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Lesson 3: Multiplication Note Sheet

Vocabulary:

Factors = The terms being multiplied
Product - The resulting term

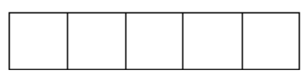
Label the factors and products in the equation:

$$\underline{5} \times \underline{3} = \underline{15}$$

Multiplication with a Rectangle:

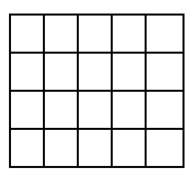
Multiplication is repeated __________________, so 4 × 5 is 5 + 5 + 5 + 5.

We can imagine that each 5 is a line with 5 squares and we are adding up 4 of these lines.

4 x 

If we stack these lines, we end up with a _____________________ of height 4 and length 5.

4 × 5 = ___



Notice that if we flip the rectangle so that the width is 4 and the height is 5, the area is preserved, and we can express the area as 5 × 4.

<u>Conclusion:</u> Multiplying two numbers is like creating a **rectangle** whose side lengths are the factors and whose **area is the product**.

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Create the product rectangle for the following expressions:

$2 \times 4 =$ ___ $7 \times 6 =$ ___

Multiplying >1-digit numbers

$$\begin{array}{r} 37 \\ \times \quad 5 \\ \hline \end{array} \qquad \begin{array}{r} 567 \\ \times \quad 48 \\ \hline \end{array} \qquad \begin{array}{r} 8593 \\ \times\ 330 \\ \hline \end{array}$$

Properties:
(Let a, b, and c represent any number)

Identity Property: True or False? ________

Definition: $\mathbf{a \times 1 = a}$

Examples: Do they work? (if not, they are countercases!)

$5 \times 1 \ ?= 5$ $4 \ ?= 4 \times 1$ $3964 \times 1 \ ?= 3964$

Commutative Property: True or False? ________

Definition: $\mathbf{a \times b = b \times a}$

Examples: Do they work? (if not, they are countercases!)

$5 \times 6 \ ?= 6 \times 5$ $7 \times 34892 \ ?= 34892 \times 7$

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Associative Property: True or False? _______

Definition: $(a \times b) \times c = a \times (b \times c)$

Examples: Do they work? (if not, they are countercases!)

$(3 \times 4) \times 10 \;?\!= 3 \times (4 \times 10)$ $(6 \times 2) \times 3 = 6 \times (2 \times 3)$

The Distributive Property: True or False? _______

Definition:

(over addition)

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

(over subtraction)

$a \times (b - c) = (a \times b) - (a \times c)$

Examples: Do they work? (if not, they are countercases!)

$3 \times (2 + 7) \;?\!= (3 \times 2) + (3 \times 7)$ $(4 \times 5) - (4 \times 3) \;?\!= 4 \times (5 - 3)$

Conclusion: The _______________________, ___________________________, ___________________________, and _________________________ properties hold true for multiplication.

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Interesting Problems using Properties:

1. Compute 456 + 456 + 456 + 456 + 456 + 456 + 456 + 456 + 456 + 456.

2. Compute (17 × 13) + (51 × 13) + (32 × 13).

3. Compute 9 × 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 × 0.

4. Compute (475 × 100) + (25 × 100).

5. Compute (1990 × 1991) – (1989 × 1990).

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6. Compute 27×399. (Hint: can you rewrite 399 as the difference of two numbers?)

7. Compute 999×345.

8. Joe, Sally, and George have 4, 2, and 11 apples, respectively. There is a magic apple multiplier machine that takes in a group of apples and doubles the quantity. All 3 friends want to increase their total number of apples. Joe proposes that each one of them take turns in putting their share of apples in the machine. (So Joe puts his 4 apples in, gets 8 back, then Sally puts her 2 in, gets 4 back, etc.). However, Sally says that it's quicker to have all of them combine their apples in the beginning and input the combined group of apples in the machine.

    a. How many apples will each method output?

    b. Will Joe and Sally's methods return the same total number of apples among all 3 of them?

    c. Which property does this demonstrate?