

**Geometry**  
**Multiplying Polynomial Expressions Notes**

Let's see the way each of these 3 methods simplifies  $(x + 3)(2x - 1)$ :

a. FOIL method:

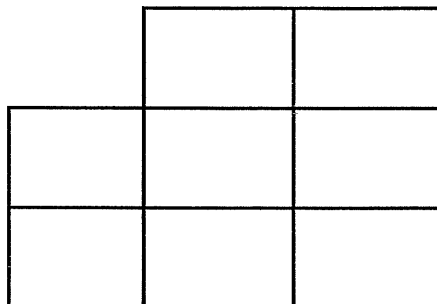
- Multiply each pair of terms that the acronym indicates: First terms, Outer terms, Inner terms, and Last terms.
- Simplify the products.

b. Old fashioned multiplication:

- Line up expressions, make sure to include zero's for missing terms
- Multiply like you did in 3<sup>rd</sup> grade

c. Box/Grid (Punnett square) method:

- Create a grid with each term of one polynomial listed across the top and each term of the second polynomial listed down one side.
- Fill in each box within the grid by multiplying the row by the column.
- Simplify the products.



From previous study in mathematics, we know that exponents show how many factors are being multiplied.

**Example 2:** Expand each expression.

a.  $-3x^4 =$  \_\_\_\_\_                      b.  $2m^3p^2 =$  \_\_\_\_\_

c.  $(5e^{2f})(-4e^{3f^2}) =$  \_\_\_\_\_

**Reasoning:** How is the product of two monomials simplified? Simplify Example 2c.

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**Example 3:** Simplify.

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

b.  $(-8a^3b)(2a^2 + 3ab - 4ab^2)$

**Example 4:** Simplify.

a.  $(3b + 7)(2b + 4)$

b.  $(2y - 5)(2y + 5)$

c.  $(6g - 7)^2$

d.  $(8e^3 + 2)(-3e^4 - 1)$

e.  $(7m - 2)(3m^2 + 4m - 8)$

f.  $9w(2w - 3) + (8w + 5)(3w - 4)$

Let's see the way each of these 3 methods simplifies  $(x + 3)(2x - 1)$ :

a. FOIL method: (Distribute)

- Multiply each pair of terms that the acronym indicates: First terms, Outer terms, Inner terms, and Last terms.
- Simplify the products.

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

b. Old fashioned multiplication:

- Line up expressions, make sure to include zero's for missing terms
- Multiply like you did in 3<sup>rd</sup> grade

$$\begin{array}{r}
 x+3 \\
 \times 2x-1 \\
 \hline
 -x-3 \\
 2x^3+6x0 \\
 \hline
 2x^2+5x-3
 \end{array}$$

c. Box/Grid (Punnett square) method:

- Create a grid with each term of one polynomial listed across the top and each term of the second polynomial listed down one side.
- Fill in each box within the grid by multiplying the row by the column.
- Simplify the products.

	$2x$	$-1$
$x$	$2x^2$	$-x$
$3$	$6x$	$-3$

$$2x^2 + 5x - 3$$

From previous study in mathematics, we know that exponents show how many factors are being multiplied.

**Example 2:** Expand each expression.

a.  $-3x^4 = -3 \cdot x^4$

b.  $2m^3p^2 = 2 \cdot m^3 \cdot p^2$

c.  $(5y^2x)(-4y^3x^2) = 5 \cdot y^2 \cdot x^1 \cdot -4 \cdot y^3 \cdot x^2$

**Reasoning:** How is the product of two monomials simplified? Simplify Example 2c.

$$-20y^5x^3$$

Example 3: Simplify,

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

$$-15x^5 + 5x^4 - 35x^3 + 20x^2$$

b.  $(-8a^3b)(2a^2 + 3ab - 4ab^2)$

$$-16a^5b - 24a^4b^2 + 32a^4b^3$$

Example 4: Simplify.

a.  $(3b + 7)(2b + 4)$

$$3b(2b + 4) + 7(2b + 4)$$

$$6b^2 + 12b + 14b + 28$$

$$6b^2 + 26b + 28$$

b.  $(2y - 5)(2y + 5)$

$$2y(2y + 5) - 5(2y + 5)$$

$$4y^2 + 10y - 10y - 25$$

$$\boxed{4y^2 - 25}$$

c.  $(6g - 7)^2$   $(6g - 7)(6g - 7)$

$$36g^2 - 84g + 49$$

d.  $(8e^3 + 2)(-3e^4 - 1)$

$$8e^3(-3e^4 - 1) + 2(-3e^4 - 1)$$

$$\boxed{-24e^{12} - 8e^3 - 6e^4 - 2}$$

e.  $(7m - 2)(3m^2 + 4m - 8)$

$$3m^2 + 4m - 8$$

$$\times \quad 7m - 2$$

$$-6m^2 - 8m + 16$$

$$+21m^3 + 28m^2 - 56m \quad 0$$

$$\boxed{21m^3 + 22m^2 - 64m + 16}$$

f.  $9w(2w - 3) + (8w + 5)(3w - 4)$

$$9w(2w - 3) + 8w(3w - 4) + 5(3w - 4)$$

$$18w^2 - 27w + 24w^2 - 32w + 15w - 20$$

$$42w^2 - 59w + 15w - 20$$

$$\boxed{42w^2 - 44w - 20}$$