

Expressions

Definition

An expression is a **mathematical** sentence consisting of numbers, **variables**, and math **operators**. It should have at least one math operator and two **terms**, numbers, or variables to be called an expression.

Variables

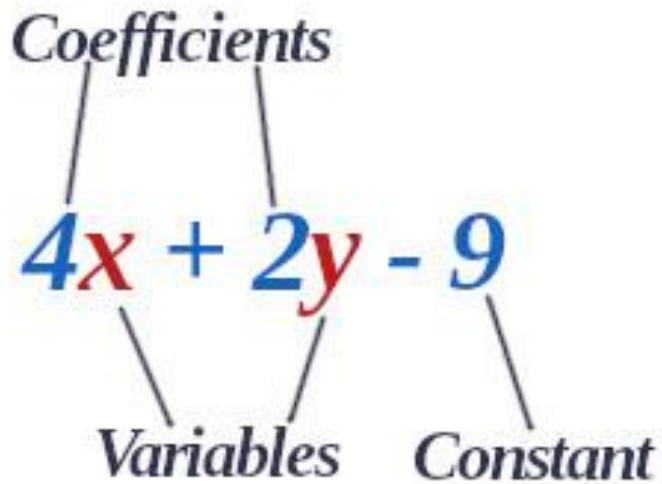
A variable is an **unknown** quantity in an expression. An **alphabet** or any **symbol** denotes it.

Terms

A term in mathematics is defined as a **number**, a variable, a number multiplied by a **variable**, many variables multiplied by each other, or variables **multiplied** by a number.

Objectives :

- Substitute positive and negative integers into linear expressions, and expressions involving small power.



Terms: $2x, 4y, 9$

The diagram shows the expression $x^2 - 3xy + 2y^2$ on a lined background. Below the expression, three upward-pointing arrows indicate the coefficients of each term. The first arrow points to x^2 with the label "coefficient of 1". The second arrow points to $-3xy$ with the label "coefficient of -3". The third arrow points to $2y^2$ with the label "coefficient of 2".

Expression

- True for all values of x .
- Common key terms:
 - Simplify
 - Expand
 - Factorise
- Example:
 - $8x + 5y - 3x - 5$

How to evaluate algebraic expressions??

1 Identify the variable and its value. This information should be given to you. Usually you will be told to evaluate the expression "when" or "where" the variable is equal to a certain value. If you are not given the variable's value, you cannot evaluate the expression.^[4]

Evaluate

$$4x + 3y \text{ when } \begin{matrix} x=2 \\ y=6 \end{matrix}$$

Solution :

$$\begin{aligned} &= 4(2) + 3(6) \\ &= 8 + 18 \\ &= 26 \end{aligned}$$



Evaluate Polynomial

$$7x^2 - 12x + 13 \text{ when } x=4$$

variable

Solution :

$$\begin{aligned} &= 7(4)^2 - 12(4) + 13 \\ &= 7(16) - 12(4) + 13 \\ &= 112 - 48 + 13 \\ &= 64 + 13 \\ &= 77 \end{aligned}$$

How do you describe a variable expression?

Variable Expression	Meaning	Operation
$5x, 5 \cdot x, (5)(x)$ (same as $x \cdot 5$)	5 times x	Multiplication
$\frac{5}{x}, 5 \div x$	5 divided by x	Division
$5 + x$ (same as $x + 5$)	5 plus x	Addition
$5 - x$	5 minus x	subtraction

Simplifying Algebraic Expressions

Commutative Properties

Addition: $a + b = b + a$

Multiplication: $a \cdot b = b \cdot a$

$$5 + y = y + 5$$

$$8 \cdot z = z \cdot 8$$

$$t + 12 = 12 + t$$

$$m \cdot r = r \cdot m$$

Simplifying Algebraic Expressions

Distributive Property of Multiplication

$$a(b + c) = ab + ac$$

$$a(b - c) = ab - ac$$

$5 \cdot (x + y) = 5x + 5y$
$-3(2 + 7x) = -6 - 21x$
$4(x + 6y - 2z) = 4x + 24y - 8z$
$-(4 - m - 7k) = -4 + m + 7k$

Simplify each of the expressions by using the distributive property.

$$8(y + 2)$$

$$8y + 16$$

$$3(7a - 5)$$

$$21a - 15$$

$$6(5 - y)$$

$$30 - 6y$$

Simplifying Algebraic Expressions and Combining Like Terms

Simplify:

$$9x + 3y + 4x + 2y$$

$$9x + 3y + 4x + 2y$$

$$\underline{9x + 4x} + \underline{3y + 2y}$$

$$\begin{array}{c} \downarrow \quad \swarrow \\ 13x + 5y \end{array}$$

<https://www.youtube.com/watch?v=g9VluFYB98g&t=21s>



Highlight the like terms. Since I have two sets of like terms, I used two different colors.


Rewrite like terms side by side.

Combine like terms. (Add or subtract the coefficients of the like terms.)

Simplify:

$$4r - 5s + 2rs - 8s - 3r$$

$$4r - 5s + 2rs - 8s - 3r$$

$$4r - 3r - 5s - 8s + 2rs$$


$$1r - 13s + 2rs$$

Final Answer (You don't need the 1 as a coefficient.)

$$r - 13s + 2rs$$

Simplifying Expressions

Simplifying algebraic expressions is when we use a variety of techniques to make algebraic expressions more efficient and compact – in their simplest form.

 **Example** Simplify $8x + 4 + 3(2x - 3)$

1 Expand the brackets $8x + 4 + 3(2x - 3) = 8x + 4 + 6x - 9$

2 Collect like terms $8x + 4 + 6x - 9 = 14x - 5$

The simplified expression is $14x - 5$  **3** Rewrite the expression

Simplify each expression by combining like terms.

$$\begin{array}{l} 8m - 14m \\ -6m \end{array}$$

$$\begin{array}{l} 6a + a \\ 7a \end{array}$$

$$\begin{array}{l} -y^2 + 3y^2 + 7 \\ 2y^2 + 7 \end{array}$$

$$\begin{array}{l} 6z + 5 + z - 4 \\ 7z + 1 \end{array}$$

$$\begin{array}{l} -7y + 2 - 2y - 9x + 12 - x \\ -9y - 10x + 14 \end{array}$$

$$\begin{array}{l} 6(4a) \\ 24a \end{array}$$

$$\begin{array}{l} -8(9x) \\ -72x \end{array}$$

Simplifying Expressions with brackets :

Expand & Simplify...

$$5(x + 3) + 6(x - 4)$$

$$5x + 15 + 6x - 24$$

$$11x - 9$$

$$4(y - 4) - 3(y - 2)$$

$$4y - 16 - 3y + 6$$

$$y - 10$$

Exercise 4:

Expand and Simplify

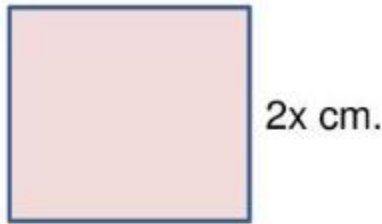
a) $8(6q + 4) - 8(-7q - 5)$

b) $-3(7y + 10) + 9(-y + 8)$

c) $7(-8u + 6) - 10(3u + 6)$

Simplifying Algebraic Expressions

Find the perimeter of the square.

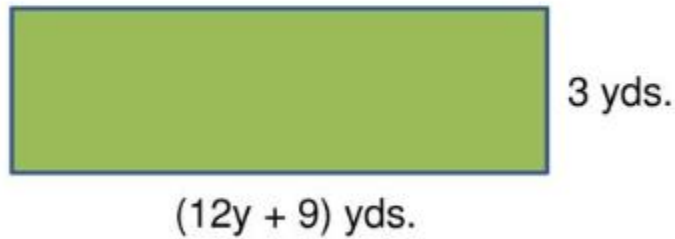


Perimeter (P) = sum of all sides

$$P = 2x + 2x + 2x + 2x$$

$$P = 8x$$

Find the area of the rectangular lawn.



Area (A) = length · width

$$A = (12y + 9) \cdot 3$$

$$A = 36y + 27$$