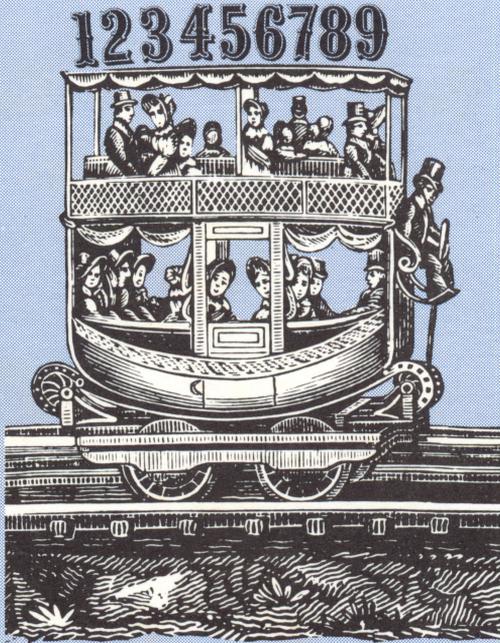


# *Binomial Multiplication*



**MATHEMATICS**



**MICROCOMPUTER WORKSHOPS COURSEWARE**

# ***Binomial Multiplication***

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designed by Don Ross

Subject: Mathematics - Algebra Series

Grade Levels: 9 - 12

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## Program Objective

To give students practice in binomial multiplication using the **FOIL** method.

## Program Description

*Binomial Multiplication* is designed to help students practice multiplying two binomials. Problems, where **A**, **B**, **C**, and **D** are one-digit integers, are randomly generated. The types of problems and the probability of appearance are as follows:

**(AX + B) (CX + D)** where the product is a trinomial 50%  
**(AX + BY) (CX + DY)** where the product is a trinomial 30%  
**(AX + B) (AX - B)** where the product is a binomial 10%  
**(AX + BY) (CX + DZ)** where the product contains  
no like terms 10%

The screen is divided into two parts, the problem area and the work area. Using the screen as a worksheet, the student enters the product one term at a time. A tutorial explaining the FOIL method of binomial multiplication becomes available if the student is unable to perform the multiplication properly. An error analysis is provided after each problem and at the end of each set.

## Program Sequence

There may be minor differences between the *Apple* version of this program, upon which the following summary is based, and versions of the program written for other computers.

The program begins with presentation of the **Main Menu**:

- 1) **Instructions**
- 2) **Learn about the FOIL method**
- 3) **Work on problems**
- 4) **Exit the program**

First-time users should read the instructions and learn about the **FOIL** method by selecting **1** and **2**. Item **2** contains a step-by-step tutorial on this method of multiplying binomials.

The word "**FOIL**" is an acronym for the sequence of steps that the student must go through in order to carry out binomial multiplication:

- a) multiply the **F**irst terms of each binomial
- b) multiply the **O**utside terms of each binomial
- c) multiply the **I**nside terms of each binomial
- d) multiply the **L**ast terms of each binomial.

After these four separate operations are carried out, the resulting products are added together. Then this sum of products is simplified by combining similar terms (*i.e.*, terms that contain the same variables with the same exponents).

The whole process can be seen in the following example:

To multiply  $(3X - 2Y)(X + 7)$  using the **FOIL** method, the student must compute the four products and then add them together.

Multiplication yields:

$$\begin{aligned} \mathbf{F:} \quad & (3X)(X) = 3X^2 \\ \mathbf{O:} \quad & (3X)(7) = 21X \\ \mathbf{I:} \quad & (-2Y)(X) = -2XY \\ \mathbf{L:} \quad & (-2Y)(7) = -14Y \end{aligned}$$

Addition of these products yields:

$$3X^2 + 21X - 2XY - 14Y$$

This expression cannot be simplified, because no terms are similar. This is the final answer.

Sometimes the sum of the products *can* be simplified. For example, using the **FOIL** method to multiply  $(X - 2)(2X + 3)$  results in the following:  $2X^2 + 3X - 4X - 6$ . This polynomial expression can be simplified, because it contains the similar terms  $3X$  and  $-4X$  which can be combined to produce  $-X$ . The final result is  $2X^2 - X - 6$ .

Sometimes the sum of the **O**-product and the **I**-product equals zero. For example:  $(X - 7)(X + 7)$  computed by the **FOIL** method, equals  $X^2 + 7X - 7X - 49$ . Because the sum of the **O**-product ( $+ 7X$ ), and the **I**-product ( $- 7X$ ), equals zero, the middle terms drop out, and the final result is  $X^2 - 49$ .

When the student is ready to try some problems, item **3) Work on problems** should be selected from the **Main Menu**. The number of problems to be worked on (1-9) must then be chosen, and a screen similar to the following will appear:

**Problem #1**

$(-3X + Y)(-4X - 4Y)$

---

**Product of the first terms:\_\_\_**

If able to enter the product of the first terms, the student is asked, in succeeding frames, to enter the products of outside terms, inside terms, and last terms. (Exponents are automatically placed in the correct, superscript position.)

If at any point the student is unable to enter the correct product, the program draws arrows to the terms to be multiplied together, and the student is asked to try again:

**Problem #1**

$$\begin{array}{c} \begin{array}{ccc} & \longleftarrow & \\ & \downarrow & \downarrow \\ (-3X + Y) & & (-4X - 4Y) \end{array} \\ 12X^2 \end{array}$$

---

**Product of the outside terms: \_\_**

If still unable to come up with the correct product, the student is given the answer, which must then be entered.

If the student makes an error in simplifying like terms, the program draws arrows to the terms that should be combined.

After all four correct products have been entered, and like terms correctly identified and combined, the final result of the binomial multiplication will be shown.

**Error Analysis**

At the end of each problem, an error summary is shown, and the student may either continue to the next problem by pressing **RETURN**, or quit by pressing **Q**.

A total error analysis, at the end of each set, shows the average number of errors of each kind.

## **Disk Loading Instructions**

Apple **II**, **II+**, //e, //c

1. Remove the disk from its sleeve and place it with the label up and near you into the disk drive. (If you have more than one disk drive, place the disk in drive 1.)
2. Close the door of the disk drive and turn on the computer. Make sure that your TV or monitor is also on.

For the Apple //e and //c computers, the **Caps Lock** key should be depressed.

3. The program should run automatically. If this is not the case, turn off your power switches and check to see that you have connected all your equipment correctly.

*If you have the old Apple **II** with the non-autostart ROM, you will see an asterisk (\*) when you turn on the power switch. Type the number **6**, and then while holding down the key marked **CTRL** press **P**, release both keys, and press the key labeled **RETURN**. The program should now run automatically.*

## Radio Shack TRS-80 Models III, 4

1. Remove the disk from its sleeve and place it with the label up and facing you in the disk drive.  
(If you have more than one disk drive, place the disk in Drive  $\emptyset$ .)
2. Close the door of the disk drive and turn on the computer.
3. The program should run automatically. If this is not the case, check to make sure that your equipment is properly connected and that you have followed the previous instructions correctly.

Commodore 64 (model 1541 disk drive)

Commodore PET (models 4040 or 2031 disk drive)

1. *First*, make sure that all the power switches are turned off. Then, turn on the computer power switch and the switch in the back of the drive. Make sure that your TV or monitor is also on.

2. Remove the disk from its sleeve and place it with the label up and near you into the disk drive. (If you have more than one disk drive, place the disk in drive Ø.) Close the door of the disk drive.

The screen should display the Commodore logo, along with some other information. The final line should read **READY** and there should be a blinking cursor below that. If your computer does not show this, check to make sure your equipment is properly connected and that you have followed the previous instructions correctly.

3. Type **LOAD "\*" , 8** and press **RETURN**.

The red light on the disk drive should light up and the screen will show the following message:

**SEARCHING FOR \***  
**LOADING**  
**READY.**

If the computer responds with any other message (such as **DEVICE NOT PRESENT**, or **FILE NOT FOUND**), make sure that all of your components are connected correctly and try again from step 1.

4. Now type **RUN** and press the **RETURN** key to begin the program.

## IBM PC, PCjr

**Note:** The disk(s) contained in this package will run on either a single-sided or double-sided PC disk drive, using either DOS 1.1 or 2.0 or 2.1.

This disk contains an autoboot program. To use it, you must have DOS and BASICA on the program disk. This can be done by using our INSTALL program. Use the following instructions:

1. Users with two disk drives, place the DOS disk in Drive A and the program disk in Drive B and turn on your computer. Users with one disk drive, place the DOS disk in Drive A. (*PCjr users: make sure the BASIC cartridge is plugged into the left cartridge port.*)

2. When the request to enter the date and time appears, press **ENTER** twice.

3. When **A >** appears, type: **B:INSTALL** and press **ENTER**.

Users with one disk drive: every time the computer prompts you for Drive B, insert the program disk. The prompt for Drive A means insert the DOS disk. When the files have been transferred, put the DOS disk away, and boot the program disk.

## **FOR YOUR INFORMATION**

**Microcomputer Workshops Courseware** uses high quality disks that are verified during reproduction. Occasionally, a few disks will become damaged in transit.

If you think this disk is defective, please try the suggestions listed below.

If these fail, mail the defective disk to us and we will send you a **free** replacement disk immediately.

### **Disk Hints**

- Gently center the disk when you insert it into the drive as some disk drives can not read misaligned disks.
- Turn your computer off for 10 seconds, then back on again.
- Have your drive speed checked: If you are having recurring problems with disks and data, have your repairperson check your drive speed. There are inexpensive programs available that allow you to do your own adjusting.

### **Disk Care**

- Always keep your disk away from magnetic devices such as televisions, monitors, magnets, and motors.
- Store your disk away from extremes of heat and cold.
- Never touch the parts of the disk that show through the sleeve.
- Avoid putting the disk in any location where it might get dusty. Always keep it in the jacket when you're not using it.
- Never write on the disk sleeve with a ball-point pen.



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