1-5 Order of Operations

Warm Up

Problem of the Day

Lesson Presentation

1-5 Order of Operations

1-5 Order of Operations

Warm Up

Evaluate in order from left to right.

1. $18 \div 3 + 7$ 13

2. $10^2 \div 4 - 8$ 17

3. $10 + 23 - 8 + 7$ 32

4. $8 \times 2 - 3 + 24$ 37

5. $81 \div 9 \times 3 + 15$ 42

Problem of the Day

Classify each statement as true or false. If the statement is false, insert parentheses to make it true.

1. $4 \times 5 + 6 = 44$ — **false**

2. $24 - 4 \times 2 = 40$ — **false**

3. $25 \div 5 + 6 \times 3 = 23$ — **true**

4. $14 - 2^2 \div 2 = 12$ — **true**

1-5 Order of Operations

Learn to use the order of operations to simplify numerical expressions.

Vocabulary

numerical expression

order of operations

1-5 Order of Operations

When you get ready for school, you put on your socks *before* you put on your shoes. In mathematics, as in life, some tasks must be done in a certain order.

A **numerical expression** is made up of numbers and operations. When simplifying a numerical expression, rules must be followed so that everyone gets the same answer. That is why mathematicians have agreed upon the **order of operations**.

1-5 Order of Operations

ORDER OF OPERATIONS

1. Perform operations within grouping symbols.
2. Evaluate powers.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

Additional Example 1A: Using the Order of Operations

Simplify the expression.

3 + 15 ÷ 5

3 + 15 ÷ 5 *Divide.*

3 + 3 *Add.*

6

Additional Example 1B: Using the Order of Operations

Simplify the expression.

44 – 14 ÷ 2 · 4 + 6

44 – 14 ÷ 2 · 4 + 6

44 – 7 · 4 + 6

44 – 28 + 6

16 + 6

22

Divide and multiply from left to right.

Subtract and add from left to right.

Additional Example 1C: Using the Order of Operations

Simplify the expression.

$3 + 2^3 \cdot 5$

$3 + 2^3 \cdot 5$ *Evaluate the power.*

$3 + 8 \cdot 5$ *Multiply.*

$3 + 40$ *Add.*

43

Check It Out: Example 1A

Simplify the expression.

2 + 24 ÷ 6

2 + 24 ÷ 6	*Divide.*
2 + 4	*Add.*
6	

Check It Out: Example 1B

Simplify the expression.

$$28 - 21 \div 3 \cdot 4 + 5$$

$28 - 21 \div 3 \cdot 4 + 5$ — *Divide and multiply from left to right.*

$28 - 7 \cdot 4 + 5$

$28 - 28 + 5$ — *Subtract and add from left to right.*

$0 + 5$

5

Check It Out: Example 1C

Simplify the expression.

$2 + 3^2 \cdot 4$

$2 + 3^2 \cdot 4$ *Evaluate the power.*

$2 + 9 \cdot 4$ *Multiply.*

$2 + 36$ *Add.*

38

Additional Example 2A: Using the Order of Operations with Grouping Symbols

Simplify the expression.

$42 - (3 \cdot 4) \div 6$

$42 - (3 \cdot 4) \div 6$ — *Perform the operation inside the parentheses.*

$42 - 12 \div 6$ — *Divide.*

$42 - 2$ — *Subtract.*

40

Helpful Hint

When an expression has a set of grouping symbols within a second set of grouping symbols, begin with the innermost set.

Additional Example 2B: Using the Order of Operations with Grouping Symbols

Simplify the expression.

$[(26 - 4 \cdot 5) + 6]^2$

$[(26 - 4 \cdot 5) + 6]^2$

$[(26 - 20) + 6]^2$

$[6 + 6]^2$

12^2

144

The parentheses are inside the brackets, so perform the operations inside the parentheses first.

Check It Out: Example 2A

Simplify the expression.

A. $24 - (4 \cdot 5) \div 4$

$24 - (4 \cdot 5) \div 4$ *Perform the operation inside the parentheses.*

$24 - 20 \div 4$ *Divide.*

$24 - 5$ *Subtract.*

19

Check It Out: Example 2B

Simplify the expression.

$$[(32 - 4 \cdot 4) + 2]^2$$

$$[(32 - 4 \cdot 4) + 2]^2$$

$$[(32 - 16) + 2]^2$$

$$[16 + 2]^2$$

$$18^2$$

$$324$$

The parentheses are inside the brackets, so perform the operations inside the parentheses first.

Additional Example 3: *Application*

Sandy runs 4 miles per day. She ran 5 days during the first week of the month. She ran only 3 days each week for the next 3 weeks. Simplify the expression (5 + 3 · 3) · 4 to find how many miles she ran last month.

Week	Days
Week 1	5
Week 2	3
Week 3	3
Week 4	3

$(5 + 3 \cdot 3) \cdot 4$ *Perform the operations in parentheses first.*

$(5 + 9) \cdot 4$ *Add.*

$14 \cdot 4$ *Multiply.*

56 Sandy ran 56 miles last month.

Check It Out: Example 3

Jill is learning vocabulary words for a test. From the list, she already knew 30 words. She is learning 4 new words a day for 3 days each week. Evaluate the expression 3 · 4 · 7 + 30 to find out how many words will she know at the end of seven weeks.

Day	Words
Initially	30
Day 1	4
Day 2	4
Day 3	4

$(3 \cdot 4 \cdot 7) + 30$ *Perform the operations in parentheses first.*

$(12 \cdot 7) + 30$ *Multiply.*

$84 + 30$ *Add.*

114

Jill will know 114 words at the end of 7 weeks.

Lesson Quiz: Part I

Simplify each expression.

1. $27 + 56 \div 7$ — 35

2. $9 \cdot 7 - 5$ — 58

3. $(28 - 8) \div 4$ — 5

4. $136 - 10^2 \div 5$ — 116

5. $(9 - 5)^3 \cdot (7 + 1)^2 \div 4$ — 1,024

Lesson Quiz: Part II

Evaluate.

6. Denzel paid a basic fee of $35 per month plus $2 for each phone call beyond his basic plan. Simplify the expression 35 + 8(2) to find how much Denzel paid for a month with 8 calls beyond the basic plan.

$51