

Algebra 2  
3.1 Multiplying Polynomials

Multiply any two polynomials:  
DISTRIBUTE LOTS OF TIMES!

$$\begin{aligned} & (4x^4y - 7x^2y + 3y) \cdot (-3x^2y + 2y) \\ & -3x^2y(4x^4y - 7x^2y + 3y) + 2y(4x^4y - 7x^2y + 3y) \\ & -12x^6y^2 + \underline{21x^4y^2} - \underline{9x^2y^2} + \underline{8x^4y^2} - \underline{14x^2y^2} + 6y^2 \\ & -12x^6y^2 + 29x^4y^2 - 23x^2y^2 + 6y^2 \end{aligned}$$

Try this: Multiply

$$(p^2q + 2pq + 2q) \cdot (2p^2q - pq + q)$$

$$p^2q(2p^2q - pq + q) + 2pq(2p^2q - pq + q) + 2q(2p^2q - pq + q)$$
$$2p^4q^2 - p^3q^2 + p^2q^2 + 4p^3q^2 - 2p^2q^2 + 2pq^2 + 4p^2q^2 - 2pq^2 + 2q^2$$

$$2p^4q^2 + 3p^3q^2 + 3p^2q^2 + 2q^2$$

## Multiplying Binomials

# F-O-I-L

first      outer      inner      last

$$\begin{matrix} \text{FO} & & \text{IL} & & \\ \text{F} & & \text{I} & & \text{O} \\ \text{O} & & \text{L} & & \text{I} \end{matrix} \\ (3xy + 2x)(x^2 + 2xy^2)$$

$$\begin{matrix} \text{First} & \text{Outer} & \text{Inner} & \text{Last} \\ 3xy \cdot x^2 & 3xy \cdot 2xy^2 & 2x \cdot x^2 & 2x \cdot 2xy^2 \end{matrix}$$

$$3x^3y + 6x^2y^3 + 2x^3 + 4x^2y^2$$

## Squares of Binomials

# F-O-I-L

FoIL  $(2x + 3y)^2$  *2 copies of same thing*

$(2x + 3y)(2x + 3y)$

F	O	I	L
$2x \cdot 2x$	$2x \cdot 3y$	$3y \cdot 2x$	$3y \cdot 3y$
$4x^2$	$+ 6xy$	$+ 6xy$	$+ 9y^2$

$$4x^2 + 12xy + 9y^2$$

## Products of Sums & Differences

# F-L

first      last

Outer and Inner terms will cancel

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

$$\begin{array}{cccc} \text{F} & \text{O} & \text{I} & \text{L} \\ y \cdot y & -5 \cdot y & 5 \cdot y & 5 \cdot -5 \end{array}$$

$$y^2 - 5y + 5y - 25$$

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

## Cube of a Binomial

Break apart  $x^3$  into  $x \cdot x^2$ .

Foil the  $x^2$  and then distribute the  $x$  through it.

$$\begin{aligned} (x+2)^3 &= \underbrace{(x+2)(x+2)}_{x^2+2x+2x+4} (x+2) \\ &= (x^2+4x+4)(x+2) \\ &= x(x^2+4x+4) + 2(x^2+4x+4) \\ &= \underline{x^3} + \underline{4x^2} + \underline{4x} + \underline{2x^2} + \underline{8x} + 8 \\ &= \boxed{x^3 + 6x^2 + 12x + 8} \end{aligned}$$

$$(5m^2 - 4n^3)^3$$

$$(5m^2 - 4n^3)(5m^2 - 4n^3)(5m^2 - 4n^3)$$

F	O	I	L
$5m^2 \cdot 5m^2$	$5m^2 \cdot -4n^3$	$-4n^3 \cdot 5m^2$	$-4n^3 \cdot -4n^3$
$25m^4$	$-20m^2n^3$	$-20n^3m^2$	$+16n^6$

$$(25m^4 - 40m^2n^3 + 16n^6)(5m^2 - 4n^3)$$

$$5m^2(25m^4 - 40m^2n^3 + 16n^6) - 4n^3(25m^4 - 40m^2n^3 + 16n^6)$$

$$125m^6 - 200m^4n^3 + 80m^2n^6 - 100n^3m^4 + 160m^2n^6 - 64n^9$$

$$125m^6 - 300m^4n^3 + 240m^2n^6 - 64n^9$$

Try this: multiply

$$1. (2x-5)(2x+5)$$

$$4x^2 + 10x - 10x - 25$$
$$\boxed{4x^2 - 25}$$

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

$$(4x-3)(4x-3)(4x-3)$$

$$16x^2 - 12x - 12x + 9$$

$$4x(16x^2 - 24x + 9) - 3(16x^2 - 24x + 9)$$

$$64x^3 - 96x^2 + 36x - 48x^2 + 72x - 27$$

$$\boxed{64x^3 - 144x^2 + 108x - 27}$$



# Homework

NS

Algebra 2

3.1 Multiplying Polynomials

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

Find each product.

1)  $(2a^2 - 5a + 2)(7a^2 + 8a - 3)$

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

3)  $(7m^2 - 5m - 1)(3m^2 - m + 2)$

4)  $(6a + 5b)(6a + 8b)$

5)  $(6x + 7y)(4x + 4y)$

6)  $(n - 7)(3n - 8)$

7)  $(7n - 4)(7n + 4)$

8)  $(-8b + 1)^2$

$$9) (2x^2 - 7y^2)^2$$

$$10) (-4a - 6b)^2$$

$$11) (7 - 4x)(7 + 4x)$$

$$12) (-6p + 3)(-6p - 3)$$

$$13) (-6x - 8)(-6x + 8)$$

$$14) (-8k^3 + 6)^3$$

$$15) (3p + 2)^3$$

$$16) (-7n + 8)^2$$

### Answers to 3.1 Multiplying Polynomials

- 1)  $14a^4 - 19a^3 - 32a^2 + 31a - 6$     2)  $12n^4 - 10n^3 + 26n^2 + 21n + 6$   
3)  $21m^4 - 22m^3 + 16m^2 - 9m - 2$     4)  $36a^2 + 78ab + 40b^2$     5)  $24x^2 + 52xy + 28y^2$   
6)  $3n^2 - 29n + 56$     7)  $49n^2 - 16$     8)  $64b^2 - 16b + 1$   
9)  $4x^4 - 28x^2y^2 + 49y^4$     10)  $16a^2 + 48ab + 36b^2$     11)  $49 - 16x^2$   
12)  $36p^2 - 9$     13)  $36x^2 - 64$     14)  $64k^6 - 96k^3 + 36$     15)  $9p^2 + 12p + 4$   
16)  $49n^2 - 112n + 64$