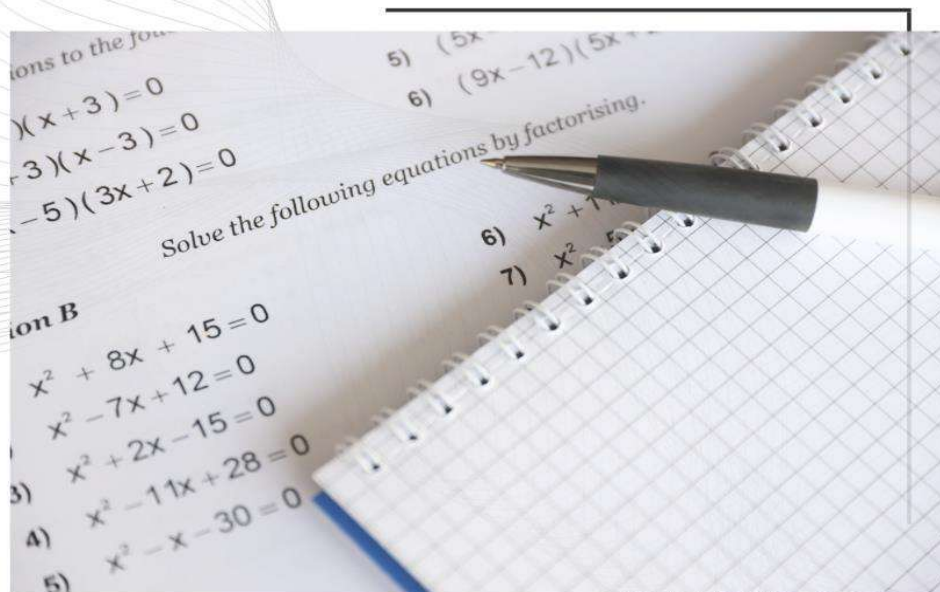


LEARNING MODULE 6

Multiplying Simple Monomials and Binomials with Simple Binomials with Simple Binomials and Multinomials, Using the Distributive Property with Various Techniques and Models



GRADE-8

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MULTIPLYING SIMPLE MONOMIALS AND BINOMIALS WITH SIMPLE BINOMIALS AND MULTINOMIALS, USING THE DISTRIBUTIVE PROPERTY WITH VARIOUS TECHNIQUES AND MODELS

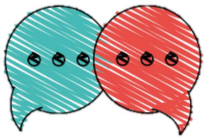
Hey there, future math whizzes! Welcome to our main course on multiplying monomials and binomials. Get ready to dive into the exciting world of algebraic expressions! Throughout this course, we'll be sharpening our skills in multiplying simple monomials and binomials using the distributive property. But fear not, we'll break down each step into bite-sized pieces, making sure you understand every bit of it. From basic techniques to more complex models, we'll guide you through it all. So, buckle up, and let's embark on this mathematical journey together!



Learning Objectives:

At the end of this module, students will be able to:

- Analyze algebraic expressions involving simple monomials, binomials, and multinomials;
- Apply various techniques for multiplying monomials and binomials with simple binomials and multinomials; and
- Demonstrate accuracy in using the distributive property to multiply simple monomials and binomials with simple binomials and multinomials.



How to Multiply Monomials

Multiplying monomials is a method for multiplying a monomial with other polynomials. The monomial is multiplied with the individual terms of the polynomial and then simplified further to get the resultant polynomial. When multiplying a monomial by a binomial and multinomial, we follow the distributive law of multiplication.

- **Multiplying Monomial by a Binomial**

Example: Multiply $(3x)(2x - 9)$.

Solution:

Steps to solve $(3x)(2x - 9)$:

Step 1: Multiply the monomial with the first term of the binomial.

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

Step 2: Multiply the monomial with the second term of the binomial.

$$= (3x)(-9) = -27x$$

Step 3: Write both the terms obtained in Step 1 and Step 2 together with their corresponding signs.

$$= 6x^2 - 27$$

Answer: $6x^2 - 27$



- **Multiplying Monomial by a Trinomial (Multinomial)**

Example: Multiply $(2x^2)(3x + 9xy - 6)$.

Solution:

Steps to solve $(2x^2)(3x + 9xy - 6)$:

Step 1: Multiply the monomial with the first term of the trinomial.

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

Step 2: Multiply the monomial with the second term of the trinomial.

$$= (2x^2)(9xy) = 18x^2y$$

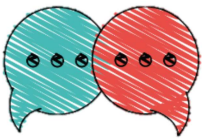
Step 3: Multiply the monomial with the third term of the trinomial.

$$= (2x^2)(-6) = -12x^2$$

Step 4: Write all three terms together with their corresponding signs.

$$= 6x^3 + 18x^2y - 12x^2$$

$$\text{Answer: } 6x^3 + 18x^2y - 12x^2$$



How to Multiply Binomials?

Multiplying binomials is similar to the multiplication of any 2-digit number but uses the concept of multiplication of algebraic expressions. The terms of one binomial are multiplied by the terms of the other binomial. After this step, the algebraic sum of these products is taken. Let us learn about the different methods that are used to multiply binomials.



- **Multiplying Binomial using Distributive Property**

Example: Let's take two binomials $(x+2)$ and $(x+3)$ and multiply them with the help of the following steps.

Step 1: To multiply $(x + 2)(x + 3)$, we will take the first term of the first binomial and multiply it with the second binomial,

$$x(x + 3)$$

Step 2: Now, we will take the second term of the first binomial and multiply it with the second binomial,

$$2(x + 3)$$

Step 3: We will combine the results of Step 1 and Step 2 and add them,

$$[x(x + 3)] + [2(x + 3)]$$

Step 4: Now we will apply the distributive property to $x(x + 3)$ and $2(x + 3)$ and individually expand them,

$$x(x + 3) = x^2 + 3x \quad \text{and}$$

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

Step 5: We will now add the results obtained in Step 4 by combining the like terms,

$$x^2 + 3x + 2x + 6$$

$$= x^2 + 5x + 6$$

Thus, the product of $(x + 2)(x + 3)$ is $x^2 + 5x + 6$. Let us understand this with the help of the calculation shown below.

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



• Multiplying Binomials Using the FOIL Method

The FOIL method is the most common strategy for multiplying binomials. You can use it as an alternative to the box method.

Example: Write the following in expanded form. Note that FOIL is an acronym that stands for FIRST – OUTER – INNER – LAST.

Step 1: FIRST - Multiply the first terms of each binomial together.

$$(8 - 5x)(8 - 5x)$$

64

First
O
I
L

Step 2: OUTER - Multiply the outer terms of each binomial together.

$$(8 - 5x)(8 - 5x)$$

64 - 40x

First
Outer
I
L

Step 3: INNER - Multiply the inner terms of each binomial together.

$$(8 - 5x)(8 - 5x)$$

64 - 40x - 40x

First
Outer
Inner
L



Step 4: LAST - Multiply the last terms of each binomial together.

$$\begin{array}{c} \text{First} \\ \text{Outer} \\ \text{Inner} \\ \text{Last} \end{array} \begin{array}{c} (8 - 5x)(8 - 5x) \\ \circ \quad \bullet \quad \circ \quad \bullet \\ 64 - 40x - 40x + 25x^2 \end{array}$$

Now you have four terms: 64 , $-40x$, $-40x$, and $25x^2$

Step 5: Notice that there are two like terms that can be combined as follows:

$$\begin{array}{c} (8 - 5x)(8 - 5x) \\ 64 - 40x - 40x + 25x^2 \end{array}$$

Step 6: The final step is to rearrange the above expression into $ax^2 + bx + c$ form.

$$\begin{array}{c} (8 - 5x)(8 - 5x) \\ 25x^2 - 80x + 64 \end{array}$$

Answer: $25x^2 - 80x + 64$



- Multiplying Binomials Using the Vertical Method**

Multiplying binomial using the vertical method is quite similar to the vertical multiplication of whole numbers. This method applies to all polynomial multiplications.

Example: Let's consider the binomials $(x + 2)$ and $(x + 3)$ and multiply them using the vertical method.

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

Step 1: Place the binomials one below the other as shown above.

Step 2: Start with the second or the right-hand term of the bottom binomial, 2, and multiply this value with both the terms of the top binomial individually that

$$\begin{aligned}
 (2 \times x) + (2 \times 3) \\
 = 2x + 6
 \end{aligned}$$

Step 3: Now let's consider the first or the left-hand term of the bottom binomial, x , and multiply this value with both the terms of the top binomial individually that is

$$(x \times x) + (3 \times x) = x^2 + 3x$$

Step 4: Write the result obtained in the previous step in the second row in such a way that the like terms are lined up.

Step 5: Finally, add the columns to obtain the result which is

$$x^2 + 5x + 6$$



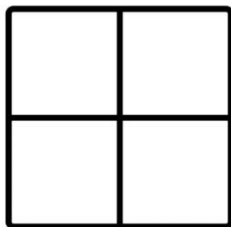
- **Multiplying Binomials Using the Box Method Area Model:**

The box method for multiplying binomials is also known as the area model method.

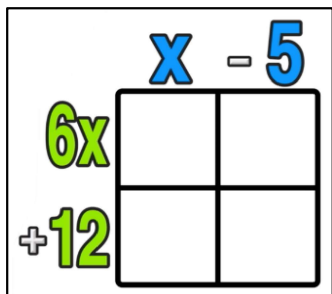
Example: Write the following in the expanded form.

$$(x - 5)(6x + 12)$$

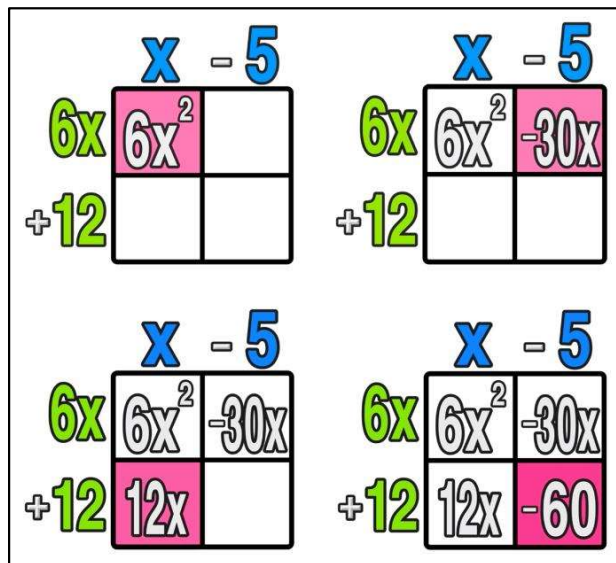
Step 1: To use the area model method or box method for multiplying binomials, start by drawing a 4x4 box.



Step 2: Then, write the terms of the first binomial [(x-5) in this example] along the top row and the terms of the second binomial [(6x+12) in this example] along the left column of the box as follows:

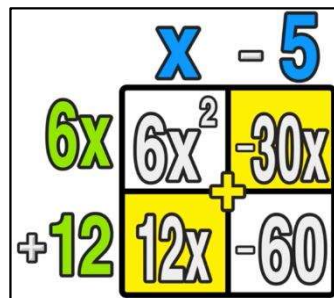


Step 3: Next, multiply the terms of each corresponding column and row (like a bingo board) as follows:

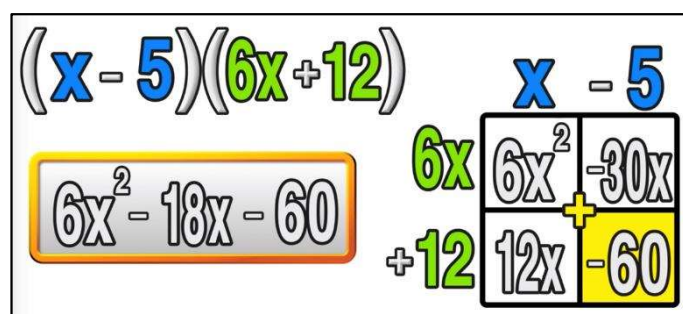


Now you have four terms: $6x^2$, $-30x$, $12x$, and -6

Step 4: Notice that $-30x$ and $12x$ are like terms.



Step 5: The final step is to combine like terms ($-30x + 12x = -18x$) and write your answer in expanded form as follows:



Answer: $6x^2 - 18x - 60$