Lesson 1 Representing Relations and Properties of Functions

A. Representing Relations

Vocabulary:

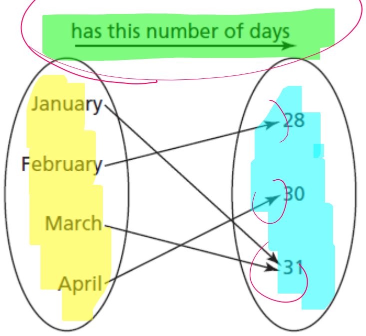
Set: a collection of distinct items. i.e. {1,2,3,4,5}

Element: one item in a set. The order of elements in a set does not matter.

Relation: when the elements of one set associate with the elements of another set.

There are 6 ways to represent a relation:

1) Arrow Diagram



{JAN., FEB., MAR., APR.}

{28, 30, 31}

2) Table of Values

x y

INDEPENDENT VARIABLES

Month	Days
January	31
February	28
March	31
April	30

DEPENDENT VARIABLES

3) In Words

The relation shows the association "has the number of" from a set of Months to a set of Days.

4) A set of Ordered Pairs (x, y)

{(January, 31), (February, 28), (March, 31), (April, 30)}

5) A graph

** NEED GRAPH PAPER

6) An equation

B. Properties of Functions

Vocabulary:

Domain: the set of first elements of a relation (INDEP. VARIABLES, X VALUES)

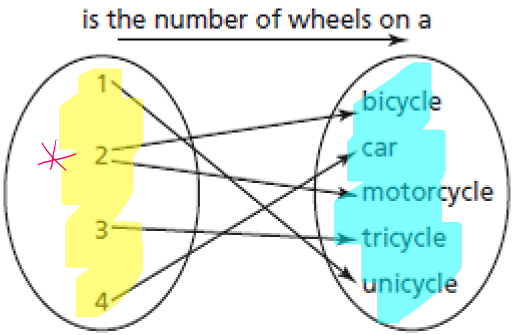
Range: the set of related second elements of a relation (DEP. VARIABLE, Y VALUES)

Function: a special type of relation where each element in the domain is associated with exactly one element in the range

Example 1:
Here are some different ways to relate vehicles and the number of wheels each has.

BOTH RELATIONS
NOT BOTH FUNCTIONS.

This relation associates a number with a vehicle with that number of wheels.



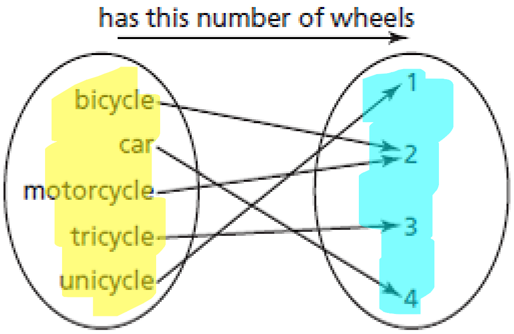
This diagram does **not** represent a **function** because there is one element in the first set that associates with two elements in the second set; that is there are two arrows from 2 in the first set.

Ordered Pairs:
{(1, unicycle), (2, bicycle),
(2, motorcycle), (3 tricycle), (4 car)}
The set of ordered pairs above does not represent a function because two ordered pairs have the same first element.

The **domain** is the set of the first elements:
{1, 2, 3, 4}

The **range** is the set of associated second elements: {unicycle, bicycle, motorcycle, tricycle, car}

This relation associates a vehicle with the number of wheels it has.



This diagram represents a **function** because each element in the first set associates with exactly one element in the second set; that is, there is only one arrow from each element in the first set.

Ordered Pairs:
{(unicycle, 1), (bicycle, 2),
(motorcycle, 2), (tricycle, 3), (car, 4)}
The set of ordered pairs above represents a function because the ordered pairs have different first elements.

The **domain** is the set of first elements:
{unicycle, bicycle, motorcycle, tricycle, car}

The **range** is the set of associated second elements: {1, 2, 3, 4}

How do you determine if a relation is a function?

DO ANY VALUES IN THE DOMAIN REPEAT?

1) Check to see if any ordered pairs have the same first element. If not, then for every first element there is exactly one second element, therefore the relation is a function.

IF NOT, IT IS A FUNCTION (FX'N)

2) Check to see if any element in the first set associates with more than one element in the second set. If it does, the relation is NOT a function.

You can look closely at the ordered pairs, in a table or in an arrow diagram to see if the above are true.

Example 2: Is {(6, -3), (4, 1), (7, -2), (-3, 1)} a function? Identify the domain and range.

The domain is: { 6 , 4 , 7 , -3 } NO Repeat
The range is: { -3 , -2 , 1 , 1 } → {-3, -2, 1}

The domain is paired with exactly one element of the range, the relation IS a function.

The INVERSE function is NOT a function since 1 is paired with more than one element of the range.

With an **inverse function** we REVERSE the order of the order pairs.

Example 3: For each relation below:

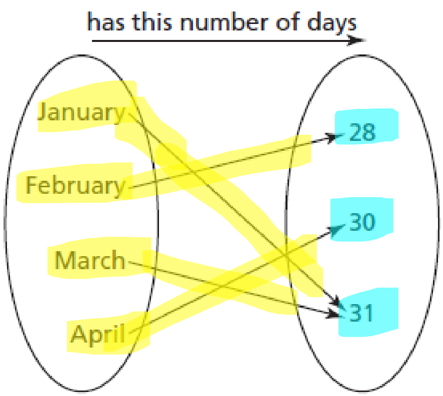
- Determine whether the relation is a function. Justify your answer.
- Identify the domain and range of each relation.

a) A relation that associates a number with a prime factor of the number:
{(4, 2), (6, 2), (6, 3), (8, 2), (9, 3)}

NOT a function (6 repeats)

D: {4, 6, 8, 9}
R: {2, 3}

b)



IS A FUNCTION (ONLY ONE OUTPUT FOR EACH INPUT)

D: {JAN, FEB, MAR, APR}
R: {28, 30, 31}

Dependent and Independent Variables

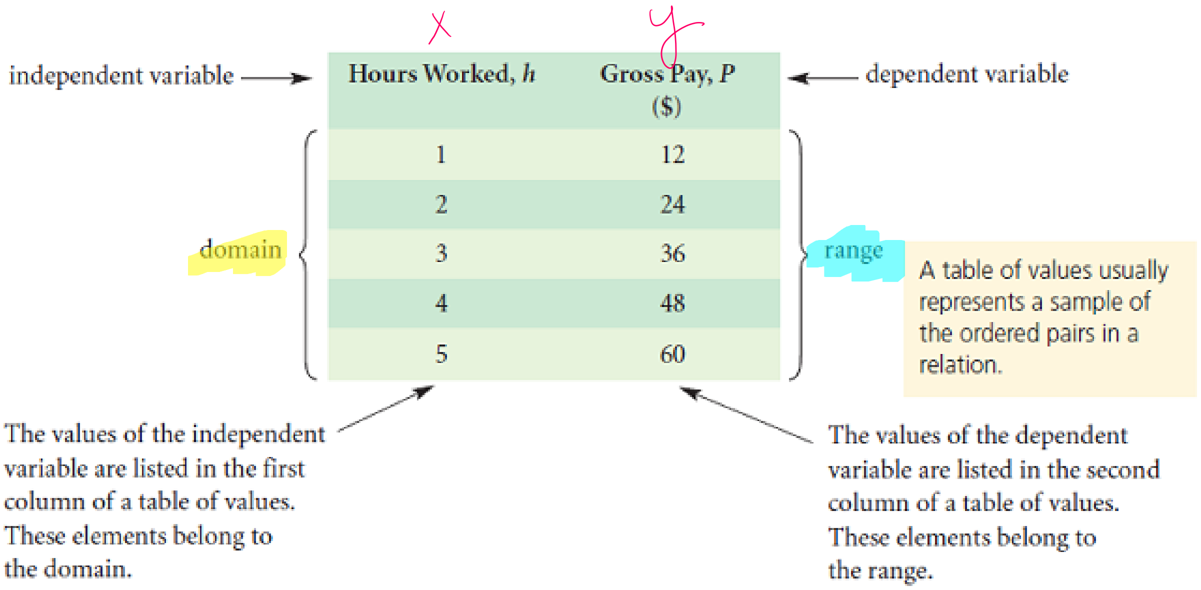
(x-axis)

Independent variable: VARIABLE NOT CHANGED BY THE OTHER VARIABLE.

Dependent variable: VARIABLE THAT DEPENDS ON OTHER FACTORS.

(y-axis)

In the workplace, a person's gross pay, *P* dollars, often depends on the number of hours worked, *h*.
So, we say *P* is the **dependent variable**. Since the number of hours worked, *h*, does not depend on the gross pay, P, we say that h is the **independent variable**.



Hours Worked, *h*	Gross Pay, *P* ($)
1	12
2	24
3	36
4	48
5	60

A table of values usually represents a sample of the ordered pairs in a relation.

The values of the independent variable are listed in the first column of a table of values. These elements belong to the domain.

The values of the dependent variable are listed in the second column of a table of values. These elements belong to the range.

We can think of a function as an input/output machine. The input can be any number in the domain, and the output is dependent on the input.

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