A

Parts of an Algebraic Expression

► GOAL

Identify the parts of an algebraic expression.

Learn about the Math

An expression containing variables, numbers, and operation symbols is called an **algebraic expression.** $5x + 3y + 8$ is an example of an algebraic expression.

Each expression is made up of **terms.** A term can be a signed number, a variable, or a constant multiplied by a variable or variables. Each term in an algebraic expression is separated by a $+$ sign or $-$ sign. In $5x + 3y + 8$, the terms are: $5x$, $3y$, and 8.

When a term is made up of a constant multiplied by a variable or variables, that constant is called a **coefficient.** In the term $5x$, the coefficient is 5.

In some terms, the variables will have exponents, such as $8x^2$. This exponent determines the **degree** of that term.

- The degree of $8x^2$ is 2. The degree of $9x^3$ is 3.
- If the variable does not have an exponent, the degree is 1. For instance, the degree of $8x$ is 1.
- If a term has more than one variable, the degree is equal to the sum of the exponents of all its variables. The degree of $8x^3y^2z$ is 6.
- If a term does not contain any variable, the degree is 0. For instance, the degree of 9 is 0.

Terms in which the same variable is raised to the same exponent are called **like terms.** $2x^2$ and $10x^2$ are like terms.

Kurt sees the temperature, 20 °C, on a thermometer on the way to school. He asks his teacher what this temperature would be in degrees Fahrenheit. His teacher gives him the expression, $1.8x + 32$, where x represents the temperature in degrees Celsuis, and tells him it can be used to change from degrees Celsius to degrees Fahrenheit.

algebraic expression
an expression containing variables, numbers, and operation symbols

term
a signed number, a variable, or a constant multiplied by a variable or variables

coefficient
a constant multiplied by a variable or variables

degree
the sum of a term's exponents

like terms
terms in which the same variable is raised to the same exponent

? What are the names for each part of the algebraic expression 1.8x + 32?

Example 1: Labelling the parts of an algebraic expression

Find the terms, coefficient, and degree for this expression: $1.8x + 32$.

Kurt's Solution

Terms: $1.8x$ and 32	I know a term is a signed number, a variable, or a constant multiplied by a variable or variables. This expression has 2 terms.
Coefficient: 1.8	I also know that coefficients are the constants by which the variables are being multiplied. x is being multiplied by 1.8, making 1.8 the coefficient.
Degree of $1.8x$ is 1 Degree of 32 is 0	To find the degree of each term, I use the fact that the degree of a term with a variable that does not have an exponent is 1, and the degree of a term that does not contain a variable is 0.
$1 + 0 = 1$	The degree of the expression is 1.

Reflecting

1. Give an example of two like terms and two unlike terms. Explain why they would or would not be classified as like terms.

2. What is the degree of each term in this expression:
   $19x^3 - 8x^2 + x$?

3. Must a term contain a variable? Explain.

Work with the Math

Example 2: Labelling the parts of an algebraic expression

List the terms, coefficients, and degree of each term in the following expression: $4x^3y^2 + 2x^2 - 3x + 4$.

Maggie's Solution

Terms: $4x^3y^2$, $2x^2$, $-3x$, and 4	To find the terms, I need to list all of the signed numbers, variables, or constants being multiplied by a variable or variables.
Coefficients: 4, 2, and -3	I determine the constants multiplied by variables are 4, 2, and -3, making each of these a coefficient.
Degree of $4x^3y^2$ is $3 + 2$ or 5 Degree of $2x^2$ is 2 Degree of $-3x$ is 1 Degree of 4 is 0	To determine the degree of each term, I will examine the exponents. The sum of the exponents in the first term is 5; the exponent in the second term is 2; the third term does not have an exponent, therefore the degree is 1; and the last term does not contain a variable, making the degree 0.

Ⓐ Checking

4. **a)** Identify the like terms in this expression: $4x^2 + 2x - 6x + 3y$.
   b) Which term has the highest degree in the following expression: $2x^3 - 4x^2 + 9y^2$?

Ⓑ Practising

5. How many terms are in each of the following algebraic expressions?

   a) $6x^3 + 8x^2 - 4x$
   b) $15xy^3 + 21x^2 - 16$
   c) $19x^4 + 8x^2 + 4xy - 2$
   d) $8x^3 + 14x^5 - 20x^2 + 9x - 25$
   e) $9x^3y + 5x^4 - 24x^2 + 7x - 6x^6$
   f) $2ab + 7$
   g) $15xy + 7x + 2y + 9$

6. Identify the coefficients in each expression.

   a) $81x^3 + 7xy^2 - 14x$
   b) $4x^3 + 8x^2 - 24$
   c) $61x^2 + 6x^2 + 2x - 7$
   d) $4xyz^3 + 8x^2 - 2xy^2 + 29x - 46$
   e) $22a^3 + 38a^2 - 12b$
   f) $28a^2 - 17ab$
   g) $7x + 2xy$

7. Identify the degree for each term.

   a) $12x^3y^2$
   b) $62x^4$
   c) $2x^2y$
   d) $125x^5$
   e) $9a^7$
   f) -12
   g) $-12ab^2c$

8. List the like terms in each of the following algebraic expressions.

  a) $14xy^2 + 25x - 6x + 2$
  b) $8x^2 + 12x^2 - 9xy + 3x$
  c) $86x^3 + 42x - 36x^3 + 21y$
  d) $4x^2 + 6y - 6x + 7y$
  e) $36m^3 + 22m^2n^2 - 2m^2n^2$
      $+ 7m - 50$

9. Identify the terms, coefficients, and degree of each term in the following expressions.

  a) $14x^3 + 42x - 36x + 21y$
  b) $26x^4 + 59x^3 - 12y + 6x - 9$
  c) $2x^2y^2 + 3xy + 4$
  d) $3xyz + 8xy + 2y + 6$
  e) $4a^2b + 2a - 17$

10. Rewrite each expression so that the terms are in order of descending (greatest to least) degree.

  a) $4a^2 - 6a^3 + 9 - 3a$
  b) $5x^3y^2 - 4xy - 6x^3y - 8x + 7y^6$
  c) $16m^2 - 2m + 9$
  d) $10ab + 7a^2b^2c - 7a + 2$
  e) $4x^8 + 10 + 7y^4$

C **Extending**

11. Write an expression with 5 terms, containing the coefficients 7, 21, 14, and 8.

12. Write an expression with at least 4 terms. List the terms, coefficients, and degree of each term.