1-4 Simplifying Algebraic Expressions

Starter 1.4 HW 1.2, 1.3??? List words that indicate each operation.

- 1. addition sum, and, total
- **2.** multiplication times, product

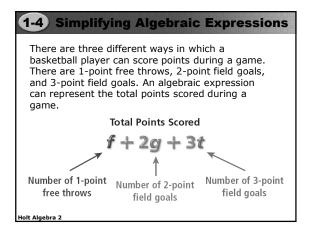
Evaluate each expression.

- **3.** 3x for x = 2
- **4.** 5x 4 3x for x = 7 10

Simplify each expression.

- **5.** 3(2x) 6x
- **6.** 4(x + y) 4x + 4y

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1-4 Simplifying Algebraic Expressions

To translate a real-world situation into an algebraic expression, you must first determine the action being described. Then choose the operation that is indicated by the type of action and the context clues.

Action	Operation	Possible Context Clues	
Combine	Add	How many total?	
Combine equal groups	Multiply	How many altogether?	
Separate	Subtract	How many more? How many remaining?	
Separate into equal groups	Divide	How many in each group?	
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1-4 Simplifying Algebraic Expressions

Addition Phrases: Subtr

- es: Subtraction Phrases:
- More than Increase by
- · Increase by
- Greater than
- Add
- Total
- Plus
- Sum

- · Decreased by
- · Difference between
- Take Away
- Less
- Subtract
- · Less than*
- Subtract from*

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Multiplication Phrases: Division Phrases:

- Product
- Quotient
- Times
- Divide
- Multiply
- Divided by

• Divided by

Of

- Split equally
- · Twice or double
- Per
- Triple

Operation	Verbal Expressions	Algebraic Expressions
+	add 3 to a number a number plus 3 the sum of a number and 3 a more than a number a number increased by 3	n + 3
_	subtract 12 from a number a number minus 12 the difference of a number and 12 12 less than a number a number decreased by 12 take away 12 from a number a number less 12	x - 12

Operation	Verbal Expressions	Algebraic Expressions
*	• 2 times a number	
	• 2 multiplied by a number	2m or 2 • m
	 the product of 2 and a number 	
÷	6 divided into a number	
	a number divided by 6	a
	•	$a \div 6 \text{ or } \frac{a}{6}$
	 the quotient of a number and 6 	

1-4 Simplifying Algebraic Expressions

Translating Words into Algebraic Expressions

- 3 more than x
- the sum of 10 and a number c
- a number *n* increased by 4.5
- a number t decreased by 4
- the difference between 10 and a number y
- 6 less than a number z
- the product of 3 and a number t
- twice the number x
- 4.2 times a number e
- the quotient of 25 and a number b
- the number y divided by 2
- 2.5 divide g

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Translating Words into Algebraic Expressions

- · converting x inches into feet
- the cost for tickets if you purchase 5 adult tickets at x dollars each
- the cost for tickets if you purchase 3 children's tickets at y dollars each
- the difference of 3 times a number and 7
- the quotient of 4 and a number, increased by 10
- · 4 times the difference of y and 8

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1-4 Simplifying Algebraic Expressions

Example 1: Translating Words into Algebraic Expressions

Write an algebraic expression to represent each situation.

A. the number of apples in a basket of 12 after *n* more are added

12 + n

Add n to 12.

B. the number of days it will take to walk 100 miles if you walk *M* miles per day

 $\frac{100}{M}$

Divide 100 by M.

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1-4 Simplifying Algebraic Expressions

Check It Out! Example 1

Write an algebraic expression to represent each situation.

a. Lucy's age y years after her 18th birthday

18 + *y*

Add y to 18.

b. the number of seconds in *h* hours

3600h

Multiply h by 3600.

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1-4 Simplifying Algebraic Expressions

To evaluate an algebraic expression, substitute a number for each variable and simplify by using the order of operations. One way to remember the order of operations is by using the mnemonic **PEMDAS.**

Order of Operations

- 1. Parentheses and grouping symbols.
- 2. Exponents.
- 3. Multiply and Divide from left to right.
- 4. Add and Subtract from left to right.

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Example 2A: Evaluating Algebraic Expressions

Evaluate the expression for the given values of the variables.

$$2x - xy + 4y$$
 for $x = 5$ and $y = 2$

$$2(5) - (5)(2) + 4(2)$$
 Substitute 5 for x and 2 for y.

$$10 - 10 + 8$$
 Multiply from left to right.

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Example 2B: Evaluating Algebraic Expressions

Evaluate the expression for the given values of the variables.

$$q^2 + 4qr - r^2$$
 for $r = 3$ and $q = 7$

$$(7)^2 + 4(7)(3) - (3)^2$$
 Substitute 3 for r and 7 for q.

$$49 + 4(7)(3) - 9$$
 Evaluate exponential expressions.

$$49 + 84 - 9$$
 Multiply from left to right.

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Check It Out! Example 2

Evaluate $x^2y - xy^2 + 3y$ for x = 2 and y = 5.

 $(2)^2(5) - (2)(5)^2 + 3(5)$ Substitute 2 for x and 5 for y.

4(5) - 2(25) + 3(5) Evaluate exponential expressions.

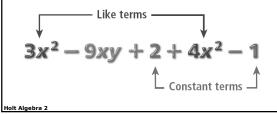
20 - 50 + 15 Multiply from left to right.

-15 Add and subtract from left to right.

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1-4 Simplifying Algebraic Expressions

- **Like terms** have the same variables raised to the same exponents.
- **Constant terms** are like terms that always have the same value.



1-4 Simplifying Algebraic Expressions

To simplify an algebraic expression, combine like terms by adding or subtracting their coefficients. Algebraic expressions are equivalent if they contain exactly the same terms when simplified.

Remember!

Terms that are written without a coefficient have an understood coefficient of 1.

$$x^2 = 1x^2$$

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Example 3A: Simplifying Expressions

Simplify the expression.

$$3x^2 + 2x - 3y + 4x^2$$

$$3x^2 + 2x - 3y + 4x^2$$
 Identify like terms.

$$7x^2 + 2x - 3y$$
 Combine like terms. $3x^2 + 4x^2 = 7x^2$

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Simplifying Algebraic Expressions

Example 3B: Simplifying Expressions

Simplify the expression.

$$j(6k^2 + 7k) + 9jk^2 - 7jk$$

$$6jk^2 + 7jk + 9jk^2 - 7jk$$
 Distribute, and identify like terms.

Combine like terms. $15jk^{2}$ 7jk - 7jk = 0

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Check It Out! Example 3

Simplify the expression -3(2x - xy + 3y) - 11xy.

$$-6x + 3xy - 9y - 11xy$$
 Distribute, and identify like terms.

$$-6x - 8xy - 9y$$
 Combine like terms. $3xy - 11xy = -8xy$

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Simplifying Algebraic Expressions

Example 4A: Application

Apples cost \$2 per pound, and grapes cost \$3 per pound.

Write and simplify an expression for the total cost if you buy 10 lb of apples and grapes combined.

Let A be the number of pounds of apples.

Then 10 - A is the number of pounds of grapes.

$$2A + 3(10 - A) = 2A + 30 - 3A$$
 Distribute 3.

= 30 - A

Combine like terms.

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Example 4B: Application

Apples cost \$2 per pound, and grapes cost \$3 per pound.

What is the total cost if 2 lb of the 10 lb are apples?

Evaluate 30 - A for A = 2.

$$30 - (2) = 28$$

The total cost is \$28 if 2 lb are apples.

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Simplifying Algebraic Expressions

Check It Out! Example 4a

A travel agent is selling 100 discount packages. He makes \$50 for each Hawaii package and \$80 for each Cancún package.

Write an expression to represent the total the agent will make selling a combination of the two packages.

Let h be the number of Hawaii packages.

Then 100 - h is the remaining Cancun packages.

$$50h + 80(100 - h) = 50h + 8000 - 80h$$
 Distribute 80.

= 8000 - 30*h* Combine like terms.

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Simplifying Algebraic Expressions

Check It Out! Example 4b

How much will he make if he sells 28 Hawaii packages?

Evaluate 8000 - 30h for h = 28.

$$8000-30(28) = 8000-840$$

= 7160

He will make \$7160.