

MATHEMATICS

Quarter 2 – Module 3: Representations of Relations and Functions



AIRs - LM

MATHEMATICS 8

Quarter 2 - Module 3: Representations of Relations and Functions

Second Edition, 2021

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Region I

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MATHEMATICS

Quarter 2 – Module 3: Representations of Relations and Functions

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.



Target

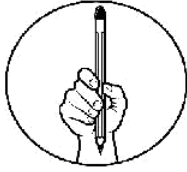
Relations and functions provide you a deeper understanding to practical situations. They play a very significant role in your daily life. In many ways, they come hand- in- hand with your regular routines whoever you are and wherever you are.

After going through this module, you are expected to:

1. Illustrate a relation and a function. **(M8AL-IIc-1)**
2. Verify if a given relation is a function. **(M8AL-IIc-2)**
3. Determine dependent and independent variables. **(M8AL-IIc-3)**

Subtasks:

1. Represent relation in various ways such as mapping, table of values, graph or ordered pairs.
2. Identify and apply the different representations of relations.
3. Use vertical line test to determine whether a given graph represents a function.
4. Determine dependent and independent variables



Pre-Test

Before you start learning this module, let's check how much do you know about the topic by answering the pre-test.

Directions: Choose the letter of the best answer. Write your answers on a separate sheet of paper.

- Which statement is true based on the relation of the color of an object?
 $\{(red, apple), (green, leaves), (blue, sky), (white, clouds), (yellow, sun)\}$
A. This relation is not a function.
B. Green is an element in the range.
C. Sun is an element in the domain.
D. Colors are the set in the domain.
- For the relation $\{(8, 11), (3, 5), (6, 17), (x, 2)\}$ to be a function, which value of x can be used?
A. 3 B. 4 C. 6 D. 8
- Which set of ordered pairs represents a function?
A. $\{(a, 3), (b, 5), (d, 6), (d, 9)\}$ B. $\{(a, 3), (b, 6), (c, 3), (c, 9)\}$
C. $\{(a, 3), (b, 3), (c, 3), (d, 3)\}$ D. $\{(a, 5), (a, -9), (a, 0), (a, 12)\}$

- Which of the following table of values **DOES NOT** define a function?

A.

x	3	5	7	9
y	4	6	8	10

B.

x	3	4	7	8
y	6	6	6	6

C.

x	-2	-2	-2	-2
y	4	3	2	10

D.

x	-2	-1	0	1
y	-2	-2	-1	-1

For items 5 – 6, use these relations.

I. $\{(3, 0), (6, 1), (6, 2), (3, 3)\}$

II. $\{(1, 5), (2, 6), (3, 7), (4, 8)\}$

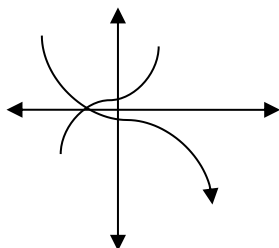
III. $\{(2, a), (4, a), (6, a), (8, a)\}$

IV. $\{(b, 3), (b, 4), (b, 5), (b, 6)\}$

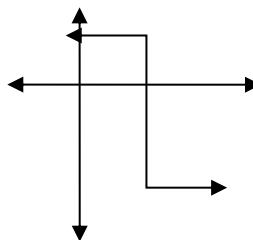
- Which of the following represents a one-to-one relation?
A. I only B. II only
C. II and III D. III and IV only
- Which of the relations represent many-to-one?
A. III only B. IV only
C. III and IV only D. I and IV only

7. Which of the following graphs represents a function?

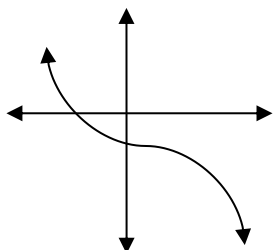
A.



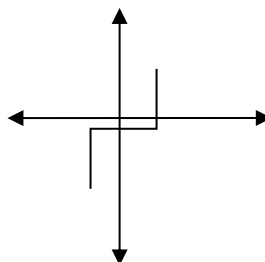
B.



C.



D.



8. Given the following equations, which of them describes a function?

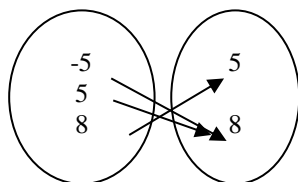
A. $y = 2x - 4$

B. $y^2 = 3x + 5$

C. $y^2 = -2x^2 - 6$

D. $y = \sqrt{3x - 4}$

9. What kind of relation describes the mapping diagram in the figure?



A. many-to-many

B. many-to-one

C. one-to-many

D. one-to-one

10. What should be the maximum number of points that a vertical line intersects a graph to be a function?

A. None

B. One

C. Two

D. Infinite

For items 11 -14, refer on the given problem below.

Suppose a professor gets Php 40,000 monthly salary and a rate of Php 450 per hour for extra teaching, which is anywhere from 0 to 40 hours per month.

11. How much will the professor earn in all, if she worked 10 extra hours per month?

A. Php 44,500

B. Php 44,750

C. Php 45,450

D. Php 45,500

12. How much will she earn in all, if she worked 34 extra hours in a month?

A. Php 55,300

B. Php 55,450

C. Php 56,600

D. Php 56,900

13. What is the minimum monthly amount she can earn in this job?
 A. Php 40,000
 B. Php 41,900
 C. Php 42,150
 D. Php 42,300
14. What is the maximum monthly amount she can earn?
 A. Php 54,450
 B. Php 56,300
 C. Php 58,000
 D. Php 60,000
15. The equation $M = 4n$. $4n$ relates the number of quarters (n), to its mass (M), in grams. What is the independent variable?
 A. The mass of the quarters
 B. The number of quarters
 C. The volume of the quarters
 D. Each quarter weighs 4.4 gram



Jumpstart

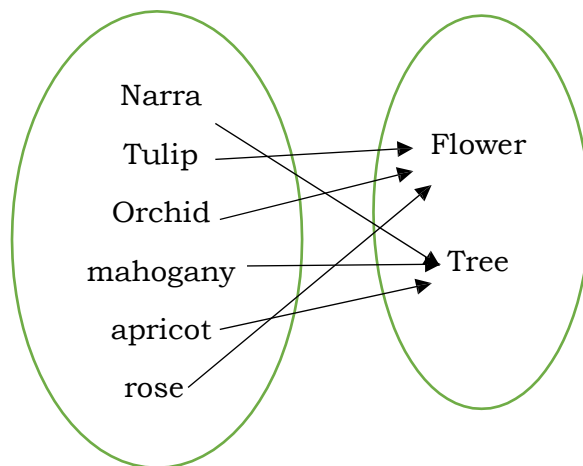
Let us start this lesson by looking at two things or quantities. As you go through this lesson, think of this question: How are the quantities related to each other?

Directions: Describe the diagram below by writing the set of ordered pairs. The first coordinate is done for you.

- A. **Set of ordered pairs**
 $\{(narra, tree), (tulip, flower)\}$

(_____), (_____)

(_____), (_____)



B. Questions:

1. How many elements are there in each of the ordered pairs you made?
2. What elements belong to the (a) first set? (b) Second set?
3. (a) Is there a repetition on the first coordinates? (b) How about on the second coordinates?
4. (a) What do you call the elements on the first set? (b) How about the elements on the second set?
5. Identify the domain and range.

Activity: DAILY WASTE

Read the problem carefully, and then answer the questions that follow.

An average adult generates about 4 kg of waste daily. This table shows the number of adults affect the amount of waste generated daily.

Number of Adult (x)	1	2	3	4	5	6	7
Amount of Waste (kg) (y)	4	8	12				

1. Complete the table.
2. What are the sets of ordered pairs?
3. How much waste would 8 adults generate?
4. Suppose 40 kg were generated in a day, how many adults were involved?
5. How are the values of y related to the values of x ?

**Discover**

From the activities above, there exists a relation between the x -values and the y -values of ordered pairs.

RELATION

A **relation** is any set of ordered pairs. The set of all the first coordinates is called **domain** of the relation. The set of all the second coordinates are called the **range**.

Aside from the ordered pairs, a relation may be represented in four ways: (1) table, (2) mapping diagram, (3) graph, and (4) rule.

REPRESENTATION of a RELATION**1. Table**

The table clearly describes the behavior of the value of y as the value x changes. The x -values are listed in separate rows. Each column represents an ordered pair.

Example of a table of values presented horizontally.

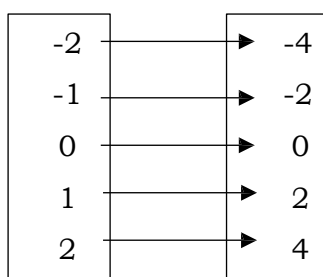
x	-2	-1	0	1	2
y	-4	-2	0	2	4

We could also pair each value in ordered pairs and can be listed as $\{(-2, -4), (-1, -2), (0, 0), (1, 2), (2, 4)\}$

2. Mapping Diagram

Subsequently, a relation can be described by using a diagram. A mapping diagram shows the domain and range as separate cluster of values. Lines are drawn to match each value in the domain with its corresponding value in the range.

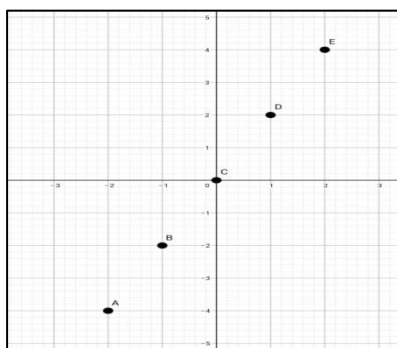
In this example, -2 is mapped to -4, -1 to -2, 0 to 0, 1 to 2, and 2 to 4.



3. Graph

Graphs can also be used to show the relationship between two values. Each ordered pair is plotted as a point on the graph. The placements of a point along the x- and y axes indicate the x - and y - values for the ordered pair.

Below is an example of a graphical representation of a relation. It illustrates the relationship of the values of x and y .



Source: Math-8 Learner's Module p.143

4. Rule

Notice that the value of y is twice the value of x . In other words, this can be described by the equation $y=2x$, where x is an integer from -2 to 2.

Illustrations:

Given below are examples of a rule, set of ordered pairs, table of values, mapping diagram and a graph

1. A. Rule:

$$\{(x, y)/x + y = 6\}$$

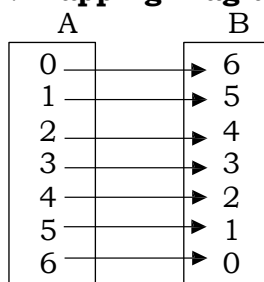
B. Set of ordered pairs:

$$\{(0, 6), (1, 5), (2, 4), (3, 3), (4, 2), (5, 1), (6, 0)\}$$

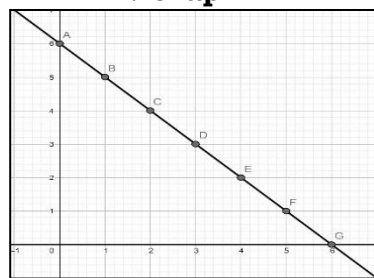
C. Table

x	y
0	6
1	5
2	4
3	3
4	2
5	1
6	0

D. Mapping Diagram



E. Graph



Source: Math-8 Learner's Module p.144

2. A. Rule:

$$\{(x, y)/y = x^2\}$$

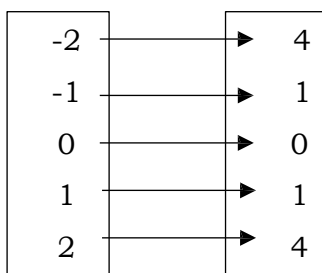
B. Set of ordered pairs:

$$\{(0, 6), (1, 5), (2, 4), (3, 3), (4, 2), (5, 1), (6, 0)\}$$

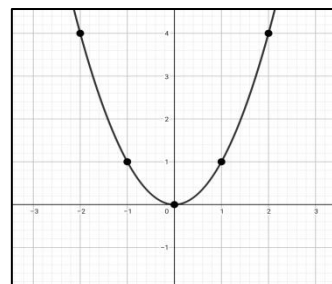
C. Table

x	y
-2	4
-1	1
0	0
1	1
2	4

D. Mapping Diagram



E. Graph



FUNCTIONS

A **function** is a special type of relation. It is a relation in which every element in the domain is mapped to exactly one element in the range. Thus, a set of ordered pairs is a function if no two distinct ordered pairs have equal abscissas.

TYPES of RELATIONS

1. One-to-one correspondence

Every element in the domain is mapped to a unique element of the range.

2. Many -to-one correspondence

Each element in the domain is mapped to any two or more elements in the range.

3. One-to-many correspondence

Each element in the domain is mapped to any two or more elements in the range.

Questions:

1. Among the types of relations, which ones are functions?
✓ One-to-one and many to one
2. Does many-to-one relation between elements always guarantee a function?
✓ Yes
3. What about one-to-many relation between the elements?
✓ One-to-many does not represent a function

NOTE:

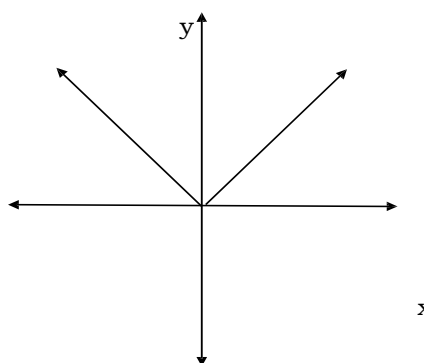
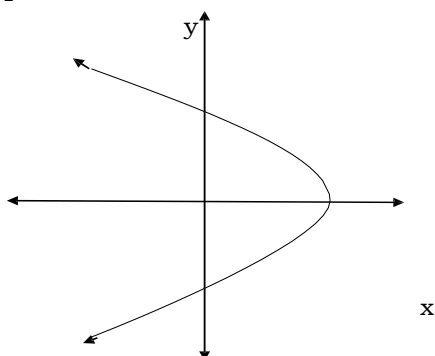
Every function is a relation but not all relation is a function.

Aside from the things mentioned above, another visual way of determining if a relation is a function or not function from a graph is with the use of the vertical line test.

Vertical line test

If any vertical line cuts the graph only once, then the relation is a function (one-to-one or many-to-one). If any of the vertical line crosses the graph of the relation more than once, then the relation is not a function (one-to-many).

Examples:



Using the vertical line test, the first illustration^y is not a graph of a function while the second illustration is a graph of a function.

Vertical Line Test

If a vertical line crosses the graph of a relation in more than one point, the relation cannot be a function. If no vertical line crosses the graph in more than one point, then the graph is a graph of function.

DEPENDENT AND INDEPENDENT VARIABLE

Another common representation of a function is the “function machine”. It illustrates the idea that a single input number from the domain of the function produces a unique number in the range of the function. Think of the **independent variable** as the input and the **dependent variable** as the **output**.

Consider the following example.

Do you know that a running faucet can waste about 15 liters of water per minute?

No. of minutes (x)	1	2	3	4	5	6
No. of liters (y)	15	30	45	60	75	90

The table shows the relationship between the numbers that waters runs (x) and the number of liters of water wasted (y).

Questions:

1. What is the amount of water (y) wasted in 10 minutes?
✓ 150 liters
2. Suppose 180 liters of water were wasted, how many minutes was the faucet left running?
✓ 12 minutes
3. What is the dependent variable?
✓ y is the dependent variable [the number of liters of water (y) depends on the number of minutes the water runs (x)]
4. Which of the two variables is independent?
✓ x is the independent variable
5. If you are given the number of minutes the water runs, how can you find the number of liters of water that is wasted?
✓ $y = x(15)$

In an equation where y is expressed in terms of x , the variable x is considered the **independent variable** because any value could be assigned to it. However, the variable y is the **dependent variable** because its value depends on the value of x . in symbol: $y = f(x)$.



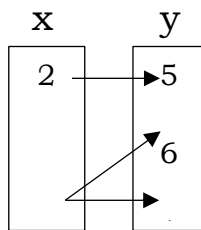
Activity 1: COMPLETE ME

ACTIVITY 2: FUNCTION or NOT FUNCTION

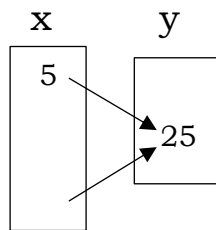
Directions: Verify if the given relation is Function or Not Function

- $\{(0, 5), (1, 6), (2, 7), (3, 8), (4, 9)\}$
- $\{(-5, -2), (0, 4), (0, 6), (0, 8), (0, 10)\}$
- $\{(0, -2), (1, -3), (2, -4), (3, -5), (4, -6)\}$

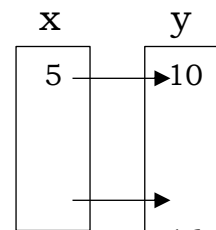
4.



5.



6.



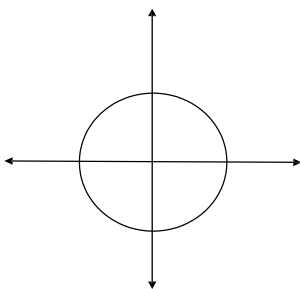
7.

x	1	2	3	4	6
y	2	4	6	6	8

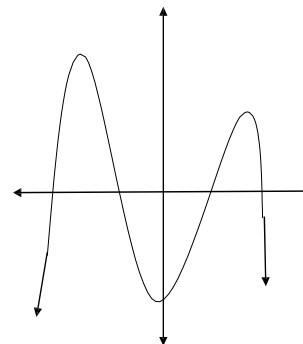
8.

x	2	3	3	5	6
y	5	7	8	-3	-2

9.



10.



Activity 3: DO YOU KNOW ME?

Directions: Determine which of the following variable is independent or dependent.

- time and salary
independent variable: _____
dependent variable: _____
- the number of hours boiling and the number of ounces of water in the pot.
independent variable: _____
dependent variable: _____

3. The distance covered and the volume of the gasoline left
independent variable: _____
dependent variable: _____
4. The number of hours studied to grade on test
independent variable: _____
dependent variable: _____
5. Height of plant to the number of months grown
independent variable: _____
dependent variable: _____



Deepen

ACTIVITY 1: MY CALL

Directions: Read the problem carefully, and then answer the questions that follow.

Suppose you want to call your mother by phone. The charge of a pay phone call is Php 9.00 for the first 3 minutes and an additional charge of Php 2.00 for every additional minute or a fraction of it.

1. How much will you pay if you have called your mother 3 minutes? 4 minutes? 5 minutes? 10 minutes?
2. Based on your answers in item 1, write ordered pairs in the form (time, charged).
3. Based on your answers in item 2; what is the domain? What is the range?
4. What kind of correspondence was shown on the relation?
5. How is the amount charged related to the number of hours you called your mother?

Activity 2: MY REFLECTION

Reflect on the activities you have just done in this lesson by completing the following statements.

I learned that _____

I was surprised that _____

I noticed that _____

I discovered that _____

I was pleased that _____

Activity 3: THIS IS ME

As a student, give at least three real - life situation with two quantities which are related to each other, then identify the independent and dependent variable.

1. _____
Independent variable _____
Dependent variable _____
2. _____
Independent variable _____
Dependent variable _____
3. _____
Independent variable _____
Dependent variable _____



Gauge

Post - Test

DIRECTION: Choose the letter of the correct answer. Answers must be written on a separate sheet of paper.

1. In the set of ordered pairs: $\{(2, 3), (3, 4), (5, 6), (2, 8)\}$, what do you call $\{3, 4, 6, 8\}$?
A. domain B. function C. range D. x-coordinates
2. In item number 1, what do you call $\{2, 3, 5, 6\}$?
A. domain B. function C. range D. x-coordinates
3. What type of relation is the set of ordered pairs: $\{(2, -3), (-3, 4), (-5, 4), (-2, 8)\}$?
A. One-to-one relation B. One-to-many relation
C. Many-to-one relation D. One-to-one and many-to-one relation

4. Which of the following equations illustrates a function?

- A. $y = 2x^2 - 3x + 3$ B. $x^2 = y^2 - 5$ C. $y = \frac{4}{x} + 3$ D. $y = \sqrt{2x+3}$

5. Which of the following relations is a function?

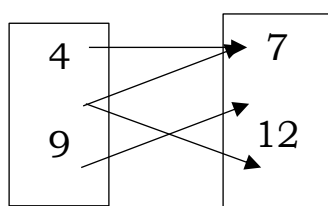
- A. $\{(1, 0), (2, 1), (3, 2), (3, 3)\}$ B. $\{(1, 0), (1, 1), (1, 2), (1, 3)\}$
 C. $\{(2, 0), (3, 2), (4, 4), (5, 6)\}$ D. $\{(-2, 3), (-2, 3), (-3, 3), (-3, 3)\}$

6. Which among the types of relation is a function?

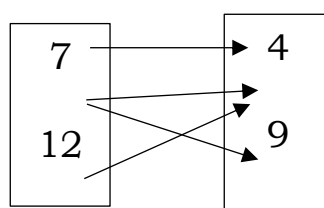
- A. One-to-one relation
 B. One-to-many relation
 C. One-to-one and one-to-many relation
 D. One-to-one and many-to-one relation

7. Which of the following represents the relation $\{(4, 7), (9, 12), (9, 17), (10, 7)\}$?

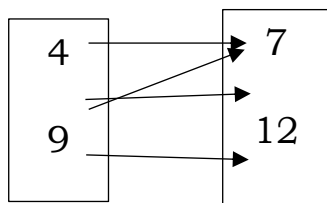
A.



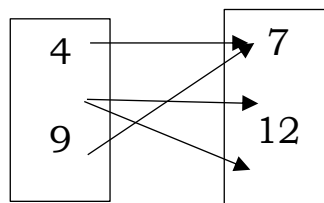
B.



C.

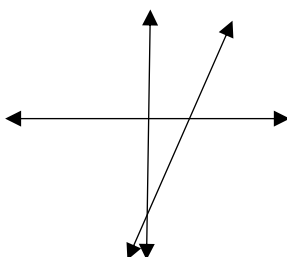


D.

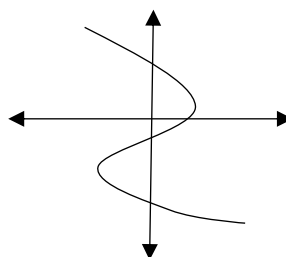


8. Which of the following graph is a function?

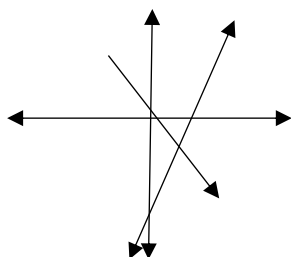
A.



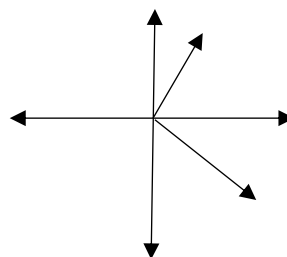
B.



C.



D.



Consider the given relations to answer numbers 9 & 10:

- I. $\{(0, 1), (1, 3), (2, 4), (3, 5), (4, 6)\}$
- II. $\{(0, 2), (0, 4), (0, 6), (0, 8), (0, 10)\}$
- III. $\{(4, 1), (6, 1), (7, 1), (9, 1), (10, 1)\}$

9. Which of the given relation is a function?
A. I only B. II only C. I and III only D. II and III only
10. Which is NOT a function?
A. I only B. II only C. I and II only D. II and III

For items 11 and 12, refer on the given situation.

Business Link: A computer center charges Php 3.00 for each page printed.

11. How much would be the printing of 8 pages cost if a computer shop charges Php 3.00 for each page printed?
A. 18 B. 21 C. 24 D. 28
12. Suppose the printing cost was 36, how many pages were printed if the charge is Php 3.00 per page?
A. 10 pages B. 12 pages C. 18 pages D. 24 pages
13. An investigation was performed to see if corn seeds would sprout at different times depending on the temperature of the air in which they are placed. What is the independent variable in the situation?
A. number of corn seeds that sprouted
B. amount of air the corn seeds are placed
C. temperature of the air at which they are placed
D. number of corn seeds that sprout at different times
14. What is the dependent variable in item number 13?
A. number of corn seeds that sprouted
B. amount of air the corn seeds are placed
C. temperature of the air at which they are placed
D. number of corn seeds that sprout at different times
15. In the equation $y = f(x)$, what do you call y ?
A. dependent variable B. function
C. independent variable D. relation

Great job! You are done with this module.

References

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