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.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. 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☺ + 4☺.
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☺.

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. $1-3x^2+1x^2+4xy+5y^2=\boxed{1-2x^2+4xy+5y^2}$
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 $x = -3$.

Step One: Substitute in the values
$2(-3)^3 - (-3)^2 + 2$

Step Two: Perform the indicated operations
$2(-27) - (9) + 2$
$-54 - 9 + 2$
$= \boxed{-61}$

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

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

Step One: Substitute in the values
$= (2)^2 - (2)^3 \cdot (9) + 6$

Step Two: Perform the indicated operations
$= 4 - 8 \cdot 9 + 6$
$= \boxed{-62}$

Simplifying an Algebraic Expression

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

Step One: Eliminate the parentheses using the distributive property.
$4x + 32 - 5x + 1$
$= 4x - 5x + 32 + 1$

Step Two: Combine like terms.
$= -1x + 33$
$= \boxed{-x + 33}$

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".

Step Two: Combine like terms.
$= 5 - 6n^2 - 4n^2 - 16n$
$= \boxed{5 - 10n^2 - 16n}$

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 $P = 2l + 2w$.

Step One: Substitute the length and width into the formula.
$2(x+7) + 2(x-2)$

Step Two: Simplify using the distributive property, combine like terms.
$= 2x + 14 + 2x - 4$
$= \boxed{4x + 10}$

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

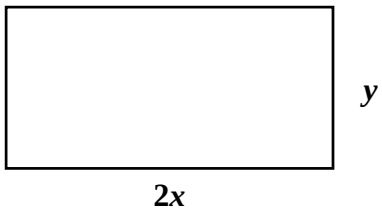
B. 3 and –4

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. $\text{tip}=p/10+\frac{(p/10)}{2}$. 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.

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

*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. $z^2/y \quad +x$

Write an expression for:

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