

## Multiplying Monomials

**Recap: Exponent Laws for Multiplication**

Simplify:

$$a) x^2 \cdot x^3 = x^{2+3} = x^5$$

$$b) x \cdot x^5 = x^{1+5} = x^6$$

$$c) x^3 y^2 \cdot x^2 y = x^{3+2} \cdot y^{2+1} = x^5 y^3$$

**To multiply monomials, you:**

1. Multiply the coefficients
2. Multiply the variables

Example 1:  $3(4x) = 12x$

Example 2:  $-2x(5x^2) = -10x^{1+2} = -10x^3$

Example 3:  $5xy(-x^2) = -5x^{1+2} \cdot y = -5x^3 y$

**Practice: Multiplying Monomials**

a)  $5(2x) = 10x$

b)  $-2x(4x) = -8x^{1+1} = -8x^2$

c)  $5x(3x^2) = 15x^{1+2} = 15x^3$

d)  $-4x(-x) = 4x^{1+1} = 4x^2$

e)  $7xy(-3xy) = -21x^{1+1}y^{1+1} = -21x^2y^2$

f)  $5x(2xy) = 10x^{1+1}y = 10x^2y$

## The Distributive Property

**To multiply a binomial by a monomial, you:**

$$a(b + c) = (a) \times (b) + (a) \times (c)$$

Multiply each term inside the bracket by the term outside the bracket.

Ex1:  $3(x+5) = (3)(x) + (3)(5) = 3x + 15$

Ex2:  $-3(x-2) = (-3)(x) + (-3)(-2) = -3x + 6$

Ex3:  $3x(x^2 - 2x + 1) = (3x)(x^2) + (3x)(-2x) + (3x)(1) = 3x^3 - 6x^2 + 3x$

**Practice: Distributive Law**

a.  $4(2a + 3b) = (4)(2a) + (4)(3b) = 8a + 12b$

b.  $2m^2(5m^3 - 2m + 1) = (2m^2)(5m^3) + (2m^2)(-2m) + (2m^2)(1) = 10m^5 - 4m^3 + 2m^2$

c.  $3(4x - 2y) = (3)(4x) + (3)(-2y) = 12x - 6y$

d.  $3b^3(2b^2 + 4b - 3) = (3b^3)(2b^2) + (3b^3)(4b) + (3b^3)(-3) = 6b^5 + 12b^4 - 9b^3$

e.  $-2(2x + 3y - z) = (-2)(2x) + (-2)(3y) + (-2)(-z) = -4x - 6y + 2z$

f.  $5h^4(-3h^3 + 4h^2 - h) = (5h^4)(-3h^3) + (5h^4)(4h^2) + (5h^4)(-h) = -15h^7 + 20h^6 - 5h^5$

g.  $2x^2(3x^3 - 4x + 1) = (2x^2)(3x^3) + (2x^2)(-4x) + (2x^2)(1) = 6x^5 - 8x^3 + 2x^2$

h.  $2a(-a + 5) = (2a)(-a) + (2a)(5) = -2a^2 + 10a$

i.  $5x(-2x + 8) = (5x)(-2x) + (5x)(8) = -10x^2 + 40x$

## Expanding & Simplifying Algebraic Expressions

To simplify some expressions, you may have to expand (remove brackets) first, then collect any like terms.

Example 1

\*add the opposite  
 $(3x + 5) - (5x - 9)$

$$\begin{aligned} &= 3x + 5 + (-5x + 9) \\ &= 3x + 5 - 5x + 9 \\ &= 3x + 5 - 5x + 9 \\ &= -2x + 14 \end{aligned}$$

Example 2

\*distributive law

$$\begin{aligned} &= 2m(m + 4) - 9m^2 \\ &= (2m)(m) + (2m)(4) - 9m^2 \\ &= 2m^2 + 8m - 9m^2 \\ &= -7m^2 + 8m \end{aligned}$$

Example 3

\*distributive law TWICE!

$$\begin{aligned} &3(d + 5) - 2d(-4 + 4) \\ &= 3(d + 5) + 2d(d - 4) \\ &= (3)(d) + (3)(5) + (2d)(d) + (2d)(-4) \\ &= 3d + 15 + 2d^2 - 8d \\ &= 3d + 15 + 2d^2 - 8d \\ &= 2d^2 - 5d + 15 \end{aligned}$$

Practice: Expanding & Simplifying Algebraic Expressions

a.  $(2x - 7) + (4x - 5) + 3$

$$\begin{aligned} &= 2x - 7 + 4x - 5 + 3 \\ &= 6x - 9 \end{aligned}$$

b.  $3(4x + 6) + 7x$

$$\begin{aligned} &= (3)(4x) + (3)(6) + 7x \\ &= 12x + 18 + 7x \\ &= 19x + 18 \end{aligned}$$

c.  $2(9p + 5) - 8(6p + 2)$

$$\begin{aligned} &= 2(9p + 5) + 8(-6p - 2) \\ &= 18p + 10 - 48p - 16 \\ &= -30p - 6 \end{aligned}$$

d.  $6m + 3(2m + 5) + 7$

$$\begin{aligned} &= 6m + 6m + 15 + 7 \\ &= 12m + 22 \end{aligned}$$

e.  $-(2 + p) + (4p - 7)$

$$\begin{aligned} &= -(2 + p) + (4p - 7) \\ &= -2 - p + 4p - 7 \\ &= 3p - 9 \end{aligned}$$

f.  $-6k(k - 4) + 5k(3 - 9k)$

$$\begin{aligned} &= -6k^2 + 24k + 15k - 45k^2 \\ &= -51k^2 + 39k \end{aligned}$$

g.  $5x(2x + 3y) - x(3x - 4y)$

$$\begin{aligned} &= 5x(2x + 3y) + x(-3x + 4y) \\ &= 10x^2 + 15xy - 3x^2 + 4xy \\ &= 7x^2 + 19xy \end{aligned}$$

h.  $-x(4x + 6) - 7x^2$

$$\begin{aligned} &= -4x^2 - 6x - 7x^2 \\ &= -11x^2 - 6x \end{aligned}$$

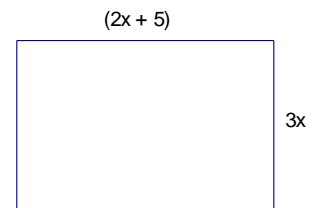
i.  $(2x + 7) - (2x + 4) - 3$

$$\begin{aligned} &= (2x + 7) + (-2x - 4) - 3 \\ &= 2x + 7 - 2x - 4 - 3 \\ &= 0 \end{aligned}$$

j. Find an algebraic expression for the area and perimeter of the following:

$$\begin{aligned} \text{Area} &= L \times w \\ &= 3x(2x + 5) \\ &= 6x^2 + 15x \end{aligned}$$

$$\begin{aligned} P &= 2(L + w) \\ &= 2(2x + 5 + 3x) \\ &= 2(5x + 5) \\ &= 10x + 10 \end{aligned}$$



ANSWERS: a)  $6x - 9$ , b)  $19x + 18$ , c)  $-30p - 6$ , d)  $12m + 22$ , e)  $3p - 9$ , f)  $-51k^2 + 39k$ , g)  $7x^2 + 19xy$ , h)  $-11x^2 - 6x$ , i)  $0$ , j)  $A = 6x^2 + 15x$  and  $P = 10x + 10$