

1 Simplifying Expressions 2.1

The problems you will be able to solve upon completion of this section will be:

1. Simplify: $3(4 - x) + 2(x + 4)$
2. Identify the variable part and the numerical coefficient in the following expression: $-5x^3$
3. Simplify: $-6x - 3[2x - 5(x - 8)] - 6$
4. Translate into a mathematical expression: A number added to the difference of four and two times the same number.

1.1 Terms, Coefficients, and Exponents

An expression in algebra represents nothing more than a number. It just so happens that it is written in a funny way. Usually, as a combination of number, letters, and operations. For example,

$$4xy + 3x^2 - 7r$$

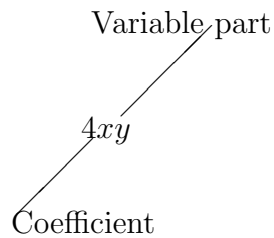
is an expression that represents a number. The parts of this expression that

are introduced by plus or minus signs are called terms. These parts are: $4xy, 3x^2, -7r$. Notice, that the last term $-7r$ is a negative term, so we must show its sign. The others are positive so their signs are understood and there is no need to show them. Technically, in an expression, we can introduce plus signs with out changing its value. So in the expression above we could write its equivalent:

$$+4xy + +3x^2 + -7r$$

Writing the expression in this way shows clearly that we think of an expression as a sum of positive and negative terms.

Each term has certain important parts. The numerical part is called the coefficient and the letter or letters are called the variable part. See below:



If a variable looks “like” it has no coefficient, then its coefficient is understood to be 1. For example,

x means $1 \cdot x$

Also, it should be understood that any variable that looks “like” it has no exponent has an exponent of 1. So,

x means x^1

1.2 Like terms

For a term to be a like term, the variables in the variable part must be the same and the powers on the variables must be the same.

If we have like terms, we may add or subtract the coefficients of the terms.

Examples follow,

$$3x^2 + 2x^2 = 5x^2$$

$$11ab^2 - 4ab^2 = 7ab^2$$

$$-2x^2y + 8x^2y = 6x^2y$$

The following are **not** like terms and can not be added or subtracted.

Example:

$$5x^2y + 2xy^2 \text{ Take no action}$$

In the above example, the powers are not on the same variables.

In the next example, the variables are not the same:

$$7x + 8y \text{ Take no action}$$

In your textbook, you must simplify expressions that contain like terms.

Here are some examples.

- Example: Simplify:

$$6 - 2(x - 3) =$$

$$6 - 2x + 6 \text{ Here, we distributed the } -2$$

$$-2x + 12 \text{ Here, we added the sixes}$$

- Example: Simplify:

$$4(2x + 2) - 3(x - 7) =$$

$$8x + 8 - 3x + 21 \text{ by distributing 4 and the 3}$$

$$11x + 29 \text{ collecting like terms}$$

Also, in this section we must be able to convert verbal phrases into algebraic sentences. The following is a dictionary that will help you translate expressions into algebra:

Verbal Expression	Algebraic Expression
A number increased by 5	$x + 5$
The sum of a number and negative eight	$x - 8$
The difference of a number and three	$x - 3$
The product of a number and ten	$10x$
The quotient of a number and four	$\frac{x}{4}$
The ratio of five times a number and seven	$\frac{5x}{7}$
Two times a number decreased by four	$2x - 4$
The product of three and the sum of a number and seven	$3(x + 7)$

Here is an example of a translation problem.

The product of five and the sum of a number and six decreased by four.

$$5(x + 6) - 4 =$$

$$5x + 30 - 4 =$$

$$5x + 26$$

2 Facts

1. Separate terms are introduced by plus signs or minus signs.
2. The coefficient in a term is the numerical part to the left of the letters in the term.
3. The variable part of a term is consists of any number of letters including their exponents.
4. A variable by itself is understood to have a coefficient of one and an exponent of one.
5. Like terms are terms that have the same variables and the same powers on those variables. Like terms may be added or subtracted.

3 Exercises

1. Simplify: $3(4 - x) + 2(x + 4)$
2. Identify the variable part and the numerical coefficient in the following expression: $-5x^3$

3. Simplify: $-6x - 3[2x - 5(x - 8)] - 6$

4. Translate into a mathematical expression: A number added to the difference of four and two times the same number.

4 Solutions

1. Simplify: $3(4 - x) + 2(x + 4)$

$$12 - 3x + 2x + 8 =$$

$$-x + 20$$

2. Simplify: $-6x - 3[2x - 5(x - 8)] - 6$

$$-6x - 3[2x - 5x + 40] - 6 =$$

$$-6x - 3[-3x + 40] - 6 =$$

$$-6x + 9x - 120 - 6 =$$

$$3x - 126$$

- 3.

-5 is the coefficient

x^3 is the variable part

- 4.

$$x + (4 - 2x) = -x + 4$$