North Penn School District

Elementary Math Parent Letter

Grade 6

Unit 3 – Chapter 7: Algebra: Expressions

Examples for each lesson:

Lesson 7.1

Exponents

An **exponent** tells how many times a number is used as a factor.

The **base** is the number being multiplied repeatedly.

For example, in 2^5, 5 is the exponent and 2 is the base.
$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Write the expression 4^5 using equal factors. Then find the value.

Step 1 Identify the base.	The base is 4.
Step 2 Identify the exponent.	The exponent is 5.
Step 3 Write the base as many times as the exponent tells you. Place a multiplication symbol between the bases.	$4 \times 4 \times 4 \times 4 \times 4$ You should have one less multiplication symbol than the value of the exponent.
Step 4 Multiply.	$4 \times 4 \times 4 \times 4 \times 4 = 1{,}024$

So, $4^5 = 1{,}024$.

More information on this strategy is available on Animated Math Model #18.

Lesson 7.2

Evaluate Expressions Involving Exponents

A **numerical expression** is a mathematical phrase that includes only numbers and operation symbols.

You **evaluate** the expression when you perform all the computations.

To evaluate an expression, use the **order of operations.**

Order of Operations
1. Parentheses
2. Exponents
3. Multiply and Divide
4. Add and Subtract

Evaluate the expression $(10 + 6^2) - 4 \times 10$.

Step 1 Start with the *parentheses*. Use the order of operations for the computations inside the parentheses.	$10 + 6^2$ Find the value of the number with an *exponent*. Rewrite as multiplication: $10 + 6^2 = 10 + 6 \times 6$ *Multiply and divide* from left to right: $10 + 6 \times 6 = 10 + 36$ *Add and subtract* from left to right: $10 + 36 = 46$
Step 2 Rewrite the original expression, using the value from Step 1 for the part in parentheses.	$\mathbf{(10 + 6^2)} - 4 \times 10 = \mathbf{46} - 4 \times 10$
Step 3 Now that the parentheses are cleared, look for *exponents*.	There are no more *exponents*, so go on to the next step in the order of operations.
Step 4 *Multiply and divide* from left to right.	$46 - 4 \times 10 = 46 - 40$
Step 5 *Add and subtract* from left to right.	$46 - 40 = 6$

So, $(10 + 6^2) - 4 \times 10 = 6$.

Lesson 7.3

Write Algebraic Expressions

Word problems use expressions that you can write with symbols. An **algebraic expression** has at least one variable. A **variable** is a letter or symbol that represents one or more numbers. Writing algebraic expressions for words helps you solve word problems.

These are a few common words that are used for operations.

add (+)	**subtract (−)**	**multiply (×)**	**divide (÷)**
sum	difference	product	quotient
increased by	minus	times	divided by
plus	decreased by		
more than	less		
	less than		

17 more than *x* $x + 17$	"More than" means add. "17 more than x" means add 17 to x.
four times the sum of 7 and *n* $4 \times (7 + n)$	"Times" means multiply. "Sum" means add. The words mean multiply 4 by $(7 + n)$.

A number next to a variable always shows multiplication.
For example, $\mathbf{5}n$ means the same as $\mathbf{5} \times n$.

More information on this strategy is available on Animated Math Model #19.

Lesson 7.4

Identify Parts of Expressions

Each part of an expression between the operation signs + or − is a **term**. A **coefficient** is a number multiplied by a variable, or letter.

Describe the parts of the expression $6b - 7$. Then write a word expression.

Step 1 Identify the terms.	There are two terms: $6b$ and 7.
Step 2 Describe the terms.	The first term shows multiplication: $6b = 6 \times b$ $6b$ is the product of 6 (the coefficient) and b (the variable). The second term is the number 7.
Step 3 Identify the operation separating the terms.	Subtraction gives the difference of the two terms in the expression.
Step 4 Write a word expression.	"the difference of 6 times b and 7" or "7 less than the product of 6 and b"

Lesson 7.5

Evaluate Algebraic Expressions and Formulas

To evaluate an algebraic expression or formula, substitute the value for the variable. Then follow the order of operations.

Evaluate $5x + x^3$ for $x = 3$, 2, 1, and 0.

$5x + x^3$ for $x = 3$	$5x + x^3$ for $x = 2$	$5x + x^3$ for $x = 1$	$5x + x^3$ for $x = 0$
$5 \times 3 + 3^3$	$5 \times 2 + 2^3$	$5 \times 1 + 1^3$	$5 \times 0 + 0^3$
$5 \times 3 + 27$	$5 \times 2 + 8$	$5 \times 1 + 1$	$5 \times 0 + 0$
$15 + 27$	$10 + 8$	$5 + 1$	$0 + 0$
42	18	6	0

To evaluate an expression with more than one variable, substitute each variable's value. Then follow the order of operations.

Evaluate $4c - 7 + 2d$ for $c = 2$ and $d = 5$.

$4 \times 2 - 7 + 2 \times 5$
$8 - 7 + 10$
$1 + 10$
11

So, $4c - 7 + 2d = 11$ for $c = 2$ and $d = 5$.

Lesson 7.6

Use Algebraic Expressions

You can use an algebraic expression to help solve a word problem.
Use a variable to represent the unknown number.

Ina wants to serve salad at her party. She will need one head of lettuce for every 6 guests who attend. Write an expression she could use for deciding how much lettuce she needs.

Step 1	Decide what operation the problem uses.	Each head of lettuce will serve 6 people. Divide the number of guests by 6.
Step 2	Identify the unknown number.	The problem does not state how many guests will attend. Use the variable g for the number of guests.
Step 3	Write a word expression. Then use the word expression to write an algebraic expression.	"the number of guests divided by 6" $g \div 6$ or $\frac{g}{6}$

Ina finds out that 18 guests will attend.
Evaluate the expression for this number of guests.

Step 1 Substitute 18 for g. $\frac{18}{6}$

Step 2 Divide. $\frac{18}{6} = 3$

So, Ina will need 3 heads of lettuce.

Lesson 7.7

Problem Solving • Combine Like Terms

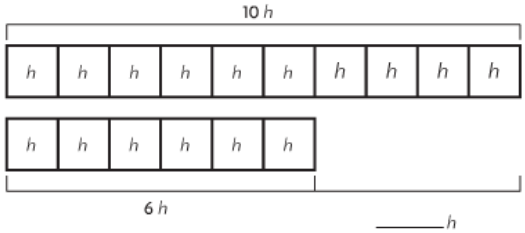
Use a bar model to solve the problem.

Each hour a company assembles 10 bikes. It sends 6 of those bikes to stores and keeps the rest of the bikes to sell itself. The expression $10h - 6h$ represents the number of bikes the store keeps to sell itself for h hours of work. Simplify the expression by combining like terms.

Read the Problem		
What do I need to find? I need to simplify the expression _____.	**What information do I need to use?** I need to use the like terms $10h$ and _____.	**How will I use the information?** I can use a bar model to find the difference of the _____ terms.

Solve the Problem

Draw a bar model to subtract _____ from _____. Each square represents h, or $1h$.



The model shows that $10h - 6h =$ _____.

So, a simplified expression for the number of bikes the store keeps is _____.

Lesson 7.8

Generate Equivalent Expressions

Equivalent expressions are two or more expressions that are equal for any value of the variable in the expressions. You can use the properties of operations to write equivalent expressions.

Write an equivalent expression for $4c + 2 + c$.

Step 1 Identify like terms. $4c$ and c

Step 2 Use properties of operations to combine like terms.
Commutative Property of Addition: switch 2 and c
Associative Property of Addition: group $4c$ and c
Add $4c$ and c.

$$\begin{aligned} 4c + 2 + c &= 4c + c + 2 \\ &= (4c + c) + 2 \\ &= 5c + 2 \end{aligned}$$

More information on this strategy is available on Animated Math Models #19, 20, 21, and 22.

Lesson 7.9

Identify Equivalent Expressions

Use properties to determine whether $5a + 7(3 + a)$ and $12a + 21$ are equivalent.

Step 1	Rewrite the first expression using the Distributive Property. Multiply 7 and 3 and multiply 7 and a.	$5a + 7(3 + a) = 5a + 21 + 7a$
Step 2	Use the Commutative Property of Addition. Switch 21 and $7a$.	$= 5a + 7a + 21$
Step 3	Use the Associative Property of Addition to group like terms. $5a$ and $7a$ are like terms.	$= (5a + 7a) + 21$
Step 4	Combine like terms.	$= 12a + 21$

Compare the expressions: $12a + 21$ and $12a + 21$. They are the same.
So, the expressions $5a + 7(3 + a)$ and $12a + 21$ are equivalent.

More information on this strategy is available on Animated Math Models #19, 20, 21, and 22.

Vocabulary

Algebraic expression – an expression that contains at least one variable

Base – a number used as a repeated factor

Coefficient – a number that is multiplied by a variable

Equivalent expressions – expressions that are equal to each other for any values of their variables

Evaluate – to find the value of an expression

Exponent – a number that tells how many times a base is used as a factor

Like terms – terms that have the same variables with the same exponents

Numerical expression – a mathematical phrase that uses only numbers and operation signs

Order of operations – a special set of rules which gives the order in which calculations are done in an expression

Terms – the parts of an expression that are separated by an addition or subtraction sign

Variable – a letter or symbol that stands for an unknown number or numbers