



TEXAS INSTRUMENTS HOME COMPUTER

MILLIKEN MATH SEQUENCES:

LAWS OF ARITHMETIC

EDUCATION

SOLID STATE CARTRIDGE

A self-paced "tutor" which presents mathematical principles to help your child develop strong math skills. Suitable for children from grades 4 through 8.



Quick Reference Guide

Note that the key sequences required to access special functions depend on the type of computer console you have. Important keystroke sequences are summarized here for your quick reference.

TI-99/4 *TI-99/4A*

ENTER	ENTER	Proceeds to next problem or continues problem after an incorrect answer has been given. Also used to enter Beginning Level and Name.
SHIFT S (←)	FCTN S (←)	Allows you to move the cursor back to correct errors on the "Levels 1-19" screen before pressing ENTER.
E	E	Tells the computer you want to quit ("exit") the work session or leave a particular level.
SHIFT Q (QUIT)	FCTN = (QUIT)	Returns to the master title screen when you want to remove the cartridge from the computer after you are finished using it.

Milliken Math Sequences: Laws of Arithmetic

This Solid State Cartridge is designed to be used with the Texas Instruments Home Computer. One in a series of twelve cartridges, it can help your child develop the strong math skills needed in today's and tomorrow's world. Suitable for children from grades four through eight.

Programmed by: John Plaster

Book developed and written by: Staff members of Texas Instruments Creative Communications.

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A NOTE TO PARENTS

Children need strong math skills to solve today's and tomorrow's problems. The Milliken Math Sequences, along with the TI Home Computer, can help your child meet these challenges. The series allows children to work at their own pace and on the skill level at which they need practice. Children find that learning with the computer is fun, challenging, and motivating. The computer never tires of repetition or loses patience—it's like having a private math tutor!

The Milliken Math Sequences, developed for Texas Instruments by Milliken Publishing Company, consists of twelve Solid State Cartridges. Each cartridge concentrates on a different skill area in mathematics, such as addition, subtraction, decimals, or laws of arithmetic. By providing different levels of difficulty, the series is suitable for children from the kindergarten age through grade eight.

The Laws of Arithmetic cartridge is divided into 19 levels of difficulty, covering material generally taught in grades four through eight. The program introduces your child to the basic laws of arithmetic: the property of zero, the principles of identity elements, and the commutative, associative, and the distributive properties.

The program also presents the applications of the laws of arithmetic. For instance, the commutative law, which states that the *order* of factors may be changed without affecting the resulting product, is applicable for addition and multiplication. The associative law, which states that the *grouping* of factors may be changed without affecting the resulting product, applies to both addition and multiplication.

Your child learns that multiplication is distributive over addition. The distributive property of multiplication states that multiplying one number (A) by a set of numbers which are to be added ($B + C$) can be done in two ways. The numbers (B) and (C) can be added first and then the sum can be multiplied, or they can be multiplied by (A) one by one and then combined. For example,

$$A \times (B + C) = (A \times B) + (A \times C).$$



Your child also encounters the applications of the principles of identity elements and the property of zero in multiplication. For example, zero is the identity element for addition; that is, zero plus a number equals that number. Similarly, this principle applies to multiplication. With multiplication, however, the number 1 is the identity element (one times a number equals that number). The property of zero in multiplication—zero times a number is zero—is also presented.

The Laws of Arithmetic cartridge offers several special features that increase its motivational and reinforcement value:

- Colorful, rewarding graphics and sound effects that appear in response to correct answers.
- An unthreatening, try-again approach to incorrect answers.
- A progress report posted at the bottom of the screen.
- A feature that allows your child to study the answer to the problem if he or she makes a mistake.
- Advancement to the next level if problems are answered correctly, or automatic return to a lower level if your child needs more practice.
- Report screens personalized with your child's name at the end of each level's activities.
- An "Exit" screen with a complete report on your child's score at the end of the work session.

YOUR CHILD AND THE COMPUTER

The Texas Instruments computer is a rugged, durable device designed for easy use and care. Teach your child to give the computer the same good care and respect he or she would give a television set, record player, or any piece of electronic equipment:

1. Keep snacks and beverages away from the console.
2. Don't hammer on the keyboard or place heavy objects on it.
3. Don't touch the cartridge contacts. These are recessed in the cartridge to help prevent accidental soiling and/or damage.

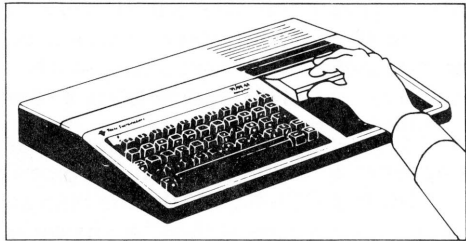
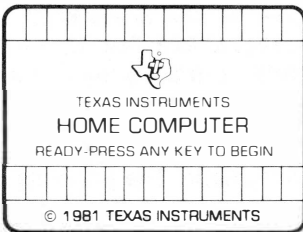
The letters and numbers on the keyboard are arranged in the same order found on standard typewriter keyboards. If your child is not familiar with a typewriter or has not used the computer before, take a few minutes to acquaint him or her with the keyboard. Point out the row of number keys at the top and the rows of letter keys below. Show your child how to insert the cartridge and how to select the activities. This brief "tour" of the computer will help reinforce correct procedures and instill confidence as your child starts out in a new world of computers.

Today computers are involved in almost every aspect of life. Working with this cartridge can help your child become familiar with computers and their operation. Since computer-enhanced instruction is more common in the classroom every year, this knowledge can give your child an important advantage.

USING THE SOLID STATE CARTRIDGE

An automatic reset feature is built into the computer. When a cartridge is inserted into the console, the computer returns to the master title screen. All data or program material you have entered will be erased.

Note: Be sure the cartridge is free of static electricity before inserting it into the computer (see page 14).



1. Turn the computer ON, and wait for the master title screen to appear. Then slide the cartridge into the slot on the console.
2. Press any key to make the master selection list appear. To select the cartridge, press the key corresponding to the number beside MILLIKEN on the list.

Note: To remove the cartridge, *first* return the computer to the master title screen by pressing **QUIT**. *Then* remove the cartridge from the slot. If you have any problem inserting the cartridge, or if it is accidentally removed from the slot while in use, please see "In Case of Difficulty" on page 15.

A SAMPLE ACTIVITY

For easy use, directions are displayed on the screen throughout all the levels. This sample activity, however, can help to illustrate the way the program works.

Let's Begin

When the Milliken title screen appears, press any key to begin. The screen then prompts you to enter the Beginning Level. Select any level from 1 to 19 by typing the number and then pressing **ENTER**. For this example, press 1 and then press **ENTER**. Next, the screen asks for Name. Type the child's name (up to ten letters long) and press **ENTER**.

Now a problem is displayed on the screen. Problems at Level 1 involve the application of the commutative property of arithmetic. The principle "ADDITION IS COMMUTATIVE" is displayed on the screen. A flashing question mark shows where the answer goes, and the directions on the screen tell you to "ENTER THE CORRECT NUMBER." Your child computes the problem mentally and types the missing addend in the equation.

A progress report appears across the bottom of the screen, with the following meanings:

PL	=	Problem Level
TC	=	Total Correct
TP	=	Total Problems
AVG	=	Average

As your child works through the problems, these figures are updated to report his or her progress. TC, TP, and AVG are reset to zero at the beginning of each level.



Entering Answers

Let your child answer a few problems as you observe. He or she simply presses the correct number from the top row of keys.

How the Computer Responds

If the problem is answered correctly, an animated picture appears. Your child then presses **ENTER** to continue to the next problem. If the problem is answered incorrectly, the computer returns a screen message and encourages your child to press **ENTER** to try again. If a second incorrect answer is given, the screen border turns red and flashes. To continue, your child presses **ENTER** again, and the computer gives the answer with a message to “STUDY THE ANSWER.” When your child presses **ENTER** again, the next problem appears.

Advancing or Moving Back

If your child answers five of the previous six problems correctly, a “Good News” report is displayed. He or she then advances to the next level. If three problems in a row are answered incorrectly, a “Bad News” report appears and your child moves back one level.

Changing Levels

You can change levels any time the question mark is flashing. To leave this level, simply press the letter **E** for “exit.” An **EXIT** screen appears, which reports on your child’s progress. Press **ENTER** to return to the Milliken title screen.

Let’s try another level. Press any key to go to the “Beginning Level” screen. This time, enter **14** as the Beginning Level. Then type your child’s name again, and press **ENTER** to continue.

Problems at Level 14 involve the application of the distributive law of multiplication over addition. The message “**MULTIPLICATION DISTRIBUTES OVER ADDITION**” is displayed on the screen. A flashing question mark shows where the answer will go, and the directions on the screen tell you to “**ENTER THE CORRECT NUMBER.**” Using mental computation, your child determines the missing factor in the equation and enters the correct answer.

Continue to observe as your child works through the problems and gains familiarity with the program’s operations.



SKILL LEVELS

This chart can help you find the appropriate starting level for your child. By looking at the sample problems and the skill description, select a level that is not too easy, but also not too difficult, for him or her. If in doubt, start at a lower level and work up from there. A glossary is provided on pages 12-13.

Level	Sample Problem	Skill Description
1-2	$1 + 8 = 8 + ?$ $(2 + 1) + 3 = ? + (2 + 1)$	Applying the commutative property of addition to problems with addends of 0 through 9.
3	$(2 + 1) + 4 = ? + (1 + 4)$	Applying the associative property of addition to problems with addends of 1 through 9.
4-5	$(4 + ?) + 3 = 4 + (3 + 5)$ $(6 + 9) + 5 = 5 + (? + 9)$	REVIEW of Levels 1 through 3. Applying both the associative and commutative properties of addition to problems with addends of 1 through 9.
6	$7 + 0 = ?$	Solving addition problems with the identity element 0 as an addend. Other addends are from 0 through 9.
7	$6 \times 7 = ? \times 6$	Applying the commutative property of multiplication to problems with factors of 1 through 9.

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Level	Sample Problem	Skill Description
8	$(6 \times 7) \times 8 = ? \times (7 \times 8)$	Applying the associative property of multiplication to problems with factors of 1 through 9.
9-10	$? \times 9 = 9 \times 8$ $(8 \times 4) \times 3 = 8 \times (3 \times ?)$	REVIEW of Levels 7 and 8. Applying both the commutative and associative properties of multiplication to problems with factors of 1 through 9.
11	$7 \times ? = 7$ $4 \times 1 = ?$	Solving multiplication problems with the identity element 1 as a factor. Other factors are from 0 through 9.
12	$8 \times 0 = ?$ $4 \times ? = 0$	Solving multiplication problems with the property 0 as a factor. Other factors are from 0 through 9.
13	$3 \times ? = 0$ $1 \times 8 = ?$	REVIEW of Levels 11 and 12. Solving multiplication problems with the identity element 1 and the property 0 as factors. Other factors are from 0 through 9.



Laws of Arithmetic

Level	Sample Problem	Skill Description
14-15	$3 \times 14 = (3 \times 10) + (3 \times ?)$ $9 \times 91 = (? \times 43) + (9 \times 48)$	Applying the distributive property of multiplication over addition to problems with factors from 2 through 9.
16-17	$? \times 3 = 3$ $6 + (1 + ?) = (1 + 2) + 6$	REVIEW of Levels 1 through 6. Applying properties for addition and the identity element, 0, for addition.
18-19	$? \times 9 = 9$ $9 \times (8 \times 7) = (8 \times 9) \times ?$	REVIEW of Levels 7 through 15. Applying properties for multiplication and the identity element, 1, for multiplication.

GLOSSARY

Addend: A number to be added to another; for example, $\text{ADDEND} + \text{ADDEND} = \text{SUM}$.

Associative property: A basic law of arithmetic which states that when elements are regrouped without changing the order, the result is not affected; for example,

$$\begin{aligned}(A + B) + C &= A + (B + C) \text{ (in addition)} \\ (A \times B) \times C &= A \times (B \times C) \text{ (in multiplication)}.\end{aligned}$$

Commutative property: A basic law of arithmetic which states that the result does not depend on the order in which quantities are combined. This property applies both to addition and to multiplication; for example,

$$\begin{aligned}A + B + C &= C + A + B \text{ (in addition)} \\ A \times B \times C &= C \times B \times A \text{ (in multiplication)}.\end{aligned}$$

Digit: Any of the numerals 0 to 9; the number "986" has three digits.

Distributive property: A basic law of arithmetic which states that a mathematical operation performed on a whole factor has the same results as when the same operation is performed on parts of that same factor. For example,

$$7 \times 25 = (7 \times 20) + (7 \times 5)$$

may be expressed as

$$7 \times 25 = (7 \times 19) + (7 \times 6)$$

with no affect upon the solution of the problem.



Equation: A statement in mathematical form in which one quantity is said to be equal to a second quantity. For example, in the equation $4 \times 4 = 16$, the product of 4×4 is said to be equal to 16.

Factor: One of two or more numbers which, when multiplied together, produce a given product; for example, $\text{FACTOR} \times \text{FACTOR} = \text{PRODUCT}$.

Identity element: A number that, when added to or multiplied by a second number, causes the result to equal the second number. Zero is the identity element for addition (zero plus a number equals that number), and 1 is the identity element for multiplication (1 times a number equals that number).

Product: The total or result of multiplying numbers; for example, $\text{PRODUCT} = \text{FACTOR} \times \text{FACTOR}$.

Property: A statement which is true in all cases; a basic assumption or law.

Sum: Total or result of adding numbers (addends) together; for example, $\text{SUM} = \text{ADDEND} + \text{ADDEND}$

CARING FOR THE CARTRIDGE

These cartridges are durable devices, but they should be handled with the same care you would give any other piece of electronic equipment. Keep the cartridge clean and dry, and don't touch the recessed contacts.

CAUTION:

The contents of a Cartridge can be damaged by static electricity discharges.

Static electricity build-ups are more likely to occur when the natural humidity of the air is low (during winter or in areas with dry climates). To avoid damaging the cartridge, just touch any metal object (a doorknob, a desk lamp, etc.) before handling the cartridge.

If static electricity is a problem where you live, you may want to buy a special carpet treatment that reduces static build-up. These commercial preparations are usually available from local hardware and office supply stores.



IN CASE OF DIFFICULTY

If the cartridge activities do not appear to be operating properly, return to the master title screen by pressing **QUIT**. Withdraw the cartridge, align it with the cartridge opening, and reinsert it carefully. Then press any key to make the master selection screen appear. (*Note:* In some instances, it may be necessary to turn the computer off, wait several seconds, and then turn it on again.)

If the cartridge is accidentally removed from the slot while the cartridge contents are being used, the computer may behave erratically. To restore the computer to normal operation, turn the computer console off, and wait a few seconds. Then, reinsert the cartridge, and turn the computer on again.

If you have any difficulty with your computer or cartridge, please contact the dealer from whom you purchased the unit and/or cartridge for service directions.

Additional information concerning use and service can be found in your *User's Reference Guide*.

THREE-MONTH LIMITED WARRANTY HOME COMPUTER SOFTWARE CARTRIDGE

Texas Instruments Incorporated extends this consumer warranty only to the original consumer purchaser.

WARRANTY COVERAGE

This warranty covers the electronic and case components of the software cartridge. These components include all semiconductor chips and devices, plastics, boards, wiring and all other hardware contained in this cartridge ("the Hardware"). This limited warranty does not extend to the programs contained in the software cartridge and in the accompanying book materials ("the Programs").

The Hardware is warranted against malfunction due to defective materials or construction. **THIS WARRANTY IS VOID IF THE HARDWARE HAS BEEN DAMAGED BY ACCIDENT, UNREASONABLE USE, NEGLIGENCE, IMPROPER SERVICE OR OTHER CAUSES NOT ARISING OUT OF DEFECTS IN MATERIALS OR WORKMANSHIP.**

WARRANTY DURATION

The Hardware is warranted for a period of three months from the date of the original purchase by the consumer.

WARRANTY DISCLAIMERS

ANY IMPLIED WARRANTIES ARISING OUT OF THIS SALE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE THREE-MONTH PERIOD. TEXAS INSTRUMENTS SHALL NOT BE LIABLE FOR LOSS OF USE OF THE HARDWARE OR OTHER INCIDENTAL OR CONSEQUENTIAL COSTS, EXPENSES, OR DAMAGES INCURRED BY THE CONSUMER OR ANY OTHER USER.

Some states do not allow the exclusion or limitation of implied warranties or consequential damages, so the above limitations or exclusions may not apply to you in those states.

LEGAL REMEDIES

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

PERFORMANCE BY TI UNDER WARRANTY

During the above three-month warranty period, defective Hardware will be replaced when it is returned postage prepaid to a Texas Instruments Service Facility listed below. The replacement Hardware will be warranted for three months from date of replacement. Other than the postage requirement, no charge will be made for replacement.

TI strongly recommends that you insure the Hardware for value prior to mailing.



TEXAS INSTRUMENTS CONSUMER SERVICE FACILITIES

U.S. Residents:

Texas Instruments Service Facility
P.O. Box 2500
Lubbock, Texas 79408

Canadian Residents:

Geophysical Services Incorporated
41 Shelley Road
Richmond Hill, Ontario, Canada L4C5G4

Consumers in California and Oregon may contact the following Texas Instruments offices for additional assistance or information.

Texas Instruments Consumer Service
831 South Douglas Street
El Segundo, California 90245
(213) 973-1803

Texas Instruments Consumer Service
6700 Southwest 105th
Kristin Square, Suite 110
Beaverton, Oregon 97005
(503) 643-6758

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Texas Instruments invented the integrated circuit,
the microprocessor, and the microcomputer.
Being first is our tradition.



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