Polynomials: Monomial Multiplication—Explanation & Practice

<u>Multiplying monomials</u> is the easiest of the many kinds of polynomial multiplication problems. You <u>must</u> know how to multiply monomials in order to do all other polynomial multiplication problems. Recall that monomials are polynomials that look like:

$3, x, 4x, -5y, 6c^2, -7x^5y^4$

A monomial consists of a <u>coefficient</u> (the number part of the monomial) and a <u>variable raised to some power</u>. If the variable is absent, it must have been raised to the 0 power and was therefore equivalent to 1.

$4x^0 = 4(1) = 4$

To multiply monomials:
1. Multiply the coefficients
2. Multiply the variables, using the "multiplication of like bases" Exponent Law when it applies.

Examples

$(-3x)(4y) = (-3)(4)(x)(y) = -12xy$

$(7)(-6m) = (7)(-6)(m) = -42m$

$(-8)(-9) = 72$

$(5x^2)(6x^3) = (5)(6)(x^2)(x^3) = 30x^5$

$(-2x^3yz^4)(x^2z) = (-2)(1)(x^3)(x^2)(y)(z^4)(z) = -2x^5yz^5$

With practice you will be able to determine the product mentally without rewriting the expression.

Practice

Multiply.

1. $(3x)(5x) =$

2. $(-7y)(4) =$

3. $(5)(-9) =$

4. $(6x^2)(3) =$

5. $(8x^3)(7x^4) =$

6. $(10y^3z)(7xy^2) =$

7. $(m^4n)(2m^3n) =$

8. $(9x^2yz^3)(-7xy^4z^2) =$

For more practice, get Handout # 464.

Answers:

1. $15x^2$

2. $-28y$

3. -45

4. $18x^2$

5. $56x^7$

6. $70xy^5z$

7. $2m^7n^2$

8. $-63x^3y^5z^5$

To multiply a monomial times a polynomial: do a series of "mini-problems" using multiplication of monomials.

Example 1

$5m(2n-7)$

$(5m)(2n) + (5m)(-7)$ rewrite (or think of) the problem as several monomial · monomial "mini problems."

$10mn + (-35m)$

$10mn - 35m$ watch your signs!

Example 2

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

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

$6x^3 + (-3x^2) + (12x)$

$6x^3 - 3x^2 + 12x$

If it helps to write out the steps above, do it! But if you work the above problem mentally, you will **think**: "Positive $3x$ times positive $2x^2$ ($6x^3$) **and** positive $3x$ times negative x ($-3x^2$) **and** positive $3x$ times positive 4 ($+12x$)." As you determine each of these products, you write them with their signs.

$6x^3 - 3x^2 + 12x$

Practice

1. $6x(x - 7) =$ 2. $4y(y + 5) =$ 3. $-7(m + 3n) =$

4. $8xy(x - 3y) =$ 5. $-2x^2(3x^3 - 7) =$ 6. $6a(-2a^2 + 3a - 5) =$

7. $m^2n^3(3mn^4 - 2n) =$ 8. $-4x^2y(7x^2y^2 + 3xy - 8) =$

For more practice, get Handout # 465.

Answers:

1. $6x^2 - 42x$ 2. $4y^2 + 20y$ 3. $-7m - 21n$

4. $8x^2y - 24xy^2$ 5. $-6x^5 + 14\,x^2$ 6. $-12a^3 + 18a^2 - 30a$

7. $3m^3n^7 - 2m^2n^4$ 8. $-28x^4y^3 - 12x^3y^2 + 32x^2y$

480