

MA 220, Lesson 3, Textbook Section 5.3
Multiplying Polynomials (part 1)

To multiply a polynomial by any monomial multiplier, use the distributive property.

Ex 1: $(4x^2 - 2x + 3)(5x)$

Ex 2: $4x^2(3x^3 - 2x^2 + 6x - 9)$

Be cautious when multiplying by a monomial with a negative coefficient. Be sure to distribute the negative sign.

Ex 3: $-4x(6x^3 - 2x + 1)$

When multiplying two binomials, the distributive property could be used; as illustrated below.

$$\begin{aligned}(4x - 3)(2x + 4) &= 4x(2x + 4) - 3(2x + 4) \\ &= 8x^2 + 16x - 6x - 12 \\ &\quad \quad \quad \begin{array}{cccc} F & O & I & L \end{array} \\ &= 8x^2 + 10x - 12\end{aligned}$$

However, as seen above; the word FOIL may be used to help students remember to multiply four pairs. F (first terms in each binomial are multiplied), O (outer terms in each binomial are multiplied), I (inner terms in each binomial), and L (last terms in each). There is a good picture on page 320 of the textbook that shows logically why FOIL works by illustrating the area of a rectangle (Figure 5.3).

Ex 4:

a) $(5a - 12)(3a + 4)$

b) $(6y + 5)(9y - 7)$

To multiply two polynomials, where one or both have three or more terms, you can use the same method (variation of the distributive property) as illustrated on previous page; each term of one polynomial must be multiplied by each term of the other polynomial. This can be done in either a horizontal or vertical format.

problem: $(2x - 3)(5x^2 + 9x - 1)$

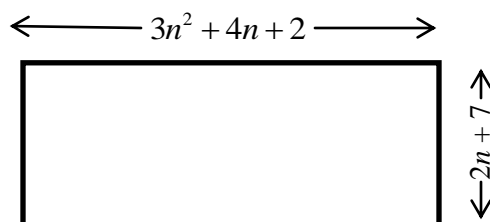
horizontal format:
 $= 2x(5x^2) + 2x(9x) + 2x(-1) - 3(5x^2) - 3(9x) - 3(-1)$
 $= 10x^3 + 18x^2 - 2x - 15x^2 - 27x + 3$
 $= 10x^3 + 3x^2 - 29x + 3$

vertical format: $\begin{array}{r} 5x^2 + 9x - 1 \\ \times \quad 2x - 3 \\ \hline -15x^2 - 27x + 3 \\ 10x^3 + 18x^2 - 2x \\ \hline 10x^3 + 3x^2 - 29x + 3 \end{array}$ Note: vertical format is similar to arithmetic multiplication

Ex 5:

$$(3u^2 - 2u + 7)(2u^2 + 9u - 3)$$

Ex 6: Find the area of the rectangle below.



Special Products:

Sum and Difference of two terms: $(u + v)(u - v) = u^2 - v^2$
 (= difference of the squares of the two terms)

Square of a Binomial: $(u + v)^2 = u^2 + 2uv + v^2$
 $(u - v)^2 = u^2 - 2uv + v^2$
 $= (1^{st})^2 \pm 2(1^{st})(2^{nd}) + (2^{nd})^2$

Ex 7: Find each product.

a) $(6a - 5)^2$

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

c) $(5 + 6u)^2$

Ex 8: $(8m - 3)^3$

Ex 9: Find a revenue function for a manufacturer whose demand function is $p = 250 - 0.01x$ (in dollars) and x is the number of units sold.

Find the revenue when 5000 units are sold.

Ex 10: The volume of a box with a rectangular base and sides is $V = LWH$. Represent the volume of a box $(n + 1)$ units wide, $(3n - 2)$ units long, and $(2n - 4)$ units high.