NAME _____ DATE _____

1 Introduction to Algebra

1–1 Variables

Objective: To simplify numerical expressions and evaluate variable expressions.

Vocabulary

Variable A symbol, such as the letter x, used to represent one or more numbers.

Value of a variable A number that a variable may represent.

Variable expression An expression, such as $x + 5$, that contains a variable.

Numerical expression, or **numeral** An expression, such as $6 + 5$, that names a particular number, called the **value of the expression.**

Simplifying an expression Replacing a numerical expression by the simplest name of its value.

Evaluating an expression Replacing each variable by a given value and simplifying the result.

Symbols $=$ (is equal to) $\neq$ (is not equal to) ab or $a \cdot b$ (multiply)

CAUTION To evaluate ab when $a = 4$ and $b = 5$, be sure to write a multiplication symbol: $ab = 4 \cdot 5$.

Example 1 Simplify: **a.** $4 + (10 - 3)$ **b.** $(20 \div 4) + (6 \div 3)$

Solution Simplify the numerical expression(s) within parentheses first.

a. $4 + \underbrace{(10 - 3)}_{}$ $\quad$ **b.** $\underbrace{(20 \div 4)}_{} + \underbrace{(6 \div 3)}_{}$

$\underbrace{4 + 7}_{11}$ $\quad$ $\underbrace{5 + 2}_{7}$

Simplify each expression.

1. $5 + (15 - 3)$ **2.** $8 + (30 + 2)$ **3.** $16 - (0 \times 7)$

4. $13 - (4 \times 2)$ **5.** $(9 + 6) + 4$ **6.** $9 + (6 + 4)$

7. $(22 - 17) \times 6$ **8.** $(36 \div 9) + 16$ **9.** $(18 \div 3) + (10 \div 5)$

10. $(8 \times 11) - (3 \times 11)$ **11.** $(24 + 6) \div (30 \div 2)$ **12.** $(42 \div 7) \div (1 \times 3)$

Example 2 Evaluate each expression if $x = 2$ and $y = 3$.

a. xy **b.** $5xy$ **c.** $(6x) - 3$

Solution Replace x with 2. Replace y with 3. Insert the multiplication symbol(s).

a. $xy = 2 \cdot 3 = 6$ **b.** $5xy = 5 \cdot 2 \cdot 3 = 30$ **c.** $(6x) - 3 = \underbrace{6 \cdot 2}_{} - 3$

$= \underbrace{12 - 3}_{}$

$= 9$

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1–1 Variables *(continued)*

Evaluate each expression if $x = 3$, $y = 5$, and $z = 0$.

13. xy	**14.** yz	**15.** xz	**16.** $4xy$
17. $6yz$	**18.** $3xz$	**19.** $2xy$	**20.** $7xz$
21. $(8x) - 6$	**22.** $(5z) + 4$	**23.** $(2y) - 3$	**24.** $(4x) + 8$

Example 3 Evaluate each expression if $x = 6$, $y = 7$, and $z = 4$.

a. $(5x) - (2y)$ **b.** $6 \cdot (x + z)$ **c.** $\dfrac{(y + z)}{(y - x)}$

Solution

a. $(5x) - (2y)$ — Replace x with 6 and y with 7 and insert the multiplication symbols.

$\underbrace{(5 \cdot 6)}_{30} - \underbrace{(2 \cdot 7)}_{14}$ — Simplify the expressions within parentheses.

$\underbrace{30 - 14}_{16}$ — Subtract.

b. $6 \cdot (x + z)$

$6 \cdot \underbrace{(6 + 4)}_{10}$ — Replace x with 6 and z with 4.

$\underbrace{6 \cdot 10}_{60}$ — Simplify the expression within parentheses.

Multiply.

c. $\dfrac{(y + z)}{(y - x)} = \dfrac{7 + 4}{7 - 6}$ — Replace x with 6, y with 7, and z with 4.

$= \dfrac{11}{1}$ — Simplify the numerator and denominator.

$= 11$ — Divide.

Evaluate each expression if $x = 3$, $y = 5$, and $z = 0$.

25. $(2y) - (3x)$	**26.** $(3y) + (5x)$	**27.** $(5y) - (6z)$	**28.** $(7z) + (4y)$
29. $5 \cdot (x - z)$	**30.** $4 \cdot (x + y)$	**31.** $\dfrac{(x + y)}{(y - x)}$	**32.** $\dfrac{(y + z)}{(y + z)}$

Mixed Review Exercises

Perform the indicated operations.

1. 0.2×1.3	**2.** $16.35 + 16.07$	**3.** $2.4 \div 0.6$	**4.** $7.3 - 5.6$
5. $106.4 + 7.8$	**6.** $6.72 - 3.9$	**7.** 50.26×1.2	**8.** $64 \div 0.2$
9. $\frac{3}{4} + \frac{1}{10}$	**10.** $\frac{3}{8} \times \frac{16}{27}$	**11.** $\frac{1}{4} \div \frac{3}{8}$	**12.** $\frac{9}{16} - \frac{3}{8}$
13. $\frac{2}{5} \times \frac{10}{3}$	**14.** $\frac{7}{20} \times \frac{5}{21}$	**15.** $\frac{5}{8} - \frac{1}{2}$	**16.** $\frac{6}{7} \div \frac{3}{14}$

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