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Mathematics

Quarter 1 - Module 3:
Properties of Operations on the Set of Integers

MATHEMATICS 7
Quarter 1 - Module 3: Properties of Operations on the Set of Integers
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MATHEMATICS

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Properties of Operations on the
Set of Integers

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

Operations on integers is one of the difficult topics in Elementary Algebra and one of the least mastered skills of learners based on researches. This module is designed and written to help you understand the different properties of operations on integers. The activities presented in this lesson will give you a tool for creating you own procedures in solving equations involving operations on integers. It is important that you understand this topic because it is useful in all succeeding Mathematics.

After going through this module, you are expected to:

Learning Competency:

illustrate the different properties of operations on the set of integers **(M7NS-Id-2)**

Learning Objectives:
1. Identify the different properties of operations on the set of integers.
2. Rewrite expressions using the given property.
3. Give examples of the different properties.

Before going on, check how much you know about this topic.

PRE – ASSESSMENT

Directions: Read carefully each item below. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. What property states that if a and b are integers, then $a + b$ is also an integer?

    A. associative   B. closure   C. commutative   D. distributive

2. Which property states that changing the order of two numbers that are either being added or multiplied does not change the value?

    A. associative   B. closure   C. commutative   D. identity

3. What property states that the sum of any number and zero is the given number?

    A. associative   B. distributive   C. identity   D. inverse

4. Which property states that changing the grouping of numbers that are being added or multiplied does not change the value?

    A. associative   B. commutative   C. identity   D. inverse

5. What does the definition of inverse property of multiplication state?

    A. The product of any number and its negative is 0.

    B. The product of any number and its negative is 1

    C. The product of any number and its reciprocal is 1.

    D. The product of any number and its reciprocal is 0.

6. Using the distributive property, how do you rewrite the expression, $2(x + 1)$?

    A. $2(x) + 2(1)$ B. $(x) + (1)$ C. $(2x) + (21)$ D. $2(x) + (1)$

7. How do you rewrite the expression, $x + y$ using the commutative property?

    A. yx B. $\frac{y}{x}$ C. $y + x$ D. $y - x$

8. What is the result of $20 + (-20)$?

    A. -40   B. 0   C. 1   D. 40

9. If negative six is multiplied to one, what is the answer?

    A. -6   B. -1   C. 0   D. 1

10. What is $\left(\frac{1}{3}\right)\left(\frac{3}{1}\right)$, according to multiplicative inverse property?

    A. 0   B. 1   C. 2   D. 3

11. Which of the following illustrates additive identity property?

    A. $0 + (-16) = -16$ B. $1(-8) = -8$ C. $2(3) = 3(2)$ D. $2(xy) = 2x(y)$

12. What property is illustrated in the expression, $2(y + z) = 2(y) + 2(z)$

    A. additive identity   B. additive inverse   C. commutative   D. distributive

13. Which of the expressions below uses commutative property?

    A. $0 + (-5) = -5$ B. $1(-8) = -8$ C. $2(5) = 5(2)$ D. $8(xy) = 8x(y)$

14. What property is illustrated in the expression, $11 + (-11) = 0$?

    A. additive identity   B. additive inverse   C. commutative   D. distributive

15. How do you illustrate associative property?

    A. $0 + (-25) = -25$ B. $1(-12) = -12$ C. $4(3) = 3(4)$ D. $2(xy) = 2x(y)$

Jumpstart

Activity 1: Define Me!

Using the graphic organizer below, write words that are related to the word property. Use another sheet of paper.
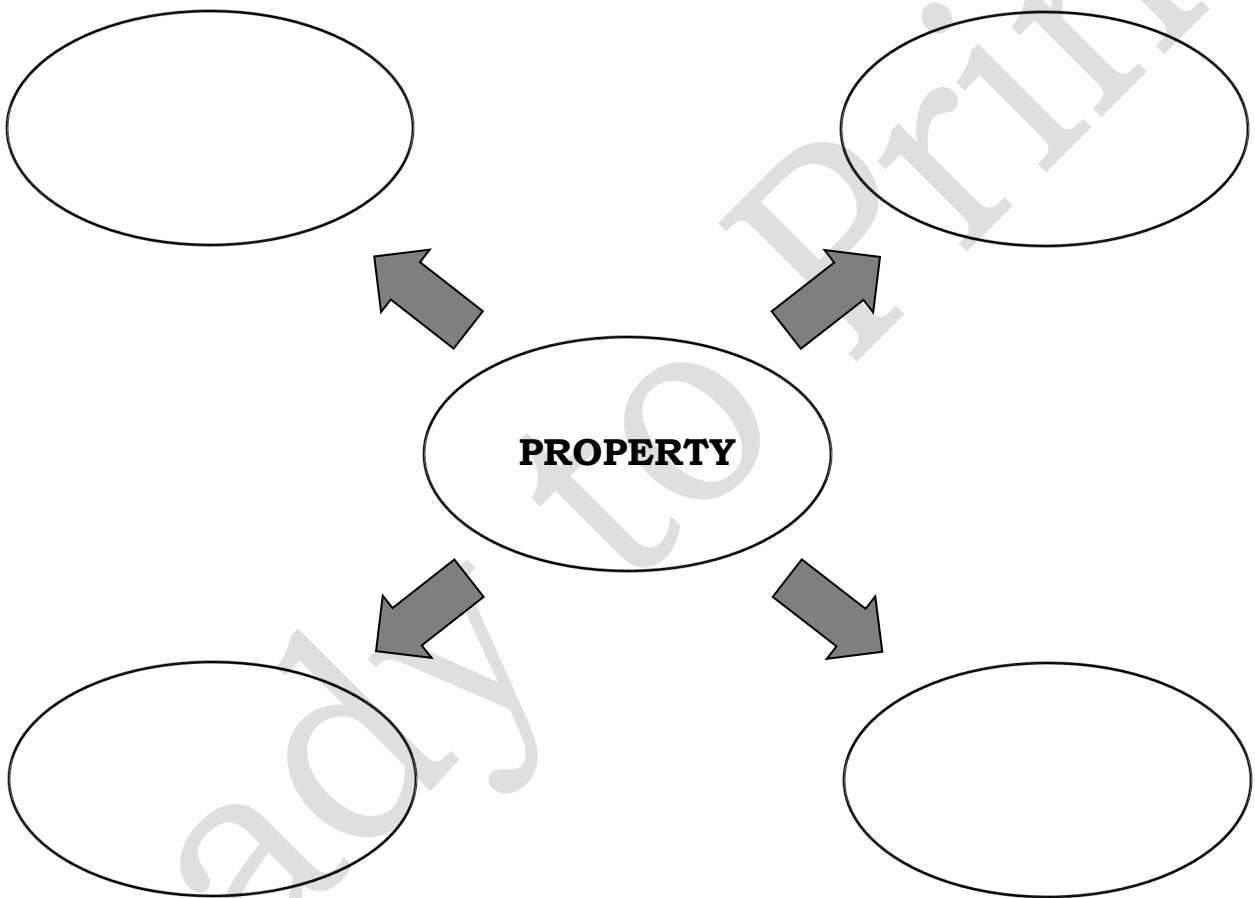
PROPERTY

Process Questions:

1. What is the meaning of the word property?

2. How do you understand properties of operations?

 Discover

Let us recall that the **set of integers** are positive numbers, negative numbers and zero.

The properties of operations on the set of integers are as follows:

Closure Property

Two integers that are added or multiplied remain as integers.

A. **Closure Property of Addition** states that if a and b are integers, then $a + b$ is an integer.

Example 1. $6 + 7 = 13$

Here, 6 and 7 are integers. Adding them results to 13 which is also an integer.

B. **Closure Property of Multiplication** states that if a and b are integers, then $a(b)$ is also an integer.

Example 2. $5(8) = 40$

Here, 5 and 8 are integers. Multiplying them results to 40 which is another integer.

Commutative Property

Changing the order of two numbers that are either being added or multiplied does not change the value.

$$a + b = b + a$$

$$ab = ba$$

Examples:
1. $2 + 3 = 3 + 2$, since $2 + 3 = 5$ and $3 + 2 = 5$.
2. $(-16) + (5) = (5) + (-16)$
3. $4(5) = 5(4)$, since $4(5) = 20$ and $5(4) = 20$
4. $10(25) = 25(10)$

Note: Subtraction and division are not commutative.

Associative Property

Changing the grouping of numbers that are either being added or multiplied does not change its value.

$$(a + b) + c = a + (b + c)$$

$$(ab)c = a(bc)$$

Examples:

1. $(2 + 3) + 4 = 2 + (3 + 4)$
    Checking: $(2 + 3) + 4 = 2 + (3 + 4)$
    $$5 + 4 = 2 + 7$$
    $$9 = 9$$

2. $(10 + 5) + 8 = 10 + (5 + 8)$
    Checking: $(10 + 5) + 8 = 10 + (5 + 8)$
    $$5 + 8 = 10 + 13$$
    $$23 = 23$$

3. $(4 \cdot 3)\, 5 = 4(3 \cdot 5)$
    Checking: $(4 \cdot 3)\, 5 = 4(3 \cdot 5)$
    $$(12)\, 5 = 4(15)$$
    $$60 = 60$$

4. $(2 \cdot 10)4 = 2(10 \cdot 4)$
    Checking: $(2 \cdot 10)4 = 2(10 \cdot 4)$

    $$(20)4 = 2(40)$$
    $$80 = 80$$
    Note: Subtraction and division are not associative.

Distributive Property

When two numbers have been added/subtracted and then multiplied by a factor, the result will be the same when each number is multiplied by the factor and the products are then added/ subtracted.

$$a(b + c) = a(b) + a(c)$$
$$a(b - c) = a(b) - a(c)$$

Examples:

1. $2(3 + 4) = 2(3) + 2(4)$
    Checking: $2(3 + 4) = 2(3) + 2(4)$
    $$2(7) = 6 + 8$$
    $$14 = 14$$

2. $5(8 - 3) = 5(8) - 5(3)$
    Checking: $5(8 - 3) = 5(8) - 5(3)$
    $$5(5) = 40 - 15$$
    $$25 = 25$$

Identity Property

A. Additive Identity Property states that the sum of any number and 0 is the given number.

$$a + 0 = a$$

Examples:
1. $4 + 0 = 4$
2. $(-10) + 0 = -10$

B. Multiplicative Identity Property states that the product of any number multiplied by 1 is the given number.

$$a(1) = a$$

Examples:
1. $23(1) = 23$
2. $-6(1) = -6$

Inverse Property

A. Additive inverse property states that the sum of any number and its additive inverse is zero. The additive inverse of a positive number is its negative. The additive inverse of a negative number is its positive.

$$a + (-a) = 0$$
$$-a + a = 0$$

Examples:
1. $11 + (-11) = 0$
2. $89 + (-89) = 0$
3. $-4 + 4 = 0$
4. $-23 + 23 = 0$

B. Multiplicative inverse property states that the product of any number and its multiplicative inverse or reciprocal is one.

$$a\left(\frac{1}{a}\right) = 1$$

Examples:
1. $8\left(\frac{1}{8}\right) = 1$
2. $-2\left(-\frac{1}{2}\right) = 1$
3. $\frac{7}{8}\left(\frac{8}{7}\right) = 1$
4. $\frac{2}{5}\left(\frac{5}{2}\right) = 1$

Explore

Activity 2: What Am I?

Identify the property used in each item below. Write your answer on a separate sheet of paper.

1. $(-3) + 0 = -3$

2. $4(m + n) = 4(m) + 4(n)$

3. $(8 + 7) = (7 + 8)$

4. $-5\left(-\frac{1}{5}\right) = 1$

5. $(-30)1 = -30$

6. $2(mn) = 2m(n)$

7. $28 + (-28) = 0$

8. $10(65) = 65(10)$

9. $\left(\frac{3}{4}\right)\left(\frac{4}{3}\right) = 1$

10. $-2(3 + 4) = (-2)(3) + (-2)(4)$

Activity 3: Give Me My Partner!

Rewrite the expressions below using the given property. Write your answer on your answer sheet.

1. $8(x - y)$ Distributive Property

2. $7(ab)$ Associative Property

3. $5 + 6$ Commutative Property

4. $(-9)(1)$ Identity Property

5. $30 + (-30)$ Inverse Property

Great job! You have understood the lesson.
Are you now ready to summarize?

Deepen

Activity 4: Complete Me!

Using the table below, give your own example illustrating the given property. The first item is done for you.

Property	Example
Closure Property under Addition	$3 + 4 = 7$ 3 and 4 are integers, and 7 is an integer
Closure Property under Multiplication	
Commutative Property of Addition	
Commutative Property of Multiplication	
Associative Property of Addition	
Associative Property of Multiplication	
Distributive Property	
Additive Identity Property	
Multiplicative Identity Property	
Multiplicative Inverse Property	
Additive Inverse Property	

Rubric for Activity 4

3	2	1
The property is illustrated correctly. All parts of the example are correct. All the given are original.	The property is illustrated correctly. All parts of the example are correct. The given are not original.	Attempted to give examples, but the property is not correctly illustrated.

Gauge

Directions: Read carefully each statement below. Write the letter of the correct answer on a separate sheet of paper.

1. Which of the following properties states that $a(b) = b(a)$?
    A. associative   B. closure   C. commutative   D. distributive

2. What property states that if x and y are integers, then $x + y$ is also an integer?
    A. associative   B. closure   C. distributive   D. identity

3. Which property states that $(a + b) + c = a + (b + c)$?
    A. associative   B. commutative   C. identity   D. inverse

4. What does the definition of inverse property of addition state?
    A. The sum of any number and its reciprocal is 0.
    B. The sum of any number and its reciprocal is 1.
    C. The sum of any number and its additive inverse is 0.
    D. The sum of any number and its additive inverse is 1

5. Which property states that the product of any number and one is the given number?
    A. additive identity   B. additive inverse
    C. multiplicative identity   D. multiplicative inverse

6. Using the distributive property, how do you rewrite the expression, $2(m + 3)$?
    A. $(m) + (3)$ B. $2(m) + 2(3)$ C. $(2m) + (23)$ D. $2(m) + (3)$

7. How do you rewrite the expression, $x + 6$ using the commutative property?
    A. $6x$ B. $\frac{6}{x}$ C. $6 - x$ D. $6 + x$

8. What is the result of $100 + (-100)$?
    A. -100   B. 0   C. 1   D. 100

9. If -22 is multiplied to one, what is the answer?
    A. -22   B. 0   C. 1   D. 22

10. According to multiplicative inverse property, what is $\left(\frac{2}{5}\right)\left(\frac{5}{2}\right)$?
    A. 0   B. 1   C. 2   D. 3

11. Which of the following illustrates additive identity property?
    A. $1(-8) = -8$ B. $0 + (15) = 15$ C. $2(xy) = 2x(y)$ D. $24(3) = 3(24)$

12. What property is illustrated in the equation, $5(y - z) = 5(y) - 5(z)$
    A. associative   B. closure   C. commutative   D. distributive

13. Which is example shows the use of commutative property?
    A. $0 + (-25) = -25$ B. $2(xy) = 2x(y)$ C. $1(-6) = -6$ D. $10(5) = 5(10)$

14. Which of the following properties is illustrated in the equation, $11 + (-11) = 0$?
    A. additive identity   B. additive inverse
    C. multiplicative identity   D. multiplicative inverse

15. How is associative property illustrated?
    A. $9(xy) = 9x(y)$ B. $1(-2) = -2$ C. $4(3) = 3(4)$ D. $0 + (-7) = -7$

References

A. Books

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- Mathematics Grade 7 Teacher's Guide, First Edition, 2013
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