Multiplying Whole Numbers: Definitions and Properties

I. **Understanding Multiplication**

Multiplication is a short way to do repeated addition.

5 + 5 + 5 = 15 There are 3 addends of 5 here.

We can get the same answer by multiplying

3 × 5 = 15
| | |
(The number of addends) × (the addend)

(NOTICE: 3 + 3 + 3 + 3 + 3 is also 15)

5 addends of 3 can be written 5 × 3

The order of the numbers to be multiplied does not change the answer.

1. Define Multiplication_____

_____ 2.

Use repeated addition to show the meaning of 6 × 4.

_____

3. Know the names of the parts of a Multiplication problem.
   a.   3   ×   2   =   6
        | | | | |
     factor   ×   factor   =   product
   A **raised** dot can also be used to indicate multiplication.

   3·2 = 6 (NOTICE this dot is **higher** than a decimal point.)

   b. 7·6 = 42   Give the name for each number.

                7 is a_____
                6 is a_____
                42 is a_____   c.

Write a problem with factors of 9 and 7. What is the

product? _____ = _____

II. **Properties of Multiplication**

It is very important to know what can be done and what cannot be done when you are multiplying. Study the Properties of Multiplication so that you:

1. can recognize what property has been used.
2. can use the property correctly yourself.

Study the Properties of Multiplication in your text.

Write each property. Then answer the questions that follow that property. A. **Multiplication Property of Zero**

1. This property tells what happens when zero is a
   _____

2. Fill in the blanks to make true statements.

   a. $6 \cdot 0 =$_____   c. $3 \times$_____$= 0$ e. $0 \cdot 0 =$_____

   b. $0 \times 8 =$_____   d. _____$\cdot 5 = 0$ f.___ $\times 0 = 0$

3. In your own words describe what happens when zero is multiplied by a number._____
   _____

B. **Multiplication Property of One**

1. This property tells what happens when <u>one</u> is a
   _____

   _____
   (What part of a multiplication problem?)

2. Fill in the blanks to make true statements.

   a. $6 \times 1 =$_____   c. $3 \times$_____ $= 3$ e. $1 \cdot 1=$_____

   b. $1 \cdot 8 =$_____   d. _____ $\cdot 5 = 5$ f. $1 \times 0 =$_____

The Multiplication Property of One is used extensively in mathematics.

3. In your own words explain the Multiplication Property of One. C. **Commutative Property of Multiplication**

1. The Commutative Property of Multiplication lets us know that we can change the_____of

the_____ without changing the answer when
we are multiplying.

2.   Use the Commutative Property of Multiplication to rewrite

each problem. Show tht both products are the same.

EXAMPLES:

a. $6 \cdot 4 = 4 \cdot 6$ b. $7 \times 8 = \underline{} \times \underline{}$ c. $9 \cdot 6 =$

$\underline{24} = \underline{24}$ $\underline{} = \underline{}$ $\underline{} = \underline{}$

d. $(3 \cdot 9) \cdot 2 = (\cdot) \cdot 2$ e. $(4 \times 7) \times 3 = 3 \times (4 \times 7)$

$\underline{} \cdot 2 = \underline{} \cdot 2$ $\underline{} \times 3 = 3 \times \underline{}$

$\underline{} = \underline{}$ $\underline{} = \underline{}$

3.   NOTICE that in d and e the same factors are in the
parentheses. What was changed in d and e?_____   4.
What property is illustrated in each problem in # 2?

_____

D.   **Associative Property of Multiplication**

1.   The Associative Property of Multiplication lets us know
that we can change the_____of the_____
without changing the answer when we are multiplying.

2.   What symbol is used to group numbers?_____
When is the operation inside the parentheses done?

_____

BE SURE YOU UNDERSTAND THE FOLLOWING SECTION:

3a. $(3 \cdot 5) \cdot 2$ What numbers are grouped
together here?

_____

b. $3 \cdot (5 \cdot 2)$ What numbers are grouped together here?

_____

c. NOTICE the ORDER of the factors is 3, 5, 2 in both examples
(a and b).
The _____ of the factors did **not** change in a and b.

The _____ of the factors did change in a and b.

4. What property is used below?_____

    5 × (9 × 3) = (5 × 9) × 3

                          3
        How do you know the property you named is correct?
        _____

5. Multiply. Show each step.

  a.   (7 × 4) × 6 = 7× (4 × 6)
      _____   × 6 = 7× _____
          _____ = _____

        What property is used?_____

  b.   3·(8 · 6) = (3·8) · 6

        _____ · _____ = _____ · _____

              _____ = _____

        What property is used?_____

E. **Practice Identifying Properties:**

    Name the property illustrated.   Tell why you chose the
    property.
        1. $8 \cdot 0 = 0$ 2. 8 × 0 = 0 × 8

        _____   _____
        because_____   because_____

    3. 15 × 1 = 15   4. $15 \cdot 1 = 1 \cdot 15$

        _____   _____
        because_____   because_____

    5. $7 \cdot (5 \cdot 4) = (7 \cdot 5) \cdot 4$ _____

        because_____
    6. 8 × (4 × 9) = 8 × (9 × 4)

        _____

        because_____

    7. (6 × 2) × 5 = 5 × (6 × 2)

_____

    because_____

ANSWERS:

<center>4</center>

I.   1.   Multiplication – the repeated addition of the same number.

      2.   4 + 4 + 4 + 4 + 4 + 4

          (6 + 6 + 6 + 6 will also show this multiplication)

      3.   b. 7 is a factor; 6 is a factor; 42 is the product

      3.   c. 9 × 7 = 63

II. A.   Muliplication Property of Zero – the product of a number and zero is zero.

      1.   factor

      2.   a. 0 c. 0   e. 0

          b. 0   d. 0   f. any number

      3.   You should tell the answer is zero.

      B.   Multiplication Property of One – the product of a number and one is the number.

      1.   factor

      2.   a. 6 c. 1 e. 1 b. 8 d. 1 f. 0

      3.   You should tell that multiplying a number by one does not change the answer.

      C.   Commutative Property of Multiplication – two numbers can be multiplied in either order. The product will be the same.

      1.   <u>Order</u> of the <u>factors</u>

      2.   b. 7 × 8 = <u>8</u> × <u>7</u>   c. $9 \cdot 6 = 6 \cdot 9$

             56 = <u>56</u>   54 = 54

          d.

$$(3 \cdot 9) \cdot 2 = (9 \cdot 3) \cdot 2$$

$$27 \cdot 2 = 27 \cdot 2$$

$$54 = 54$$

          e. (4 × 7) × 3 = 3 × (4 × 7)

              28   × 3 = 3 × 28

                84 = 84

      3.   Order of factors changed.

      4.   Commutative Property of Multiplication

D.   Associative Property of Multiplication – grouping the numbers to
      be multiplied in any order gives the same result. Do the
      multiplication inside the parentheses first.
      1.   grouping of the factors
      2.   parentheses. first
      3.   a. 3 and 5 b. 5 and 2
           c. <u>order</u> did not change
           d. <u>grouping</u> did change
      4.   Associative Property of Multiplication

                                5
           because the grouping changed

      5.   a. (7 × 4) × 6 = 7 × (4 × 6)
                <u>28</u> × 6 = 7 × <u>24</u>
                <u>168</u>   =   <u>168</u>
           b.

                 $3 \cdot (8 \cdot 6) = (3 \cdot 8) \cdot 6$

                    $3 \cdot 48 = 24 \cdot 6$

                     $144 = 144$

E.   1. Multiplication Property of Zero
              Zero is a factor; product is zero
      2.   Commutative Property of Multiplication
              Order of factors changed
              (the product is not shown here)
      3.   Multiplication Property of One
              One is a factor; product is the other factor
      4.   Commutative Property of Multiplication
              Order of factors changed
              (the product is not shown here)
      5.   Associative Property of Multiplication Grouping of factors
            changed
      6.   Commutative Property of Multiplication
              Order of factors changed; 9 and 4 are in both
              parentheses so grouping is the same.
      7.   Commutative Property of Multiplication
              Order of factors changed; (grouping is the same.)