



## EXPRESSIONS

**Review** these concepts of algebra throughout the course.

This material has been taught in previous courses, but it is important to help students remember it. **The student will identify and apply real number properties using variables, including distributive, commutative, associative, identity, inverse, and absolute value to expressions or equations.**

### Real Number Properties

For a Review of Real Numbers, see the Prepare for Algebra Unit before Unit 1

#### **A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★**

- Interpret parts of an expression, such as terms, factors, and coefficients.
- Interpret complicated expressions by viewing one or more of their parts as a single entity.

#### **A.SSE.A.2 Use the structure of an expression to identify ways to rewrite it.**

**Note:** This unit can be used as needed (review or introductory) to practice with expressions and variables.

## MATH BACKGROUND

### **PREVIOUS KNOWLEDGE** (What skills do they need to have to succeed?)

- Express algebraic expressions verbally

### **In this unit you will**

- Evaluate numerical expression using the order of operations
- Evaluate algebraic expressions using the order of operations

### **You can use the skills in this unit to**

- Create algebraic expressions (patterns) to represent real-life applications.

### **Overall Big Ideas**

There is an identified order that mathematical operations are performed. It is important to learn this in order to be able to “undo” the operations later when solving equations.

### **Essential Questions**

- Why is it helpful to be able to simplify numerical or algebraic expressions?
- What type of grouping symbols are used to write expressions and why are they important when simplifying expressions?



### Notes, Examples and Exam Questions

**Learning Target: 2.4 To evaluate algebraic expressions, 2.5 To simplify algebraic expressions, 2.6 To create algebraic expressions.**

#### Vocab:

- Terms: algebraic expressions separated by a + or a – sign
- Constant Term: a term that is a real number (no variable part)
- Coefficient: the numerical factor of a term
- Like Terms: terms that have the exact same variable part (must be the same letter raised to the same exponent)      Note: Only *like terms* can be added or subtracted (combined).

▲ **To add or subtract like terms, add or subtract the coefficients and keep the variable part.**

**Ex 1:** Simplify  $3\text{☺} + 4\text{☺}$ .

This means we are adding 3 smiley faces plus 4 smiley faces. Therefore, we have a total of 7 smiley faces, which we can write as  $7\text{☺}$ .

**Ex 2:** Use the expression  $1 - 3x^2 + 4xy + x^2 + 5y^2$  to answer the following questions.

1. How many terms are in the expression?    **Solution: There are 5 terms.**
2. Name the constant term(s).                      **Solution: There is one constant term, 1.**
3. How many like terms are in the expression?  
**Solution: There are 2 like terms.  $-3x^2$  and  $x^2$**
4. What is the coefficient of the  $xy$  term?              What is the coefficient of the fourth term?  
**Solution: The  $xy$  term has a coefficient of 4.      The third term has a coefficient of 1.**
5. Simplify the algebraic expression.  
**Solution: Combine like terms.       $1 - 3x^2 + 1x^2 + 4xy + 5y^2 = 1 - 2x^2 + 4xy + 5y^2$**
6. How many terms are in the simplified form of the algebraic expression?  
**Solution: There are 4 terms.**



### Evaluating an Algebraic Expression

**Ex 3:** Evaluate the expression  $2x^3 - x^2 + y$  when  $y = 2$  and  $x = -3$ .

$$\begin{aligned} \text{Step One: Substitute in the values} & \quad 2(-3)^3 - (-3)^2 + 2 \\ & \quad 2(-27) - (9) + 2 \\ \text{Step Two: Perform the indicated operations} & \quad -54 - 9 + 2 \\ & \quad = \boxed{-61} \end{aligned}$$

**\*\*Note:** Make sure to stress the importance of using parentheses when substituting values into the expression.

**Ex 4:** Evaluate the expression  $x^2 - x^3y + 6$  when  $y = 9$  and  $x = 2$ .

$$\begin{aligned} \text{Step One: Substitute in the values} & \quad = (2)^2 - (2)^3 \cdot (9) + 6 \\ & \quad = 4 - 8 \cdot 9 + 6 \\ \text{Step Two: Perform the indicated operations} & \quad = \boxed{-62} \end{aligned}$$

### Simplifying an Algebraic Expression

**Ex 5:** Simplify the expression  $4(x + 8) - 5x + 1$ .

$$\begin{aligned} \text{Step One: Eliminate the parentheses using the distributive property.} & \quad 4x + 32 - 5x + 1 \\ & \quad = 4x - 5x + 32 + 1 \\ \text{Step Two: Combine like terms.} & \quad = -1x + 33 \\ & \quad = \boxed{-x + 33} \end{aligned}$$

**Ex 6:** Simplify the expression  $5 - 2n(3n + 8) - 4n^2$

Step One: Eliminate the parentheses using the distributive property.  $5 - 6n^2 - 16n - 4n^2$

Note: The expression in parentheses is being multiplied by  $-2n$ , which is what was “distributed”.

$$\begin{aligned} \text{Step Two: Combine like terms.} & \quad = 5 - 6n^2 - 4n^2 - 16n \\ & \quad = \boxed{5 - 10n^2 - 16n} \end{aligned}$$

Note: The answer may be written as  $-10n^2 - 16n + 5$  by the commutative property.

**Ex 7:** Write a simplified expression for the perimeter of a rectangle with length  $(x + 7)$  and width  $(x - 2)$ . Note: The formula for the perimeter of a rectangle is  $P = 2l + 2w$ .

$$\begin{aligned} \text{Step One: Substitute the length and width into the formula.} & \quad 2(x + 7) + 2(x - 2) \\ & \quad = 2x + 14 + 2x - 4 \\ \text{Step Two: Simplify using the distributive property, combine like terms.} & \quad = \boxed{4x + 10} \end{aligned}$$



**Ex 8:** Translate the following phrases to expressions.

- |    |   |                 |
|----|---|-----------------|
| a. | Three more than five times a number                             | $5x + 3$        |
| b. | Twice a number decreased by seven                               | $2x - 7$        |
| c. | Twelve less than eight times a number                           | $8x - 12$       |
| d. | Twenty diminished by four times a number                        | $20 - 4y$       |
| e. | Fifty increased by three times a number                         | $50 + 3m$       |
| f. | The sum of triple a number and seventeen                        | $3w + 17$       |
| g. | Two times the difference of fifty and ten times a number        | $2(50 - 10x)$   |
| h. | The quotient of fifteen and twice a number                      | $\frac{15}{2y}$ |
| i. | Eight less than the product of five times a number              | $5x - 8$        |
| j. | Jim's age is 3 times Sarah's age                                | $3S$            |
| k. | The amount of money earned if you make \$7 per hour for x hours | $7x$            |

You Try:

1. Simplify the expression  $x - (4 - 3x) + 8$ .
2. Write a simplified expression for the area of a triangle with a base of  $4x$  and a height of  $(2x + 1)$ .

QOD: Explain in your own words why only like terms can be added or subtracted.

### SAMPLE EXAM QUESTIONS

**1. Simplify the expression:**

$$5 + 3(x - 4) - x$$

- A.  $7x - 4$
- B.  $7x - 32$
- C.  $2x + 1$
- D.  $2x - 7$

**ANS: C**

**2. Simplify the expression:**

$$5x^2 - 2x + 6 + 4x + 6x^2 - 1$$

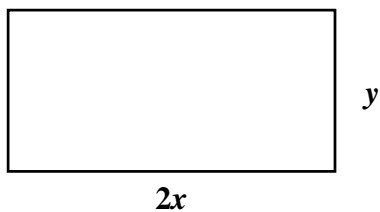
- A.  $-x^2 + 6x + 5$
- B.  $3x^2 + 10x + 5$
- C.  $11x^2 + 2x + 5$
- D.  $11x^2 + 6x + 5$

ANS: C

**3. What are the coefficients in the expression  $3x - 4y + 2$ ?**

- A.  $3x$ ,  $-4y$ , and  $2$
- B.  $3$  and  $-4$
- C.  $x$  and  $y$
- D.  $2$

ANS: B

**4. Write an expression for the perimeter of the rectangle:**

- A.  $2xy$
- B.  $6xy$
- C.  $4x + 2y$
- D.  $4x^2 + 2y^2$

ANS: C



5. An athlete works out each day for 60 minutes, of which  $t$  minutes is spent running at  $0.20 \frac{\text{mi}}{\text{min}}$ , and the rest of the time is spent walking at  $0.05 \frac{\text{mi}}{\text{min}}$ . Which expression represents the total distance the athlete travels in miles while working out each day?

- (A)  $(0.25)(60)$   
 (B)  $0.25t + (60 - t)$   
 (C)  $0.20t + 0.05(60 - t)$   
 (D)  $(0.20)(0.05) + t(60 - t)$

ANS: C

6. Let the price of a meal at a restaurant be  $p$ . The tax and tip on the meal are generally a percentage of the meal's price. The total cost of the meal is its price plus tax plus tip.

- (a) Write an expression for the total cost of a meal where the tax is 8% and the tip is 15%.

$$p + 0.08p + 0.15p$$

- (b) Write an expression for the total cost of a meal where the tax is  $x\%$  and the tip is  $g\%$ .

$$p + \frac{x}{100}p + \frac{g}{100}p$$

- (c) David calculates a 15% tip by dividing the meal price by 10, dividing that number by

2, and then adding the two numbers, i.e.  $\text{tip} = \frac{p}{10} + \frac{\left(\frac{p}{10}\right)}{2}$ . Explain whether or not this method is correct.

Yes, this works. Dividing by 10 gives one-tenth of 10% of the price. Dividing that by 2 gives one-twentieth or 5% of the price. Adding those two numbers gives 15% of the price.

$$\frac{p}{10} + \frac{\frac{p}{10}}{2} = \frac{p}{10} + \frac{p}{20} = 0.10p + 0.05p = 0.15p$$



\*These two-column notes are designed to be used for study. The left side or the right side can be covered for self-check or buddy-check support and are meant to be developed throughout each unit. For example, certain vocabulary words may not be defined until that concept is covered/discussed/developed during the unit.

**Vocabulary**

**Definition/Meaning/Example**

- Expression
- Constant
- Variable
- Order of Operations
- Numerical expression
- Evaluate
- Algebraic expression
- Open sentence
- Equation
- Literal equation
- Solution of an equation
- Power, exponent, base
- \*Properties of Equality



**Give two ways to write each algebraic expression in words**

1.  $n-5$

2.  $8x$

3.  $\frac{t+12}{4}$

**Translate from words to algebraic expressions**

1. Sam is 2 years less than three times the age of his younger brother

**Evaluate each, given  $x=5$ ,  $y=8$ ,  $z=4$**

1.  $x+y$

2.  $y/z$

3.  $z^2/y + x$

**Write an expression for:**

1. area of a rectangle if the length of the rectangle is 9 inches.