

Lesson 3: Multiplication of Two Binomials

Friday, August 31, 2018 2:35 AM

Polynomial Operations Lesson #3: Multiplication of Two Binomials

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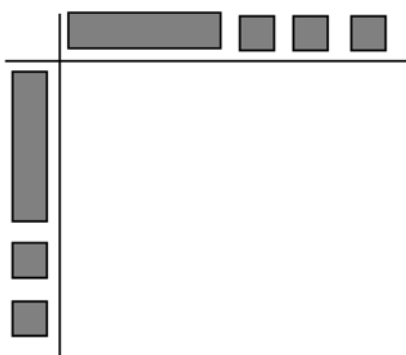
Multiplying Two Binomials using Area Diagrams

In the last lesson, we multiplied a monomial by a polynomial. In this lesson, we extend the process to the product of two binomials.

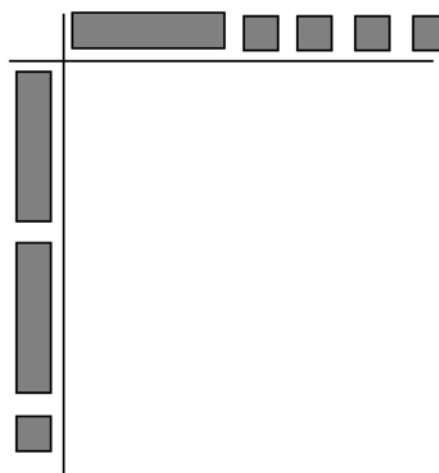


Complete the algebra tile diagrams and determine the binomial products.

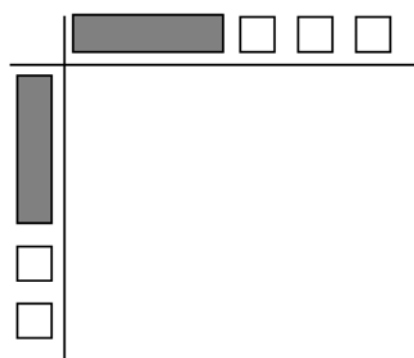
a) $(x + 3)(x + 2) = x^2 + 5x + 6$



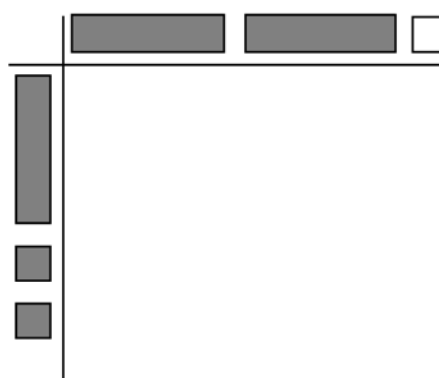
b) $(2x + 1)(x + 4) = 2x^2 + 9x + 4$



c) $(x - 3)(x - 2) = x^2 - 5x + 6$



d) $(2x - 1)(x + 2) = 2x^2 + 3x - 2$



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In class example 1a), we used an algebra tile diagram to show that the product $(x+3)(x+2)$ could be expressed in simplified expanded form as $x^2 + 5x + 6$.

The algebra tile diagram used to model $(x+3)(x+2)$ can be modified into the following area diagram which shows that the product of two binomials is equivalent to four monomial products.

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



Use an area diagram like the one above to determine the product of each of the following binomials.

a) $(5x-6)(2x+1)$

	$5x$	-6
$2x$	$10x^2$	$-12x$
1	$5x$	-6

$= 10x^2 - 7x - 6$

b) $(a^2-5)(a^2-8)$

	a^2	-5
a^2	a^4	$-5a^2$
-8	$-8a^2$	40

$a^4 - 13a^2 + 40$

c) $(3p+2q)(p+9q)$

d) $(a+b)(c+d)$

	a	b
c	ac	bc
d	ad	bd

$ac + bc + ad + bd$

An area diagram can be used to show that the multiplication of two, two-digit numbers can be performed as four separate products.

For example the product 32×34 can be determined without a calculator, by long multiplication or by an area diagram as follows:

Long Multiplication

$$\begin{array}{r} 32 \\ \times 34 \\ \hline 128 \\ 96 \\ \hline 1088 \end{array}$$

Area Diagram

	30	2
30	900	60
4	120	8

$$\begin{aligned} 32 \times 34 \\ &= 900 + 120 + 60 + 8 \\ &= 1088 \end{aligned}$$



Use an area diagram and no calculator to determine the following products.

a) 43×51

b) 76×82

Complete Assignment Questions #1 - #3

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Multiplying Two Binomials using the Distributive Property

$$a(b+c)$$

In the area diagram modelling $(x+3)(x+2)$, we noted that there were four separate monomial products involved in the expansion. These products are simply the extension of the distributive property to binomial products.

Distributive property for binomials

$$(a+b)(c+d) = a(c+d) + b(c+d) = ac + ad + bc + bd$$



Use the distributive property to determine the following products.

a) $(x+3)(x+2)$ b) $(a-7)(2a-1)$ c) $(p-8)(q-8)$

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

$$\begin{aligned} a(2a-1) - 7(2a-1) &= 2a^2 - 1a - 14a + 7 \\ &= 2a^2 - 15a + 7 \end{aligned}$$

d) $(x+4y)(x-5y)$ e) $(9a^2-1)(5a^3+6)$

$$\begin{aligned} x(x-5y) + 4y(x-5y) &= x^2 - 5xy + 4xy - 20y^2 \\ &= x^2 - xy - 20y^2 \end{aligned}$$

The method used in the distributive property can be simplified by noticing that the four monomial products $(a+b)(c+d) = ac + ad + bc + bd$ can be memorized using the acronym FOIL.

F – first term in each bracket ie ac
O – outside terms ie ad
I – inside terms ie bc
L – last term in each bracket ie bd



Use FOIL to determine each product.

a) $(x+6)(x+4)$

$$\begin{aligned} x^2 + 4x + 6x + 24 &= x^2 + 10x + 24 \end{aligned}$$

b) $(y-7)(y+2)$

$$\begin{aligned} y^2 + 2y - 7y - 14 &= y^2 - 5y - 14 \end{aligned}$$

c) $(3x+1)(x-5)$

$$\begin{aligned} 3x^2 - 15x + 1x - 5 &= 3x^2 - 14x - 5 \end{aligned}$$

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

$$\begin{aligned} &= (6a-5b)(6a-5b) \\ &= 36a^2 - 30ab - 30ab + 25b^2 \\ &= 36a^2 - 60ab + 25b^2 \end{aligned}$$

Complete Assignment Questions #4 - #9

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