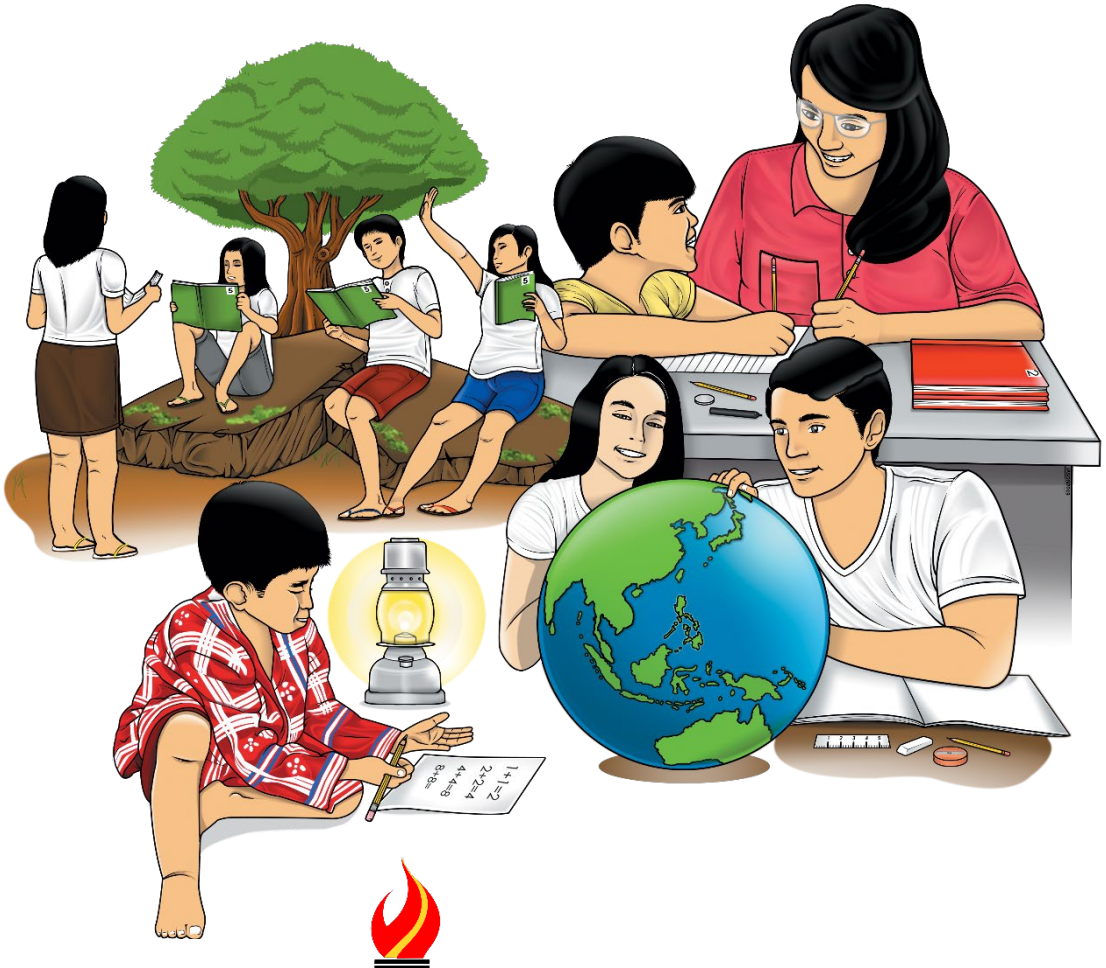
Senior High School

DepED
DEPARTMENT OF EDUCATION

General Mathematics

Quarter 1 – Module 11:
One-to-One Functions



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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you to assess our knowledge on the different mathematics concepts previously studied and your skills in performing mathematical problems. These knowledge and skills will help you understand one-to-one functions. As you go through this lesson, think of this important question: "*How one-to-one functions represents real life situations"?* To find the answer, read, understand and perform the provided activities.

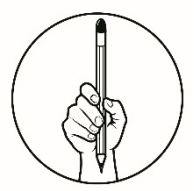
In this module, the learners are expected to demonstrate understanding of key concepts of inverse functions, exponential functions, and logarithmic functions. Learners should also be able to apply concepts of inverse functions, exponential functions, and logarithmic functions to formulate and solve real-life problems with precision and accuracy.

The module

- Lesson 1 – One-to-One Functions

After going through this module, you are expected to:

1. determine if a function is a one-to-one.
2. identify real-life situation using one-to-one function.



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. It is a rule which associates each element of set A with at least one element in set B.
   a. Function
   b. Relation
   c. Set
   d. Subset

2. It is a rule which uniquely associates elements of one set A with the elements of another set B; each element in set A maps to a single element in set B.
   a. Function
   b. Relation
   c. Set
   d. Subset

3. It associates two or more values of the independent (input) variable with a single value of the dependent (output) variable.
   a. One-to-one
   b. One-to-many
   c. Many-to-one
   d. Many-to-many

4. It is a single x-value that relates to two different y-values.
   a. One-to-one
   b. One-to-many
   c. Many-to-one
   d. Many-to-many

5. A single x-value relates to only one unique y-values.
   a. One-to-one
   b. One-to-many
   c. Many-to-one
   d. Many-to-many

6. *Mabuhay* National High School has its own School ID which is 143142 while other schools have their own school ID. Which rule represents the given statement?
   a. One-to-one
   b. One-to-many
   c. Many-to-one
   d. Many-to-many

7. Which of the following does not represent one-to-one function?

   a. My father to its child

   b. Facebook name to password

   c. Student's Name to Learner's Reference number (LRN)

   d. Cellphone Number to the owner

8. Which of the following table of values represents one-to-one function?

a.

Wife	Husband
Raiza	Anthony
Mitchie	Jeff
Sarah	Jordan

b.

x	y
Klara	Iphone
Kath	Iphone
Loraine	Samsung
Ana	Vivo

c.

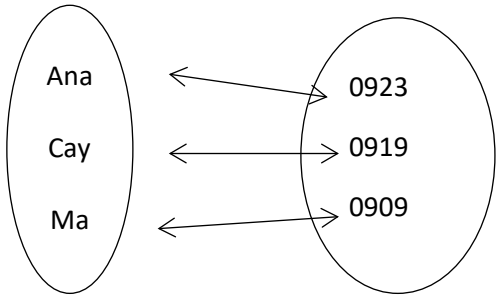
x	y
a	g
b	g
c	h

d.

x	y
-4	17
-2	5
0	1
2	5
6	17

9. Below is a sample of Venn diagram, which figure doesn't belong to the group?

a.



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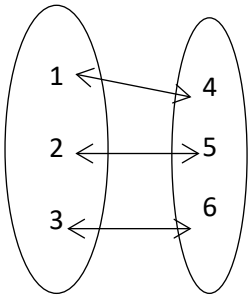

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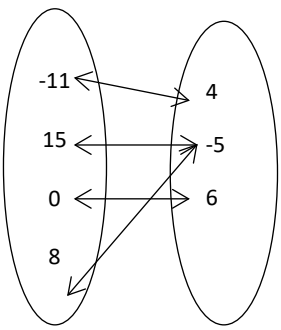
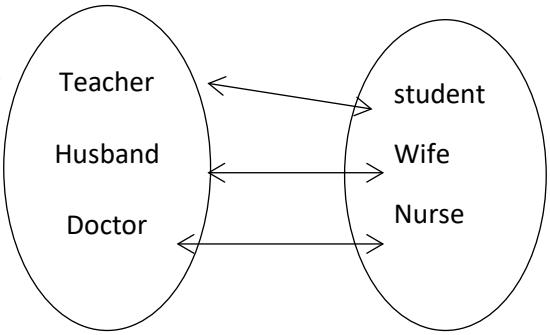


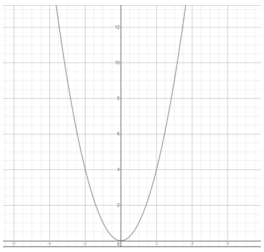
d.



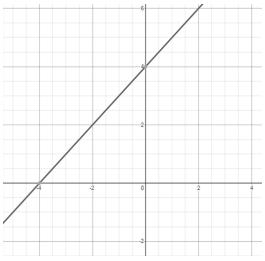
10. If a _____ can intersect the graph of the function, more than one time then the function is not mapped as one-to-one.
    a. Vertical Line Test
    b. Horizontal Line Test
    c. T-test
    d. Z-test

11. Which of the following graphs represents a one-to-one function?

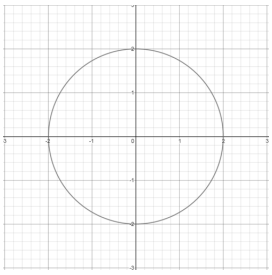
a.



c.



b.



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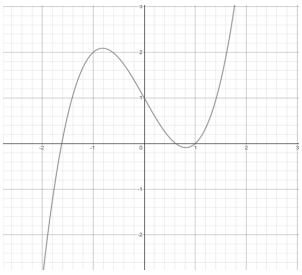


12. Functions can be written as _____.
    a. ordered pairs
    b. tables
    c. graphs
    d. all of the choices

13. Let A = {10, 20, 30} and B = {*Pandesal, Yema* Cake*, Mamon, Ensaymada*}. Which of the following is a one-to-one function?

    a. {(10,*Pandesal*),(20,*Mamon*), (30,*Pandesal*)}
    b. {(10,*Yema Cake*), (20,*Ensaymada*), (30,*Pandesal*)}
    c. {(10,*Pandesal*), (20,*Pandesal*), (30,*Pandesal*)}
    d. {(10,*Mamon*), (20,*Yema* Cake), (10,*Pandesal*), (30,*Ensaymada*)}

14-15. Below are the statements that may represent real life situation using one-to-one function.

14. Which of the following is not included?

i. One person has one passport.
ii. A shoe has one place on which you would wear it (your foot).
iii. A mouse for a computer.
iv. A washing machine has two function (to wash and dry)

a. i only
b. ii and iii only
c. iii and iv
d. iv only

15. Which of the following is an example of one-to-one function?

a. i and ii
b. ii and iv
c. iii and iv
d. i and iv

Lesson 1 Represent Real-Life Situation using One-to-One Functions

Start Lesson 10 of this module by assessing your knowledge of representing real-life situation using one-to-one functions. These knowledge and skill will help you understand easily on how to represent real-life situation using one-to-one functions. Seek the assistance of your teacher if you encountered any difficulty.

What's In

Study the graph below, write the values of y in the table below.

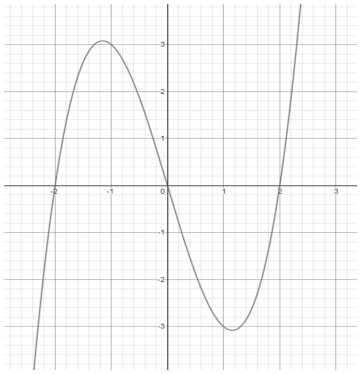


Figure 1

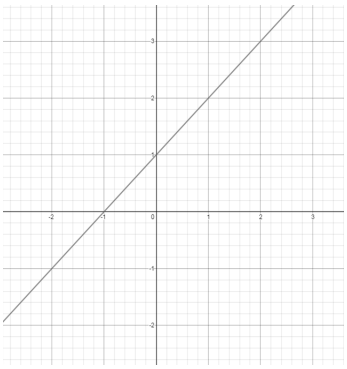


Figure 2

x	y
-2	
-1	
0	
1	
2	

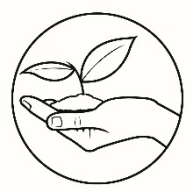
x	y
-2	
-1	
0	
1	
2	

Now, you have recalled to identify the values of x, answer the following questions.

1. What are the values of y in figure 1 and figure 2?
2. What have you noticed on their values?
3. Does the value of x in figure 1 have the same value in y? How about figure 2?
4. Draw horizontal lines on each figure. How many times does the horizontal line intersect on figure 1 and figure 2?
5. What function do you call when no two ordered pairs have the same first component and different second component?

Notes to the Teacher

When working on the coordinate plane, a function is a **one-to-one** function when it will pass the **vertical line test** *(to make it a function)* and also a **horizontal line test** *(to make it one-to-one)*



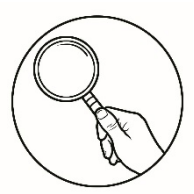
What's New

Contact five (5) of your classmates to write their Learner's Reference Number (LRN) on the table provided below.

Name of the Member	Learner's Reference Number (LRN)

Questions:

1. What did you observe from the table? Did you notice any repeated LRN?
2. What do you think is the reason why learners have their own LRNs?
3. What kind of function is depicted from the given activity?



What is It

One-to-One Functions

A function f is one-to-one if it never takes the same value twice or $f(x_1) \neq f(x_2)\ whenever\ (x_1) \neq (x_2)$. That is, the same y-value is never paired with two different x-values.

In the Venn diagram below, function f is a one-to-one since not two inputs have a common output.

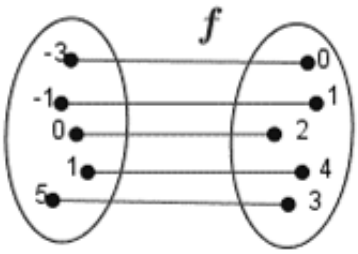


Figure 1. Venn Diagram of a One-to-One Function

In the Venn diagram below, function f is NOT a one-to-one since the inputs -1 and 0 have the same output.

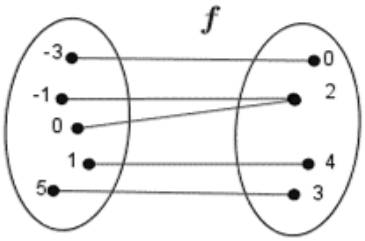


Figure 2. Venn diagram of a function that is not a one-to-one

On the other hand, the function g(x) = x^2 is not a one-to-one function, because g(−1) = g(1). There are a lot of real-life applications of a one-to-one function. Determine whether the given relation is a function. If it is a function, determine whether it is one-to-one.

Example 1: The relation pairing an SSS member to his or her SSS number.

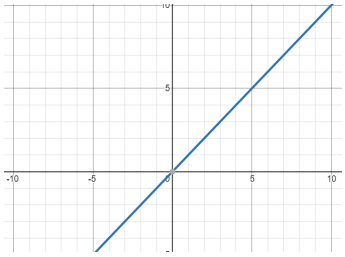
Solution:
Each SSS member is assigned a unique SSS number. Thus, this relation is a function. Further, two members cannot be assigned with the same SSS numbers, therefore, the function is one-to-one.

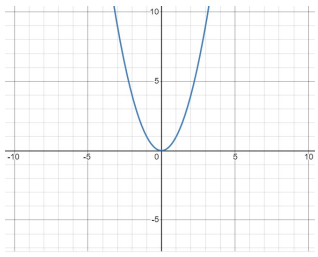
Example 2: The relation pairing a citizenship to a person

Solution:
The relation is a function because each person has a citizenship. However, a person can have two citizenship, (dual citizen) therefore, it is not one-to-one function.

Graph of a One-to-one Function

If f is a one-to-one function then no two points (x_1, y_1) and (x_2, y_2) , have the same y-value. Therefore, no horizontal line cuts the graph of the equation y = f(x) more than once. Example. Compare the graphs of the above functions



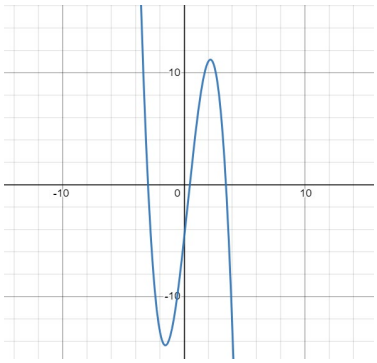


How to Determine if a Function is One-to-One

Horizontal Line test: A graph passes the Horizontal Line Test if each horizontal line cuts the graph at most once.

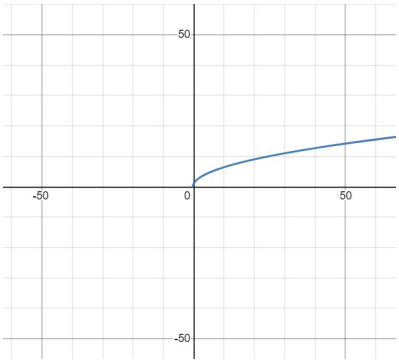
A function f is one-to-one if and only if the graph y = f(x) passes the horizontal Line test.

Example. Which of the following functions are one-to-one?



$y = x^2 - x^3 + 10x - 5$

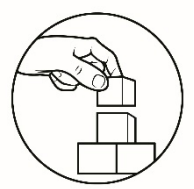
Figure 3



$y = \sqrt{4x + 1}$

Figure 4

Figure 3. shows that the horizontal line test intersects more than one, while the other horizontal line test intersects no more than one. It means that Figure 4 is an example of one-to-one function.



What's More

Activity 1.1 Understanding One-to-One Functions

Determine whether each of the following situations is a one-to-one function. Elaborate your answer.

1. The relation of a dog to its family members

_____
_____
_____

2. The relation of a person to his or her passport

_____
_____
_____

3. A car model to its manufacturing company

_____
_____
_____

4. A shark to where it lives

_____
_____
_____

5. True or False questions to answers

_____
_____
_____

Activity 1.2 True or False

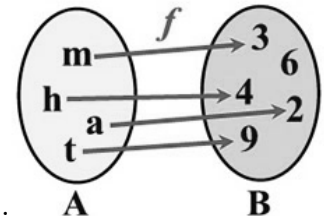
Identify whether each of the following represents one-to-one functions.

1. Degree Fahrenheit to its equivalent degree Celsius measurement
2. Person to his/her citizenship
3. Fare to the distance travelled
4. Cellphone to its cellphone number
5. Length in meters to its length in inches
6. Father to his first biological son
7. ATM Card Number to account name
8. Person to his favorite music
9. House to telephone number
10. Brand name to pair of shoes

What I Have Learned

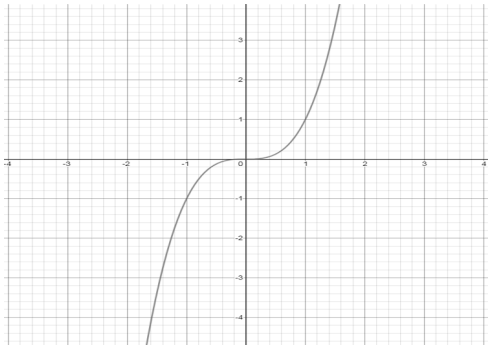
A. Complete the statements below.

1. The _____ is a set of ordered pairs in which no two ordered pairs that have the same first component have different second components.
2. When working on the coordinate plane, a function is a one-to-one function when it will pass the _____ (to make it a *function*) and also a _____ (to make it *one-to-one*).
3. Is the Function f**:**(m,3), (a,2), (t,9), (h,4) represents one-to-one functions? If yes, why? _____
4. In the diagram below, set A is the _____ of the function and set B is the _____of the function.

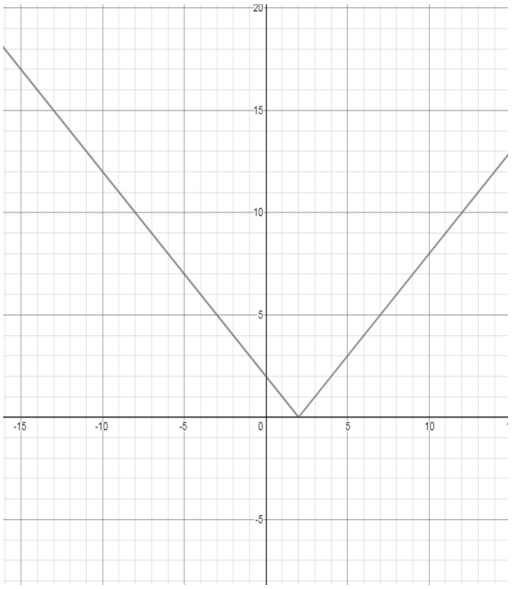


5. In a one-to-one function, given any *y* value, there is only one *x* that can be paired with the given *y*. Such functions are also referred to as _____**.**

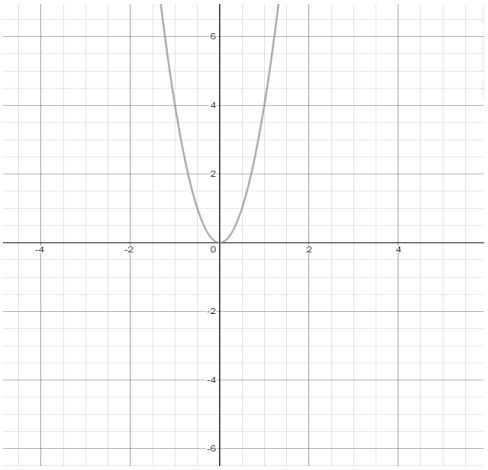
B. Which of the following graphs show one-to-one function? State the reason below.



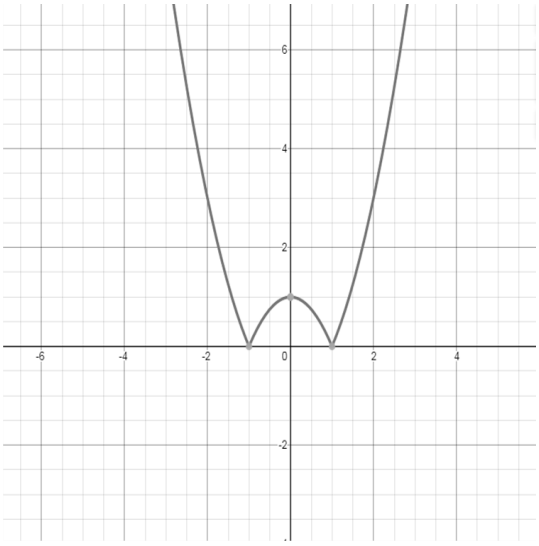
Graph A



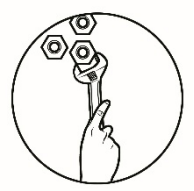
Graph B



Graph C



Graph D



What I Can Do

Now that you have deeper understanding of the topic, you are ready to answer the problem below.

Anthony's math teacher gives a quiz every day. However, Anthony missed his Thursday quiz due to high fever. On Friday, her teacher tells him that since he was excused, his score on the Friday quiz will be doubled to compensate for his absence. If he got 8, 9, and 10 on his other three quizzes.

Let x = Anthony's score on Friday quiz

f(x) = Anthony's total score at the end of the week

1. What would be Jayson's total score of the week?
2. Show that the function f(x) is a one-to-one function
3. Is the problem an example of one-to-one function? Why?

Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. It is a rule that produces a correspondence between the elements of two sets: D (domain) and R (range), such that to each element in D there corresponds one and only one element in R.

   a. Function c. Set

   b. Relation d. Subset

2. It is a graph of function that can also be used to determine whether a function is one-to-one using the _____.

   a. vertical line test c. t-test

   b. horizontal line test d. z-test

3. It is a method of testing if the graph represents a function by determining whether a vertical line intersects the graph no more than once.

a. vertical line test
c. t-test
b. horizontal line test
d. z-test

4. Which of the following is **not** a one-to-one function?

a.

X	-5	-3	0	3
Y	8	4	0	-4

b.

X	-5	-3	1	3
Y	-5	6	2	-4

c.

X	-5	-3	0	3
Y	-5	-3	-5	-4

d.

X	-5	-3	1	3
Y	8	-3	0	-5

5. Which type of relation wherein every element in the domain is paired with exactly one element in the range?

a. Function
c. Inverse
b. Asymptote
d. Composite

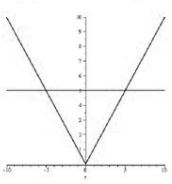
6. Which of the following relationships DOES NOT indicate a one-to-one function?

a. A tricycle and its plate number
c. Parents and their children
b. Chemical symbol to its chemical element
d. Husband and wife

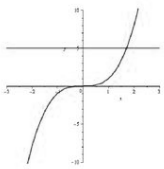
7. Which of the following represents a one-to-one function?

a. Teacher to students
c. Mother to her children
b. Student to their LRN
d. Students to teacher

8. Consider the graph below. Which of the following line tests crosses the graph of a function at no more than one point?



Line Test X

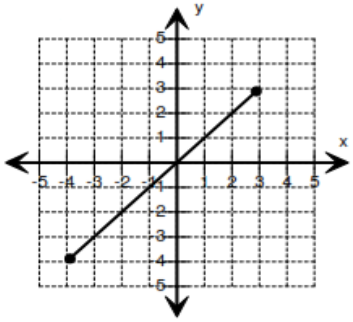


Line Test Y

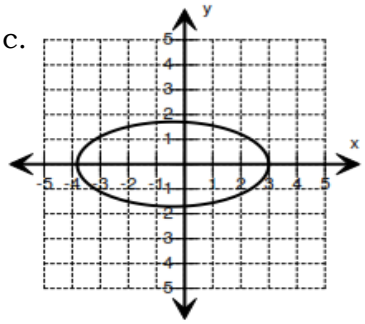
a. Line Test X only
b. Line Test Y only
c. Both Line Test X and Y
d. None of the following.

9. Which of the following graphs represent a one-to-one function?

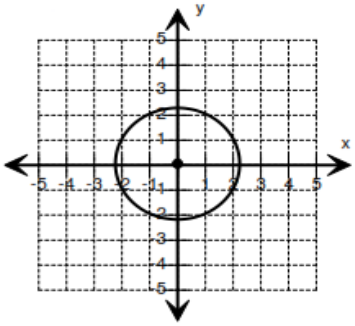
a.



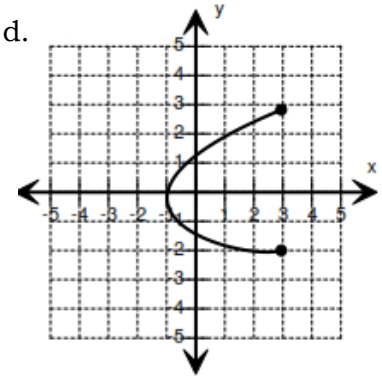
c.



b.



d.



10. Which of the following statements represents one-to-one-function?
    a. One person has one passport.
    b. A car model is made by one company.
    c. A house building prototype belongs to one company.
    d. A shampoo to your hair

11. Which of the following does not represent one-to-one function?

a. Thumbmark of a person.

b. GSIS number to a person.

c. Grocery item bar code.

d. Cellphone number

12. The input values make up the _____, and the output values make up the _____.

a. Domain, horizontal line test
b. Range, horizontal line test
c. domain, range
d. range, domain

13. The coffee shop menu being shown in figure below consists of items and their prices. Does the menu represent to one-to-one function?

MENU	
Dunkin Donut	₱25.00
Krispy Kreme	₱45.00
Mister Donut	₱25.00

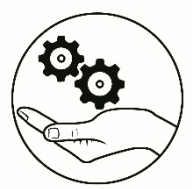
a. Yes, because each item on the menu has only one price, so the price is a function of the item.
b. Yes, because one item on the menu has only one price, so the price is a function of the item.
c. No, because the two items on the menu have the same price.
d. No, because one item on the menu has the same price.

14. The table shows the lists of five greatest volleyball players of all time in order of rank. Is the rank a function of the player name? Is the player name a one-to-one function of the rank?

Player	Rank
Tokyo	1
Nairobi	2
Alicia	3
Lisbion	4
Manila	5

a. Yes
b. No
c. Maybe
d. I don't know.

15. Is the area of a circle a function of its radius? Which of the following statements proves that the area of a circle a function of its radius.
    a. A circle of radius r has a unique area measure given by $A=\pi r^2$, so for any input r, there is only one output, A.
    b. If the function is one-to-one, the output value, the area, must correspond to a unique input value, the radius.
    c. Any area measure A is given by the formula $A=\pi r^2$. Because areas and radii are positive numbers, there is exactly one solution: $\sqrt{\frac{A}{\pi}}$.
    d. All of the choices.



Additional Activities

Below are words which can be associated with one-to-one functions. Write a statement below that may prove it is an example of one-to-one function.

Example: Passport ID

Answer: A person has only one passport ID.

1. Citizenship
2. Fare
3. Car
4. Area of a circle.
5. Soap

Answer Key

What I Know

1. B
2. A
3. C
4. B
5. A
6. A
7. A
8. A
9. B
10. B
11. C
12. D
13. B
14. D
15. A

What's More

1. Since the dog is related to all the family members, therefore it is not one-to one.
2. A certain passport can only belong to a certain person, therefore it is one-toone.
3. A manufacturer produces thousands of car for a certain model, therefore it is not one-to-one.
4. Shark can live in various temperatures/place. It is not one to one function.
5. True or false question to answers can be repeating. It is not one-to-one function.

Assessment

1. A
2. B
3. A
4. C
5. A
6. C
7. B
8. B
9. A
10. D
11. C
12. C
13. C
14. A
15. D

What I Have Learned

A

1. Function
2. Vertical Line Test, Horizontal Line Test
3. Yes, by the definition of one-to-one function.
4. Domain, Range
5. Injective.

B

Graph A. This cubic function is indeed a "function" as it passes the vertical line test. In addition, this function possesses the property that each x-value has one unique y-value that is not used by any other x-element. This characteristic is referred to as being a 1-1 function.

Notice that this function passes BOTH a vertical line test and a horizontal line test.
Graph B. This absolute value function passes the vertical line test to be a function. In addition, this function has y-values that are paired with more than one x-value, such as (4, 2) and (0, 2). This function is not one-to-one.

This function passes a vertical line test
but not a horizontal line test.

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