Lesson 1-2

Words and Expressions

Interactive Study Guide

See pages 7–8 for:
- Getting Started
- Vocabulary Start-Up
- Notes

Essential Question

How can you use numbers and symbols to represent mathematical ideas?

Common Core State Standards

Content Standards
7.NS.3

Mathematical Practices
1, 3, 4

Vocabulary

numerical expression
evaluate
order of operations

What You'll Learn

- Translate verbal phrases into numerical expressions.
- Use the order of operations to evaluate expressions.

Real-World Link

Inventions The first consumer digital camera was introduced in 1990, the portable music digital player was introduced in 2001, and a video sharing Website began in 2005. You can use numbers and operations to find how many years apart these events occurred.

Translate Verbal Phrases into Expressions

To find the number of years between the introduction of digital cameras and the portable music digital player, you can use the numerical expression 2001 – 1990. **Numerical expressions** contain a combination of numbers and operations such as addition, subtraction, multiplication, and division.

Example 1

Tutor

Write a numerical expression for each verbal phrase.

a. the total amount of money if you have nine dollars and twelve dollars

Phrase the sum of nine and twelve
Expression $9 + 12$

b. the age difference between fifteen years old and ten years old

Phrase the difference of fifteen and ten
Expression $15 - 10$

SUBTRACT

$\frac{1}{2}$ DIVIDED BY $\frac{1}{4}$

$\frac{\frac{1}{2}}{\frac{1}{4}}$

3×10

$3 \cdot 10$

Got It? Do these problems to find out.

1a. the cost of ten yo-yos if each costs three dollars $3(10)$

1b. the number of students in each group if fifteen students are divided into five equal groups $15 \div 5$ or $\frac{15}{5}$

1c. the number of students on three buses if each bus holds twenty-two students $3(22)$

1d. the amount of money Nina earned if she mowed the lawn for fifteen dollars and walked the dog for four dollars $15 + 4$

Grouping Symbols
Grouping symbols include:
- parentheses ( ),
- brackets [ ], and
- fraction bars, as in $\frac{6+4}{2}$, which means $(6+4) \div 2$

Key Concept Order of Operations

Step 1	Simplify the expressions inside grouping symbols. ( ) [ ] { }
Step 2	Multiply and/or divide in order from left to right.
Step 3	Add and/or subtract in order from left to right.

PEMDAS

To **evaluate** an expression, you find its numerical value. If an expression has more than one operation, use the order of operations. The **order of operations** are the rules to follow when evaluating an expression with more than one operation. These rules ensure that numerical expressions have only one value.

[4 + (3·5) ÷ 6]

Example 2

Tutor

Evaluate each expression.

a. $20 - 3 \times 5$

$20 - 3 \times 5 = 20 - 15$ Multiply 3 and 5 first.

$= 5$ Subtract 15 from 20.

b. $30 \div 5 \times 3$

$30 \div 5 \times 3 = 6 \times 3$ Divide 30 by 5.

$= 18$ Multiply 6 and 3.

c. $4(10 - 7) + 2 \cdot 3$

$4(10 - 7) + 2 \cdot 3 = 4(3) + 2 \cdot 3$ Evaluate $(10 - 7)$ first.

$= 12 + 2 \cdot 3$ 4(3) means 4×3 or 12.

$= 12 + 6$ $2 \cdot 3$ means 2×3 or 6.

$= 18$ Add 12 and 6.

d. $5[11 - (7 + 5) \div 4]$

$5[11 - (7 + 5) \div 4] = 5[11 - 12 \div 4]$ Evaluate $(7 + 5)$.

$= 5(11 - 3)$ Divide 12 by 4.

$= 5(8)$ Subtract 3 from 11.

$= 40$ Multiply 5 and 8.

e. $\frac{60 - 15}{2 + 7}$

$\frac{60 - 15}{2 + 7} = (60 - 15) \div (2 + 7)$ Rewrite as a division expression.

$= 45 \div 9$ Evaluate $(60 - 15)$ and $(2 + 7)$.

$= 5$ Divide 45 by 9.

Watch Out!
In Example 2b, you divide before you multiply because division comes first in order from left to right.

2a.
6 - 3 + 5
3 + 5
8

2b.
24 ÷ 3 × 9
8 × 9
72

2c.
2[(10 - 3) + 6(5)]
2[7 + 30]
2[37]
74

2d.
$\frac{19-7}{25-22} = \frac{12}{3} = 4$

Got It? Do these problems to find out.

2a. $6 - 3 + 5$

2b. $24 \div 3 \times 9$

2c. $2[(10 - 3) + 6(5)]$

2d. $\frac{19 - 7}{25 - 22}$

Example 3

A cell phone company charges $20 per month and $0.15 for each call made or received. Write and evaluate an expression to find the cost for 40 calls. Then make a table showing the cost for 40, 50, 60, and 70 calls.

First, write an expression for 40 calls.

Words	$20 per month and $0.15 for each call made or received
Expression	$20 + 0.15 \cdot 40$

$$20 + 0.15 \cdot 40 = 20 + 6 \quad \text{Multiply.}$$
$$= 26 \quad \text{Add.}$$

So, 40 calls will cost $26. Make a table showing the costs for 40, 50, 60, and 70 calls.

Number of Calls	Expression	Cost ($)
40	$20 + 0.15 \cdot 40$	26.00
50	$20 + 0.15 \cdot 50$	27.50
60	$20 + 0.15 \cdot 60$	29.00
70	$20 + 0.15 \cdot 70$	30.50

Calls | Cost
n | $15 + 0.25n$
40 | $15 + 0.25(40)$
$15 + 10$
25
50 | $15 + 0.25(50)$
$15 + 12.5$
27.5

As the number of calls increases by 10, the cost increases by $1.50.

Got It? Do this problem to find out.

3. The same phone company offers another plan where they charge $15 per month and $0.25 for each call made or received. Write and evaluate an expression to find the cost for 40 calls during one month. Then make a table showing the cost for 40, 50, 60, and 70 calls.

60 | $15 + 0.25(60)$
$15 + 15$
30

70 | $15 + 0.25(70)$
$15 + 17.50$
32.50

Guided Practice

Write a numerical expression for each verbal phrase. (Example 1)

1. the cost of six electronic handheld games if each costs eight dollars

2. the cost of one box of cereal if four boxes cost twelve dollars

Evaluate each expression. (Example 2)

3. $18 + 2 \times 4$

4. $2 \times 9 \div 3$

5. $4(6) + 9$

6. $6(17 - 8)$

7. $4[6(2) - 3]$

8. $3[(20 - 7) + 1]$

9. $\frac{15 - 5}{6 - 4}$

10. $\frac{34 + 18}{27 - 14}$

11. A tour bus costs $75 plus $6 for each passenger. Write and evaluate an expression to find the total cost for 25 passengers. Then make a table showing the cost for 25, 30, 35, and 40 passengers. (Example 3)