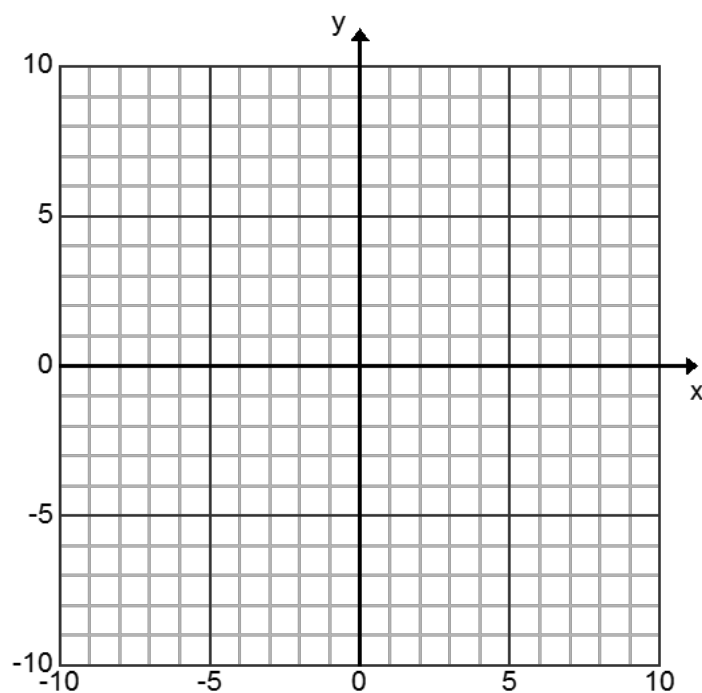
$$\{(3, -2), (8, 1), (9, 2), (3, 3), (-4, 0)\}$$

$$\{(6.5, 0), (7, -1), (6, 2), (2, 6), (5, -1)\}$$

TRY Does the input/output table below represent a function?

| Input | Output |
|-------|--------|
| -2 | 5 |
| -3 | 0 |
| -4 | 0 |
| -5 | 0 |
| -6 | 0 |
| -7 | 0 |
| -2 | 3 |

Graph the points and explain your answer.



TRY

Suppose you are comparing the relationship between student ages and shoe size. If your input for this study was age and your output was shoe size would the relationship be a function?
EXPLAIN YOUR ANSWER

TRY

Does each relationship in the form $(input, output)$ represent a function?

If the relationship does not represent a function, find an example of one input that has two or more outputs. This is called a *counterexample*.

$(City, ZIP Code)$

$(person, birth date)$

$(Last\ name, first\ name)$

$(state, capital)$

$y =$ NOTATION:

| x | y |
|-----|-----|
| 1 | |
| 2 | |
| 3 | |

$$y = 3x + 4$$

FUNCTION NOTATION:

| x | $f(x)$ |
|-----|--------|
| 1 | |
| 2 | |
| 3 | |

$$f(x) = 3x + 4$$

NOTE: $g(x)$ and $h(x)$ are common names of functions as well.

EXAMPLE

Evaluate the function $f(a) = -3a + 5$ to find the range if the domain = $\{-3, 1, 4\}$.

Writing function rules (or equations) to represent mathematical situations

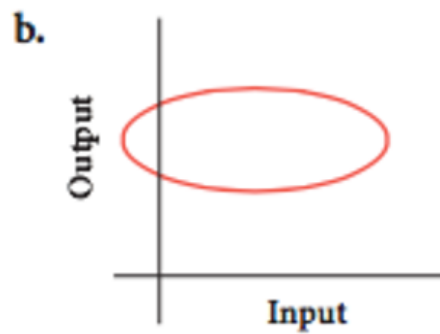
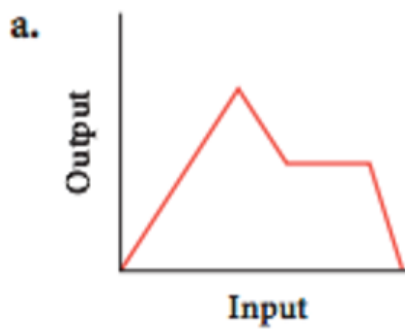
The admission fee to a local carnival is \$8 and each ride costs \$1.50. Write a function rule to find total cost to go to the fair.

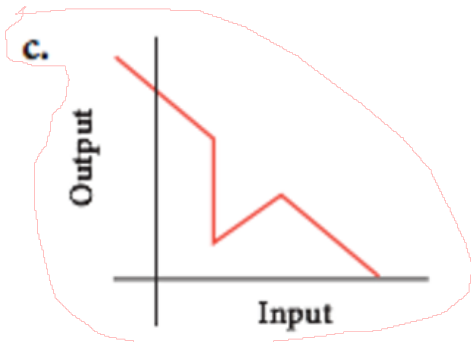
Independent Variable

Dependent Variable

Function Rule:

Find whether each graph below represents a function.





Rule for all graphs: