

## Simplifying expressions

- "Like terms" are terms that have the same variables

Examples:

- $4x$  and  $7x$  are like terms because their variable " $x$ " are identical
- $9xy$  and  $2xy$  are like terms because their variables " $xy$ " are identical
- $x^2y^5$ ,  $7x^2y^5$  and  $-13x^2y^5$  are like terms because their variables " $x^2y^5$ " are identical

- When there is no number in front of the variable (called the coefficient), that number is assumed to be 1

Examples:

- $x = 1x$
- $x^2y^5 = 1x^2y^5$

- Like terms can be combined, by adding or subtracting coefficients. This process is called "simplifying."

- $4x + 7x = 11x$
- $9xy - 2xy = 7xy$
- $x^2y^5 + 7x^2y^5 - 13x^2y^5 = -5x^2y^5$

Practice: Simplify the following

a)  $3x + 2x$

b)  $5x - 2y - x + 9y$

c)  $-3m + 6 - 2 + m$

d)  $\frac{1}{5}x + \frac{3}{5}x$

e)  $5xy^2 - 8xy^2 + xy^2$

f)  $x^2y^3 - 2x^5y^7 + 6y^3x^2 + 5y^7x^5$

g)  $x + 6y + 7x - 5y - 8x$

Answers:

a)  $5x$

b)  $4x + 7y$

c)  $-2m + 4$

d)  $\frac{4}{5}x$

e)  $-2xy^2$

f)  $7x^2y^3 + 3x^5y^7$

g)  $y$

## Multiplying monomials (multiplying one term by another)

- Multiply the coefficients and multiply similar variables (remember your exponent laws)

Examples:

$$(3x^2)(5x^7) = 15x^9$$

$$(m^5)(4m^7)(6m^3) = 24m^{15}$$

$$(8n)(n^{10}) = 8n^{11}$$

$$(7x^2y^5z^3)(2x^4y^6z) = 14x^6y^{11}z^4$$



Don't forget that if a variable has no exponent shown, then the exponent is 1  
e.g.,  $x = x^1$

Practice: Simplify the following

a)  $(5y^3)(8y^6)$

b)  $(4j^2k^3m^5)(9j^6k^4m)$

c)  $(-4x^3y^3)(x^2y^5)(5xy^3)$

d)  $(x^2y^3)(2x^5y^7)(5y^7x^5)$

e)  $(4x^2y)(3x)(2y^5z^2)$

Answers:

a)  $40y^9$

b)  $36j^8k^7m^6$

c)  $-20x^6y^{11}$

d)  $10x^{12}y^{17}$

e)  $24x^3y^6z^2$

Practice: Fill in the blanks

a)  $(9y^5)(\quad) = 18y^8$

b)  $(4x^5)(2x)(\quad) = 40x^{12}$

c)  $(\quad)(6x^3y^2) = -24x^8y^3$

d)  $(-10xyz^2)(\quad) = 30x^3y^5z^2$

e)  $(5yz)(\quad) = 5wx^2y^3z^2$

Answers:

a)  $(9y^5)(2y^3) = 18y^8$

b)  $(4x^5)(2x)(5x^6) = 40x^{12}$

c)  $(-4x^5y)(6x^3y^2) = -24x^8y^3$

d)  $(-10xyz^2)(-3x^2y^4) = 30x^3y^5z^2$

e)  $(5yz)(wx^2y^2z) = 5wx^2y^3z^2$

## Multiplying a polynomial by a monomial

- Multiply each term in the polynomial by the monomial in front.

Examples:

$$5(2x + 7) = 10x + 35$$

$$2x^3(7x^2 - 3x) = 14x^5 - 6x^4$$

$$-10(m^6 - 2m^5) = -10m^6 + 20m^5$$

$$-7x(x^2 + 2x - 5) = -7x^3 - 14x^2 + 35x$$

$$4x^3y^2z(5xyz - x^3z^2) = 20x^4y^3z^2 - 4x^6y^2z^3$$



The process of multiplying each term in the parentheses by the term in front is called "expanding"

Practice: Simplify the following

a)  $3(2y^2 + 4y - 7)$

b)  $2x(x^3 - 5x)$

c)  $-5x^2y^6(3xy - x^7y^2 - x^2)$

d)  $-6xy^2(-3 + 2x - y^7)$

e)  $7z^2(xz + 2x - 4wyz)$

Answers:

a)  $6y^2 + 12y - 21$

b)  $2x^4 - 10x^2$

c)  $-15x^3y^7 + 5x^9y^8 + 5x^4y^6$

d)  $18xy^2 - 12x^2y^2 + 6xy^9$

e)  $7xz^3 + 14xz^2 - 28wyz^3$

Practice: Fill in the blanks

a)  $-2x(\quad) = -4x^6 + 6x$

b)  $4x^3(\quad) = 20x^8 + 16x^5 - 12x^3$

c)  $5x^3y(\quad) = -10x^7y + 5x^3y^2$

d)  $4xz(\quad) = -4x^4yz + 8xyz^4$

Answers:

a)  $-2x(2x^5 - 3) = -4x^6 + 6x$

b)  $4x^3(5x^5 + 4x^2 - 3) = 20x^8 + 16x^5 - 12x^3$

c)  $5x^3y(-2x^4 + y) = -10x^7y + 5x^3y^2$

d)  $4xz(-x^3y + 2yz^3) = -4x^4yz + 8xyz^4$

## Multiplying two binomials

- One by one, multiply a term from one binomial with a term from the other binomial
- Multiply terms in the following order Front, Outside, Inside, Last (F.O.I.L.)

$$\begin{array}{c} (x+3)(x+7) \\ \uparrow \quad \uparrow \\ \text{First} \\ x^2 \end{array}$$

$$\begin{array}{c} (x+3)(x+7) \\ \uparrow \quad \uparrow \\ \text{Outside} \\ 7x \end{array}$$

$$\begin{array}{c} (x+3)(x+7) \\ \uparrow \quad \uparrow \\ \text{Inside} \\ 3x \end{array}$$

$$\begin{array}{c} (x+3)(x+7) \\ \uparrow \quad \uparrow \\ \text{Last} \\ 21 \end{array}$$

Examples:

$$\begin{aligned} (x+3)(x+7) &= x^2 + 7x + 3x + 21 \\ &= x^2 + 10x + 21 \end{aligned}$$

$$\begin{aligned} (x-2)(x+9) &= x^2 + 9x - 2x - 18 \\ &= x^2 + 7x - 18 \end{aligned}$$

$$\begin{aligned} (3x-5)(2x+1) &= 6x^2 + 3x - 10x - 5 \\ &= 6x^2 - 7x - 5 \end{aligned}$$

$$\begin{aligned} (5x-2)(3x-7) &= 15x^2 - 35x - 6x + 14 \\ &= 15x^2 - 41x + 14 \end{aligned}$$

Practice: Expand and simplify the following

Answers:

a)  $(x+6)(x+2)$

a)  $x^2 + 8x + 12$

b)  $(2x+1)(x+5)$

b)  $2x^2 + 11x + 5$

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

c)  $x^2 - x - 12$

d)  $(3x-5)(2x-1)$

d)  $6x^2 - 13x + 5$

e)  $(3x+7)(x+1)$

e)  $3x^2 + 10x + 7$

f)  $(5x+2)(5x-2)$

f)  $25x^2 - 4$

g)  $(4x^2-3)(2x+5)$

g)  $8x^3 + 20x^2 - 6x - 15$