

Math 3131 Prof. Pennance – Summary of Lecture 7 - Multiplication¹

1. Definition of Multiplication

Let m and n be natural numbers. The *product* $m \times n$ is the repeated addition

$$\underbrace{n + n + \dots + n}_{m \text{ times}}$$

2. Example 3×4 is the number $\underbrace{4 + 4 + 4}$

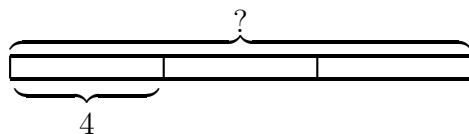
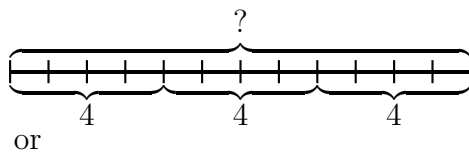
3. Interpretations of 3×4

(a) Set model

“3 groups of 4 objects”

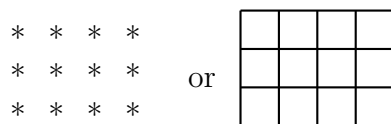
(b) Measurement model

“3 displacements on the number line, each of size 4” or “3 bars of length 4.”



(c) Rectangular array model

“3 rows of 4 objects”

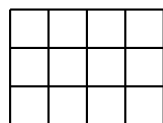


Warning: Area not introduced until grade 3 or 4.

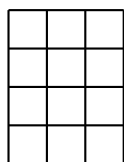
4. Properties of Multiplication

(a) Multiplicative identity $n \times 1 = n$

(b) Commutative property $n \times m = m \times n$



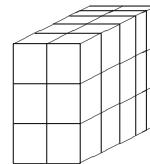
$$3 \times 4$$



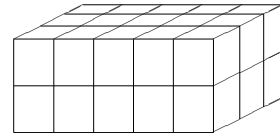
$$4 \times 3$$

(c) Associative property

$$(n \times m) \times p = n \times (m \times p)$$



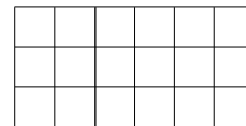
$$(5 \times 3) \times 2$$



$$5 \times (3 \times 2)$$

(d) Distributive Property

$$n \times (m + p) = (n \times m) + (n \times p)$$



$$3 \times (2 + 4) = (3 \times 2) + (3 \times 4)$$

5. Multiplication Strategies

(a) Grade 1-2

Multiplication by 2, 3, 4, 0, 1, 10

(b) Grades 2-3

Mental strategies:

- i. Multiplication by 5
- ii. 6×20 by associativity
- iii. 6×40 by place value
- iv. Multiples of 9 learned by distributivity.
- v. 7×14 by distributivity
- vi. Squares memorized.
- vii. 6×7 , 7×8 , 8×9 learned by distributivity.
- viii. Multiplication tables memorized

¹Reference: Chapter 1. Elementary Mathematics for Teacher by Thomas Parker and Scott Baldrige