

9

Mathematics

Quarter 2-Module 2

**Translating into variation statement a
relationship between two quantities given by a
table of values and a mathematical equation**

Week 2

Learning Code - M9AL-IIb-1



Learning Module for Junior High School Mathematics

Quarter 2 – Module 2 – **New Normal Math for G9**

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MODULE
2

TRANSLATING INTO VARIATION STATEMENT A
RELATIONSHIP BETWEEN TWO QUANTITIES GIVEN BY A
TABLE OF VALUES AND A MATHEMATICAL EQUATION

WHAT I NEED TO KNOW

LEARNING COMPETENCY

The learner

translates into variation statement a relationship between two quantities given by: (a) a table of values; (b) a mathematical equation; (c) a graph, and vice versa. (**M9AL-IIIb-1**) Take note that graphing will be thoroughly discussed in the next module (Module 3)

WHAT I KNOW

Write the letter of the correct answer on your answer sheet.

- If y varies **directly** as x , and $y = 32$ when $x = 4$, find the constant (k) of variation.
A. 8 B. 36 C. 28 D. 128

- What happens to T when h is doubled in the equation $T = 4h$?
A. T is halved C. T is doubled
B. T is tripled D. T becomes zero

- Which statement of variation describes the table of values below?

| | | | | | |
|-----|----|----|---|---|----|
| x | 3 | 4 | 6 | 8 | 12 |
| y | 16 | 12 | 8 | 6 | 4 |

- y varies directly as x C. y varies inversely as x
B. y varies jointly as x D. y varies directly and inversely as x
- What is the constant (k) of variation in item #3?
A. 48 B. 38 C. 19 D. 2
 - A car travels d km in t hours. The formula that relates d to t is $d = kt$. What kind of variation is it?
A. Direct B. Inverse C. Joint D. Combined
 - If y varies **inversely** as x , and $y = 32$ and $x = 4$, find the constant of variation.
A. 8 B. 36 C. 28 D. 128
 - Which variation statement applies to $y = 8xz$?
A. y varies inversely as x
B. y varies directly as x and z
C. y varies inversely to two or more quantities
D. y varies directly to some quantities and varies inversely to some other quantities.

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8. Which of the following equations is an example of combined variation?
- A. $y = \frac{14}{x}$ B. $y = \frac{1000}{x}$ C. $y = \frac{3z}{x}$ D. $y = \frac{\frac{6}{12}}{x}$
9. What does “ y varies inversely as x ” mean?
- A. As the value of y increases, the value of x remains constant.
 B. As the value of y increases, the value of x also increases.
 C. As the value of y decreases, the value of x also decreases.
 D. As the value of y increases, the value of x decreases.
10. Jelly can finish 3 assignments (a) in 30 minutes (t). What is the constant (k) of variation if t varies inversely as a ?
- A. 90 B. 100 C. 110 D. 120

WHAT'S IN

Before you go further, review and revisit the types of variation. Identify what type of variation (**direct, indirect, joint, combined**) the following statements describe, then write your answers on your answer sheet.

1. As the value x increases, the value of y decreases.
2. The value of y varies directly to two or more quantities.
3. As the value of x increases, the value of y also increases.
4. The value of y varies directly to some quantities and varies inversely to some other quantities.
5. As the value of y increases, the value of x decreases.

WHAT'S NEW

During the time of Enhanced Community Quarantine (ECQ), everyone was required to stay at home to avoid exposure to the COVID-19 infection. Only those who had a *Quarantine Pass* could go outside to buy essential needs. Because of this situation, most people relied on online transactions. Consequently, online sellers, delivery food and courier companies became the popular businesses. These helped people obey the ECQ rules while getting what they wanted and what they needed every day.

Suppose your family owns a branch of a courier company and every day your branch needs to deliver 180 parcels. Consider the number of parcels delivered in an hour. Which condition do you think will take a shorter time to deliver all 180 parcels?

- A. Delivering more parcels in an hour
 B. Delivering less parcels in an hour

WHAT IS IT

Based on the situation in *What's New*, which do you think is the practical answer? To analyze it better, we can set different numbers of parcels (x) delivered in an hour, *as shown in Table 1*, and solve for the number of hours (y) it takes to deliver all 180 parcels.

The problem can be solved using the mathematical equation $y = \frac{180}{x}$, where x is the number of parcels your branch can deliver in an hour, and y is the number of hours your branch can deliver all these parcels.

Complete the table.

Table 1: Company delivery time

| Number of parcels delivered in an hour (x) | 10 | 12 | 18 | 20 |
|----------------------------------------------------------|----|----|----|----|
| Number of hours spent delivering all 180 parcels (y) | 18 | | | |

Solution:

Use the mathematical equation, $y = \frac{180}{x}$ where x is the number of parcels your branch can deliver in an hour, and y is the number of hours your branch can deliver all 180 parcels.

Substitute $x = 10$,

$$y = \frac{180}{x} = \frac{180}{10} = 18$$

Substitute $x = 12$,

$$y = \frac{180}{x} = \frac{180}{12} = 15$$

Substitute $x = 18$,

$$y = \frac{180}{x} = \frac{180}{18} = 10$$

Substitute $x = 20$,

$$y = \frac{180}{x} = \frac{180}{20} = 9$$

This shows that the more parcels you could deliver in an hour (x), the shorter the time (y) it would take to deliver all 180 parcels as shown in Table 1. The relationship states that “as the value of x increases, the value of y decreases.”

Table 1: Company Delivery Time

| Number of parcels delivered in an hour (x) | 10 | 12 | 18 | 20 |
|----------------------------------------------------------|----|-----------|-----------|----------|
| Number of hours spent delivering all 180 parcels (y) | 18 | 15 | 10 | 9 |

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Moreover, to completely say that the table of values represents an inverse variation, it must have a *constant of variation* (k). The constant of variation is the number that relates two or more variables that are directly proportional or inversely proportional to one another. In this case, the constant of variation (k) given by $k = xy$ is the case value for all parcels.

| | | | | |
|----------------------------------------------------------|------------|------------|------------|------------|
| Number of parcels delivered in an hour (x) | 10 | 12 | 18 | 20 |
| Number of hours spent delivering all 180 parcels (y) | 18 | 15 | 10 | 9 |
| Constant of Variation (k) | 180 | 180 | 180 | 180 |

Since the product of x and y in all columns are the same, then the table of values represents an inverse variation. This implies that the relationship of the number of hours spent (y) in delivering 180 parcels is inversely proportional to the number of parcels (x) delivered in an hour. Thus, the problem illustrates an **inverse variation** and the variation statement of the given table of values is “ **y varies inversely as x .**”

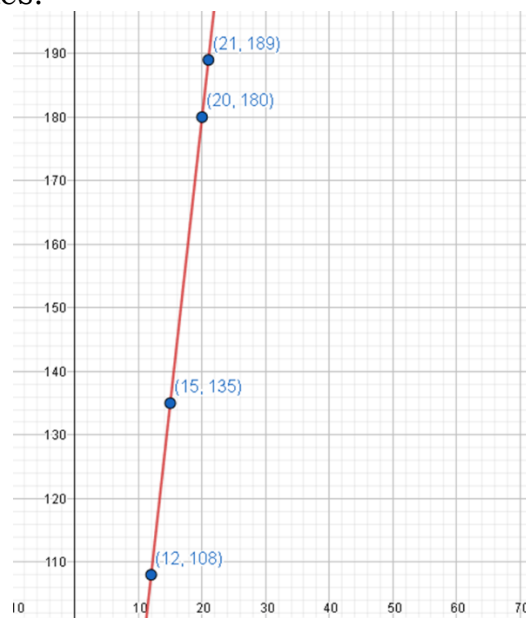
Example 1:

People are required to wear facemask whenever they leave their home. Assume that a re-seller of facemasks recorded her profits for the sales she made (See Table 2). Does the table show direct or inverse variation?

Table 2: Profits Earned (in Php)

| | | | | |
|------------------------------|-----|-----|-----|-----|
| Number of boxes sold (x) | 12 | 15 | 20 | 21 |
| Profit (y) | 108 | 135 | 180 | 189 |

This could also be graphed as shown, where y -axis is the profit while x -axis is the number of boxes:



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There are two steps to determine if the table of values represents a direct or inverse variation. First is to check the trend of the values whether it is increasing or decreasing, and then, determine if there is a constant of variation.

Looking at the trend of each variable in the table, it shows a direct variation because as the number of boxes sold (x) increases, the profit (y) also increases. Since the trend illustrates a **direct variation**, the formula in finding the constant of variation (k) is $k = \frac{y}{x}$. Furthermore, if given a graph, a direct variation is represented by a line when graphed.

Table 3: Profit Earned (in Php) and the Constant of Variation

| | | | | |
|-------------------------------|----------------------|----------------------|----------------------|----------------------|
| Number of boxes sold (x) | 12 | 15 | 20 | 21 |
| Profit (y) | 108 | 135 | 180 | 189 |
| Constant of variation (k) | $\frac{108}{12} = 9$ | $\frac{135}{15} = 9$ | $\frac{180}{20} = 9$ | $\frac{189}{21} = 9$ |

Using the constant of variation, k (See Table 3), we can generate a mathematical equation for direct variation, $y = kx$, where y is the profit, x is the number of boxes sold and k is the constant of variation. The mathematical equation is obtained by substituting the computed constant of variation ($k = 9$) to $y = kx$ and gives $y = 9x$. The variation statement for this example is “**y varies directly as x.**”

Example 2:

Given the mathematical equation $y = 17x$, determine the following:

- Kind of variation (Direct or Inverse)
- Variation statement
- Constant of variation

Solution:

- The mathematical equation shows a direct variation because it is in the form $y = kx$, where k is a constant.
- y varies directly as x
- $k = 17$

The two other types of variation are **Joint variation** which is just like a direct variation, but it involves two or more variables: $y = k(xz)$, and the **Combined variation** where there is a combination of direct and inverse variation: $y = \frac{kx}{z}$.

Example 3:

Given the mathematical equation $y = 8xz$, determine the following:

- Kind of variation
- Variation statement

Solution:

- The mathematical equation shows a direct variation but includes more than two variables because it is in the form $y = kxz$, where k is a constant, therefore, this is a joint variation.
- y varies directly as x and z

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Example 4:

Given the mathematical equation $y = \frac{20x}{z}$, determine the following:

- Kind of variation
- Variation statement

Solution:

- The mathematical equation shows a direct variation together with an inverse variation therefore, this is a combined variation.
- y varies directly as x and inversely as z

Example 5

If y varies inversely as x , and $y = 8$ when $x = 12$, find the constant of variation.

Solution:

The relationship of the variables shows an inverse variation. Thus, the constant of variation (k) is the product of x and y , that is, $k=xy$.

Substitute the given values of x and y to solve for k . Since $y=8$ and $x=12$, then to solve for k we have:

$$k = xy$$

$$k = (12)(8)$$

$$k = 96$$

Therefore, the constant of variation is 96.

WHAT'S MORE

ACTIVITY 1 – Transportation

Given: You wanted to know the relationship between the distance travelled by your car (x) and its fuel consumption (y). You have decided to take a daily note for one week to compare the two quantities (See *Table 4*).

Table 4 – Car Fuel Consumption

| Distance travelled in km (x) | 2 | 3 | 4 | 5 | 6 |
|----------------------------------|----|----|----|----|----|
| Fuel consumption in L (y) | 14 | 21 | 28 | 35 | 42 |

Answer the following:

- What is the constant of variation? _____
- Make a mathematical equation: _____
- Write the relationship in a sentence: _____
- What type of variation does the table represent? _____
- Give the variation statement: _____

ACTIVITY 2 – Get Together

Given: Lhaila and her friends organized an overnight swimming pool get-together. The total amount of Php 24 000 was allotted for the resort reservation and car rental which would be divided in proportion to the number of attendees.

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Lhaila noted some possible amount of contribution in proportion to the number of attendees (See Table 5).

Table 5 – Possible Amount of Contribution

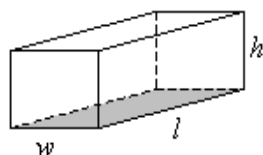
| | | | | | |
|--------------------------------------------------------------------|------|------|------|------|------|
| Number of attendees (x) | 8 | 10 | 12 | 15 | 24 |
| Amount of contribution per attendee in PhP (y) | 3000 | 2400 | 2000 | 1600 | 1000 |

Answer the following:

1. What is the constant of variation? _____
2. Make a mathematical equation: _____
3. Write the relationship in a sentence: _____
4. What type of variation does the table represent? _____
5. Give the variation statement: _____

ACTIVITY 3 - SOLID

The figure below shows a rectangular solid. Its width is represented by w , its length is l , and height is h .



Answer the following:

1. Express the volume, V of the rectangular solid using the given representation of its dimensions. _____
2. What type of variation does the equation in (1) represent? _____
3. Consider that the volume of the rectangular solid is constant. Express its width, w , in terms of its constant volume k , length, l , and height, h . _____.
4. What type of variation does the equation in (3) represent? _____

WHAT I HAVE LEARNED

To check if the table of values represents a direct or inverse variation, follow the steps below:

1. Check the trend of the values (x and y). If the values of x and y have the same trend (e.g. “as the values of x increase, the values of y also increase” and “as the values of x decrease, the values of y also decrease), then the table represents a **direct variation**. If the values of x and y go on opposite trends (e.g. “as the values of x increase, the values of y decrease” and vice versa), then the table represents an **inverse variation**.
2. Determine if there is a constant of variation (k). A direct variation follows the formula, $k = \frac{y}{x}$ to solve for the constant of variation while an inverse variation follows the formula, $k = xy$ to solve for the constant of variation.
3. The two other types of variation are **Joint variation** which is just like a direct variation, but it involves two or more variables: $y = k(xz)$, and the **Combined variation** where there is a combination of direct and inverse variation: $y = \frac{kx}{z}$.

WHAT I CAN DO

A typhoon hit some areas of Luzon that caused floods and destruction of houses. It recorded a maximum speed of 70km/h that lasted for 4 days and left the country on its 5th day. Naturally, when the speed of the typhoon over the land increases, the number of days it stays in that place decreases.

As described above, the two quantities, namely, speed of the typhoon and number of days it stays in a particular area have inverse relationships. Thus, the statement can be written in a mathematical equation, $y = \frac{k}{x}$ where x is the speed of the typhoon and y is the number of days it will stay.

1. Complete the table of values by solving for the speed (y).

| | | | | | |
|--------------------|---|---|----|-----|---|
| No. of Days | 8 | 5 | 4 | 3.5 | 2 |
| Speed | | | 70 | | |

2. If the speed of the typhoon increases and the number of days it stays on the land decreases, what type of variation is described?

3. What is the constant of variation?

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4. Write the variation statement.
5. If the speed of typhoon is increased to 80km/hour, how many days will it stay?

ASSESSMENT

Write the letter of the correct answer on your answer sheet. If your answer is not found among the choices, write the correct answer.

1. What statement of variation describes the table of values below?

| | | | | | |
|----------|----|----|----|----|----|
| x | 2 | 5 | 10 | 20 | 25 |
| y | 50 | 20 | 10 | 5 | 4 |

- A. y varies directly as x
 - B. y varies jointly as x
 - C. y varies inversely as x
 - D. y varies directly and inversely as x
2. Determine the constant of variation of the table of values in item #1.
 - A. 200
 - B. 100
 - C. 25
 - D. 20
3. A motorbike travels d km in h time. The formula that relates d to h is $d = kh$. What type of variation is it?
 - A. Direct
 - B. Inverse
 - C. Joint
 - D. Combined
4. If y varies inversely as x , and $y = 64$ when $x = 16$, find the constant of variation.
 - A. 1024
 - B. 1204
 - C. 2048
 - D. 2408
5. If y varies directly as x , where $y = 48$ when $x = 4$. Find the constant of variation.
 - A. 8
 - B. 12
 - C. 28
 - D. 128
6. Which variation statement describes $y = 3x$?
 - A. y varies inversely as x
 - B. y varies directly as x
 - C. y varies directly to two or more quantities
 - D. y varies directly to some quantities and varies inversely to some other quantities
7. Which of the following is **not** an example of inverse variation?
 - A. $y = \frac{1400}{x}$
 - B. $y = \frac{1488z}{x}$
 - C. $y = \frac{888}{x}$
 - D. $\frac{1}{x}$
8. What happens to M when s is zero in the equation $M = 2s$?
 - A. M is halved
 - B. M is tripled
 - C. M is doubled
 - D. M becomes zero

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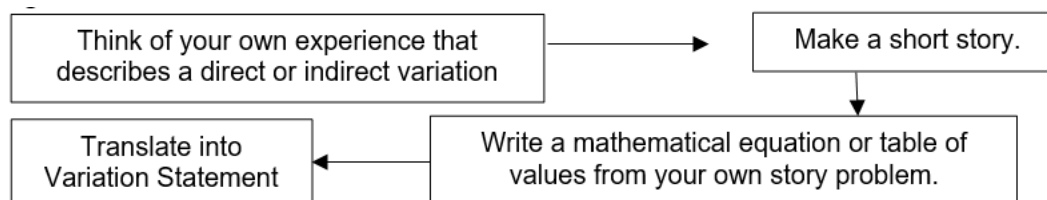
9. Which variation statement describes the relationship of variables in the given table below?

| | | | | |
|----------|-----|----|----|----|
| m | 55 | 44 | 33 | 22 |
| n | 110 | 88 | 66 | 44 |

- A. m varies inversely as n
 B. m varies directly as n
 C. m varies directly to two or more quantities
 D. m varies directly to some quantities and varies inversely to some other quantities
10. You can finish 4 modules (m) in 12 hours (t). If number of hours varies directly as number of modules, what is the constant of variation?
- A. 3 B. 4 C. 8 D. 2

ADDITIONAL ACTIVITIES

Reflect on your journey as a student. Express your reflection by following the instructions below.



E-Search

You may also check the following links for your reference and further learnings.

https://www.youtube.com/watch?v=oXGjA_tstEY

https://www.youtube.com/watch?v=La_HU1PXNMw

<https://www.youtube.com/watch?v=92U67CUy9Gc>

<https://www.youtube.com/watch?v=U2S23yivcMc>

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<https://braingenie.ck12.org/skills/107199>

https://www.google.com/search?q=joint+variation&sxsrf=ALeKk01mY1MTs27s84Yqcq2qB16vCFLVdg:1591965049714&source=lnms&tbn=isch&sa=X&ved=2ahUKEwiHwqH6o_zpAhUNQd4KHcAIAAsQ_AUoAXoECA0QAw&biw=1366&bih=625#imgrc=pNEP0Ni_hqIHaiM

PROBLEM – BASED LEARNING WORKSHEET

LET'S RECYCLE

Problems brought about by inconsiderate and careless waste disposal of people that causes pollution and destroys the environment are on the rise. Environmentalists and cause-oriented groups find ways to resolve these problems. They even lobby for some government policies that would minimize the effects of the problem in the economy and in health and safety of people. As a student, do you also experience the effects of these problems? What do you do to alleviate the effects of these problems?



A local government organization launches a recycling campaign in schools to raise the student's awareness of protecting the environment and of lessening the effects of pollution and climate change. Every kilogram of waste material that is still recyclable earns points that can be exchanged for school supplies and grocery items. Paper which accounts for the biggest bulk of collected recyclable waste, earns 5 points for every kilo.

The table below shows the points earned by a Grade 8 class for every kilogram of wastepaper collected.

| | | | | |
|------------------------------------|---|----|----|----|
| Wastepaper collected in kg (x) | 1 | 2 | 4 | 8 |
| Points earned (y) | 5 | 10 | 20 | 40 |

LET'S ANALYZE

1. What happened to the number of points when the number of kilograms of paper is doubled? Tripled?

2. How many kilograms of paper will the Grade 8 students have to gather to raise 500 points?

3. In what way will you be able to clean the environment by collecting bulks of wastepaper?

4. Find the equation of the variation.

5. Translate the equation into variation statement.

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of the newspaper.

5. Points earned in the campaign varies directly to the total mass
4. $y = 5x$
3. Answer varies
- 500 points.
2. The Grade 8 students have to raise 100kg. of paper together to raise
1. When the number of kilograms of paper is doubled, the number of points also doubled. When the number of kilograms of paper is tripled, the number of points in also tripled.

PROBLEM-BASED LEARNING WORKSHEET

10. A
9. B
8. D
7. B
6. B
5. B
4. A
3. A
2. B
1. C

ASSESSMENT

5. 3.5 days
4. "Specd varies inversely as the no. of days"
3. 280
2. Inverse Variation

| Speed | No. of Days |
|-------|-------------|
| 35 | 8 |
| 56 | 5 |
| 70 | 4 |
| 80 | 3.5 |
| 140 | 2 |

1.

WHAT I CAN DO

5. "y varies directly as x"
4. Direct Variation
- car can travel
3. The more fuel to consume, the farther
2. $y = 7x$
1. $k = 7$
5. "y varies inversely as x"
4. Inverse Variation
3. The more the attendees to come, the less contribution to share.
2. $y = \frac{x}{24000}$
1. $k = 24000$
4. Combined Variation
3. $w = \frac{lh}{k}$
2. Joint variation
1. $V = lwh$

ACTIVITY 3 - SOLID

ACTIVITY 2 - Get together

ACTIVITY 1 - Transportation

WHAT'S MORE

2. Joint Variation
1. Inverse Variation
3. Direct Variation
4. Combined Variation
5. Inverse Variation

WHAT'S IN

1. A
2. C
3. C
4. A
5. A
6. D
7. B
8. C
9. D
10. A

WHAT I KNOW

ANSWER KEY