Properties of Operations

Spot mistakes, reason, and work backward

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

You may switch multiplication factors: $3 \times 4 = 4 \times 3 = 12$ (commutative). You may regroup three factors: $(2 \times 3) \times 4 = 2 \times (3 \times 4) = 24$ (associative). You may split a factor: $3 \times 7 = 3 \times 5 + 3 \times 2 = 21$ (distributive). Division does not allow switching the two numbers.

Worked example

Use $6 = 4 + 2$ to find 3×6. Show two smaller products.

1. $3 \times 4 = 12$ and $3 \times 2 = 6$.

2. Add the parts: $12 + 6 = 18$, so $3 \times (4 + 2) = 18$.

Answer: 18.

Practice Problems

Show your thinking.

1. Ben says division can switch order: $24 \div 6 = 6 \div 24$. Test his claim.

2. Complete $7 \times 6 = 7 \times 3 + 7 \times \square$. Find the total.

3. Compute $(3 \times 2) \times 3$ and $3 \times (2 \times 3)$. What changes?

4. Rui changes $(2 \times 3) \times 4$ to $(3 \times 2) \times 4$ and calls it the associative property. Name the actual property and check the values.

5. Use the distributive property with subtraction to find 6×9 from 6×10.

6. Pat writes $(3 + 2) \times 4 = 3 + (2 \times 4) = 11$. Repair the split without changing the original expression.

7. Use $24 = 12 + 12$ to compute $24 \div 3$. Divide each part by 3, then add. Check the quotient.

8. Fill both boxes with the same number: $(2 \times \square) \times 5 = 2 \times (\square \times 5) = 30$. Name the property shown.

Answer Key

1. False; $24 \div 6 = 4$, but 6 cannot make even 1 group of 24.
2. $\square = 3$; total 42.
3. Both are 18; only the grouping changes.
4. Commutative property; both equal 24.
5. 54.
6. $(3 \times 4) + (2 \times 4) = 12 + 8 = 20$.
7. 8.
8. Both boxes are 3; associative property.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. $24 \div 6 = 4$ because $6 \times 4 = 24$.

2. $6 < 24$, so sharing only 6 objects among 24 people cannot give 4 whole objects each.

Problem 2

1. The split factors must add to 6: $6 - (3) = 3$.

2. $7 \times 3 + 7 \times 3 = 21 + 21 = 42$.

Problem 3

1. Left grouping: $(3 \times 2) \times 3 = 6 \times 3 = 18$.

2. Right grouping: $3 \times (2 \times 3) = 3 \times 6 = 18$; the factors stay in the same order.

Problem 4

1. The two inner factors switch places: $2 \times 3 = 6$ and $3 \times 2 = 6$. The parentheses do not move.

2. Both expressions become $6 \times 4 = 24$. Switching order is commutative, whereas changing parentheses is associative.

Problem 5

1. Write $9 = 10 - 1$ and find $6 \times 10 = 60$ and $6 \times 1 = 6$.

2. Subtract the extra group: $6 \times (10 - 1) = 60 - 6 = 54$.

Problem 6

1. The original has $3 + 2 = 5$ groups of 4, so $5 \times 4 = 20$.

2. Both parts need multiplication by 4: $3 \times 4 = 12$ and $2 \times 4 = 8$, giving $12 + 8 = 20$.

Problem 7

1. Each part gives $12 \div 3 = 4$, so the two parts give $4 + 4 = 8$.

2. Check with multiplication: $3 \times 8 = 24$. The split works because both 12-object parts are shared among the same 3 groups.

Problem 8

1. The two outside factors give $2 \times 5 = 10$, and $30 \div 10 = 3$.

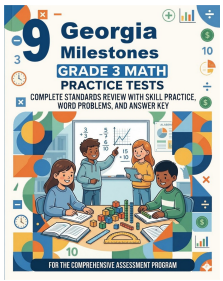
2. Check both groupings: $(2 \times 3) \times 5 = 6 \times 5 = 30$ and $2 \times (3 \times 5) = 2 \times 15 = 30$.

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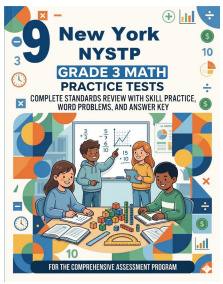
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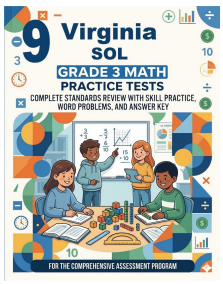
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