

Multiplication of Polynomials

If the polynomials are functions we write: $(f * g)(x) = f(x)g(x) = f(x)*g(x)$

To multiply polynomials

- 1) Distribute each term of the first polynomial to the second polynomial
- 2) Distribute these terms to each term in parentheses.
 - a. (Apply the distributive property repeatedly)
- 3) Perform each multiplication.
- 4) Use the commutative property to rearrange, get like terms together (the sign stays with the term that follows, if no sign + is understood).
- 5) Combine like terms.
- 6) You want your final answer to be in Standard Form, that is, the highest degree term first, with lowest degree term last. Keep in mind the constant term has degree 0.

Examples:

1) Monomial with a polynomial

$$\begin{array}{ll} 5r^3(2r^2 - 3r - 4) & \text{Distribute} \\ 5r^3*2r^2 - 5r^3*3r - 5r^3*4 & \text{Multiply} \\ 10r^5 - 15r^4 - 20r^3 & \end{array}$$

2) Binomial with a polynomial

$$\begin{array}{ll} (4z - 2)(z^2 + 3z + 5) & \text{Distribute} \\ 4z(z^2 + 3z + 5) - 2(z^2 + 3z + 5) & \text{Distribute AGAIN!} \\ 4z*z^2 + 4z*3z + 4z*5 - 2*z^2 - 2*3z - 2*5 & \text{Multiply} \\ 4z^3 + 12z^2 + 20z - 2z^2 - 6z - 10 & \text{Commute} \\ 4z^3 + 12z^2 - 2z^2 + 20z - 6z - 10 & \text{Combine} \\ 4z^3 + 10z^2 + 14z - 10 & \end{array}$$

3) Polynomial with a polynomial

$$(2p^2 + 3p + 6)(3p^2 - 4p - 1)$$

Distribute

$$2p^2(3p^2 - 4p - 1) + 3p(3p^2 - 4p - 1) + 6(3p^2 - 4p - 1)$$

Distribute AGAIN!

$$2p^2 \cdot 3p^2 - 2p^2 \cdot 4p - 2p^2 \cdot 1 + 3p \cdot 3p^2 - 3p \cdot 4p - 3p \cdot 1 + 6 \cdot 3p^2 - 6 \cdot 4p - 6 \cdot 1$$

Multiply

$$6p^4 - 8p^3 - 2p^2 + 9p^3 - 12p^2 - 3p + 18p^2 - 24p - 6$$

Commute

$$6p^4 - 8p^3 + 9p^3 - 2p^2 - 12p^2 + 18p^2 - 3p - 24p - 6$$

Combine

$$6p^4 + p^3 + 4p^2 - 27p - 6$$