

## Properties of Multiplication

The properties of multiplication are little rules that let you rearrange and break apart problems to make them easier. You already use them without thinking — this lesson gives them names.

Property	Rule
Commutative	$a \times b = b \times a$
Associative	$(a \times b) \times c = a \times (b \times c)$
Identity	$a \times 1 = a$
Zero	$a \times 0 = 0$
Distributive	$a \times (b + c) = a \times b + a \times c$



### Key Concepts

- 1. Commutative property:** switching the order of two factors does not change the product.  $4 \times 7$  and  $7 \times 4$  both equal 28.
- 2. Associative property:** when you multiply three numbers, the grouping does not matter.  $(2 \times 3) \times 4 = 2 \times (3 \times 4)$ . Both equal 24.
- 3. Distributive property:** a hard fact can often be split into two easier ones.  $6 \times 7 = 6 \times 5 + 6 \times 2 = 30 + 12 = 42$ .
- 4. Identity:** multiplying by 1 leaves the number alone.     **Zero:** multiplying by 0 always gives 0.

## Worked Examples

① Use the commutative property to find  $8 \times 3$  if you know  $3 \times 8 = 24$ .

 The commutative property says you can swap the two numbers and the product stays the same. So  $8 \times 3$  is the same as  $3 \times 8$ , which we already know equals 24. The answer is 24 without doing any new arithmetic.

 **Answer:** 24

② Use the distributive property:  $7 \times 6$ .

 Break the 6 into pieces that you know well. One easy way:  $6 = 5 + 1$ . Then  $7 \times 6 = 7 \times 5 + 7 \times 1 = 35 + 7 = 42$ . The distributive property turns one hard multiplication into two easier ones plus an addition.

 **Answer:** 42

③ Find  $(2 \times 4) \times 5$  using the associative property.

 The associative property lets you re-group the multiplication. The original groups  $(2 \times 4) \times 5$  would have you compute  $8 \times 5 = 40$ . But  $4 \times 5 = 20$  is a friendly fact, so regroup:  $2 \times (4 \times 5) = 2 \times 20 = 40$ . Same answer, easier path.

 **Answer:** 40

### Practice Problems

Fill in the blank or find the product. Name the property when asked.

- |  |   |
|--|---|
| <p>1. <math>5 \times 9 = 9 \times ?</math> _____</p> <p>2. <math>0 \times 47 =</math> _____</p> <p>3. <math>1 \times 86 =</math> _____</p> <p>4. <math>(3 \times 2) \times 5 = 3 \times (2 \times ?)</math> _____</p> <p>5. <math>4 \times 8 = 4 \times 5 + 4 \times ?</math> _____</p> <p>6. <math>6 \times 7 = 7 \times ?</math> _____</p> | <p>7. <math>8 \times (3 + 2) = 8 \times 3 + 8 \times ?</math> _____</p> <p>8. <math>(5 \times 1) \times 9 = 5 \times ?</math> _____</p> <p>9. <math>3 \times 0 + 3 \times 4 = 3 \times (0 + ?)</math> _____</p> <p>10. <math>9 \times 4 = 9 \times 2 + 9 \times 2 =</math> _____</p> <p>11. <math>7 \times 1 =</math> _____</p> <p>12. <math>(4 \times 5) \times 2 = 4 \times (5 \times 2) =</math> _____</p> |
|--|---|

### Study Tips

-  The commutative property is your most-used shortcut: if you forget  $7 \times 8$ , try  $8 \times 7$  — it might come to you faster.
-  The distributive property is what teachers eventually call “break-apart strategy.” Splitting one factor often turns a scary fact into two friendly ones.
-  Multiplying by 0 wipes out the whole product. Don’t get tricked:  $0 \times 100 = 0$ , not 100.

**Word Problems**

1. Emma knows  $5 \times 8 = 40$ . Use a property to explain why  $8 \times 5$  also equals 40.

Answer: \_\_\_\_\_

2. A baker makes 3 trays of cookies. Each tray has 2 rows of 5 cookies. How many cookies in all?

Answer: \_\_\_\_\_

**Answer Key — with Friendly Explanations****Practice Problems**

1. Commutative property — swap the factors, the missing number is 5.

 **Answer:** 5

2. Zero property — any number times 0 is 0.

 **Answer:** 0

3. Identity property — any number times 1 stays the same.

 **Answer:** 86

4. Associative — regrouping does not change the answer. The missing factor is 5.

 **Answer:** 5

5. Distributive —  $4 \times 8 = 4 \times 5 + 4 \times 3 = 20 + 12 = 32$ . Missing: 3.

 **Answer:** 3

6. Commutative — the missing factor is 6.

 **Answer:** 6

7. Distributive —  $8 \times (3 + 2) = 8 \times 3 + 8 \times 2$ . Missing: 2.

 **Answer:** 2

8. Identity —  $(5 \times 1) = 5$ , so the expression is  $5 \times 9$ . Missing: 9.

 **Answer:** 9

9. Distributive — both sides equal  $3 \times 4 = 12$ . Missing: 4.

 **Answer:** 4

10.  $9 \times 2 + 9 \times 2 = 18 + 18 = 36$ . Same as  $9 \times 4$ .

 **Answer:** 36

11. Identity — any number times 1 is itself.

 **Answer:** 7

12. Associative — compute either side:  $5 \times 2 = 10$ , then  $4 \times 10 = 40$ .

 **Answer:** 40

**Word Problems**

1. Commutative property — swapping factors leaves the product unchanged.

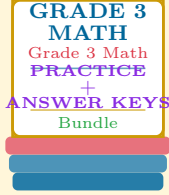
 **Answer:** *Commutative property*

2. Each tray has  $2 \times 5 = 10$  cookies; three trays = 30. Uses associative.

 **Answer:** 30 *cookies*

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