TEXAS INSTRUMENTS
HOME COMPUTER

MILLIKEN MATH SEQUENCES:
FRACTIONAL NUMBERS
EDUCATION

SOLID STATE CARTRIDGE

A self-paced "tutor" which presents a variety of math
problems involving fractions. Suitable for children from
grades 5 through 8.

Quick Reference Guide

To take full advantage of the features and benefits of this cartridge, please read this manual completely. Important keystroke sequences are summarized here for your quick reference.

ENTER	Proceeds to next problem or continues problem after an incorrect answer has been given. Proceeds to the next step of a problem in the "Let Me Help You" feature. Also used to enter Beginning Level and Name.
SPACE BAR	Selects the greater than (>), less than (<), or equals (=) symbol when they alternately flash on the screen.
Y, N	Answers "yes" or "no" to questions "Can the answer be reduced ?," "Can this be a mixed or whole number ?," and "Do you need to regroup ?"
A, B, C, D	Selects from four possible answers displayed on the screen (Level 36 only).
E	Tells the computer you want to quit ("exit") the work session or leave a particular level.

Milliken Math Sequences: Fractional Numbers

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

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 fractions. By providing different levels of difficulty, the series is suitable for children from the kindergarten age through grade eight.

The Fractional Numbers cartridge is divided into 36 levels of difficulty, covering material generally taught in grades four through eight. The program provides practice with a wide variety of skills related to fractions, including finding common factors, recognizing order of fractions, reducing fractions to lowest terms, working with mixed numbers (whole numbers plus a fractional part), finding least common denominators, finding reciprocals, and changing fractions to decimals.

The program includes adding, subtracting, multiplying, and dividing fractional and mixed numbers. Problems are presented both vertically and horizontally. This program assumes that your child has mastered basic arithmetic and a certain degree of mental computation.

The Fractional Numbers 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 unintimidating, try-again approach to incorrect answers.

- A progress report posted at the bottom of the screen.

- A "help" feature that displays the problem step by step until the final answer is found.

- Advancement to the next level if problems are answered correctly, or automatic return to a lower level if your child needs more practice.

- Question-and-answer activities which allow your child to interact with the computer so that the skills of reducing to lowest terms and the relationship between mixed numerals and improper fractions are understood.

- A special regrouping feature to help your child in rewriting mixed numbers for easy problem solving.

- 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 the correct procedures for your child and instill confidence as he or she 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-aided 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).

```
TEXAS INSTRUMENTS
HOME COMPUTER
READY PRESS ANY KEY TO BEGIN

© 1981 TEXAS INSTRUMENTS
```
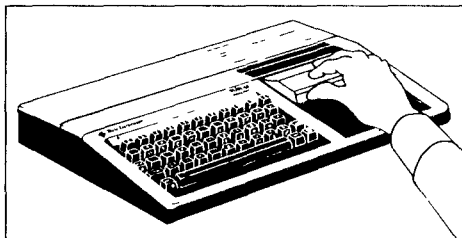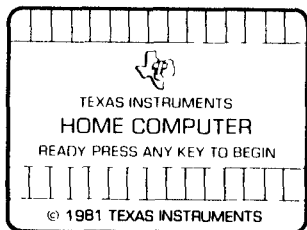
1. Turn the computer ON, and wait for the master title screen to appear. Then slide the cartridge into the slot on the console.
2. Press any key to make the master selection list appear. To select the cartridge, press the key corresponding to the number beside MILLIKEN on the list.

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 14.

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 36 by typing the number and then pressing **ENTER**. For this example, press **4** and **ENTER**. Next, the screen asks for Name. Type your child's name (up to ten letters long) and press **ENTER**.

Now a problem is displayed on the screen. The directions on the screen tell you to "Press **SPACE BAR** when true." Your child must decide whether the fractions are equal or if one is greater than the other.

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 automatically reset to zero at the beginning of each level.

How the Computer Responds

Let your child answer a few problems as you observe. He or she simply presses the **SPACE BAR** when the appropriate symbol is displayed — greater than ($>$), less than ($<$), or equals ($=$). 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 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.

Only one chance is given to answer correctly problems or questions that have only two or three possible answers (such as >, <, =, or yes-or-no questions). Two chances are given to answer correctly problems with several possible answers. On problems which involve several steps, two chances are given to answer each step correctly unless that step is a yes-or-no question.

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 title screen.

Let's try another level. Press any key to go to the "Levels 1-36" screen. This time, enter **18** (from left to right) as the Beginning Level. Then type your child's name again, and press **ENTER** to continue.

Interacting with the Computer

Problems at Level 18 involve adding unlike fractions. Since several steps are involved, be sure your child follows the onscreen directions and questions closely.

Now an addition problem is displayed on the screen. A flashing question mark shows where the answer will go, and the directions on the screen ask, "What is the least common denominator?" Your child simply presses the correct number from the top row of keys. The problem is rewritten with common denominators, and the directions "Enter the correct number" appear.

Add the numerators, type the sum (from left to right) and the denominator under it, and the question "Can the number be reduced? (Y,N)" appears. Type **Y** for "yes" or **N** for "no." Reduce the fraction if the correct answer is "yes." The next question given is "Can this be a mixed or whole number? (Y,N)." Answer this question and change to a mixed or whole number if necessary. This interactive feature helps to assure that the skills involved are understood completely.

Regrouping Feature

Let's change to still another level. Press **E**, then **ENTER**, and then any key to return to the "Beginning Level" screen. Type **26** and press **ENTER**. Then type the child's name, press **ENTER** again, and you see the first problem in Level 26.

The problem shows that a mixed number is to be subtracted from a whole number. The question on the screen asks, "Do you need to regroup? (Y,N)." Though your child may be able to regroup mentally, THIS IS NOT AN OPTION. You must answer "yes" to this question in Levels 26-27. The whole number is then regrouped into a mixed numeral so that the problem can be more easily solved. Follow the directions on the screen to finish the problem.

"Let Me Help You"

Now let's try the "Let Me Help You" feature. On the next problem, deliberately enter a wrong answer twice. When the border flashes red, press **ENTER** and the message "Let Me Help You" is displayed. Keep pressing **ENTER** as the computer completes the problem step by step until the final answer is found. Thus, if your child has difficulty with a particular problem, the computer demonstrates the solution.

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 page 13.

Level	Sample Problem	Skill Description
1 – 2	$\dfrac{3}{4} = \dfrac{?}{20}$	Writing equivalent fractions. Finding common factors for denominators from 2 through 50.
3	$\dfrac{?}{6} = \dfrac{8}{24}$	
4	$\dfrac{1}{9} < \dfrac{5}{9}$	Recognizing order of fractions with numerators from 1 through 9 and denominators from 2 through 12.
5	$\dfrac{3}{7} > \dfrac{3}{9}$	
6 – 7	$\dfrac{2}{7} < \dfrac{3}{5}$	Recognizing order of fractions with numerators from 1 through 12 and denominators from 1 through 12.
8 – 9	$\dfrac{9}{12} = \;?$	Reducing fractions to lowest terms and finding common factors from 2 through 24.
10 – 11	$\dfrac{17}{2} = \;?$	Changing fractions to mixed numbers; numerators from 5 through 50 and denominators from 2 through 9.
12 – 13	$2\dfrac{3}{5} = \;?$	Changing mixed numbers to fractions; whole numbers from 2 through 10 and fractional numbers from 1 through 99.

TEXAS INSTRUMENTS **HOME COMPUTER**

Level	Sample Problem	Skill Description
14	$\dfrac{7}{12} + \dfrac{4}{12} = \ ?$	Adding like fractions with numerators from 0 through 9 and denominators from 2 through 24. Horizontal form.
15	$\dfrac{8}{9} - \dfrac{3}{9} = \ ?$	Subtracting like fractions with numerators from 0 through 9 and denominators from 2 through 24. Horizontal form.
16	$\begin{array}{r} \dfrac{7}{8} \\ -\ \dfrac{2}{8} \\ \hline ? \end{array}$	Adding or subtracting like fractions with numerators from 0 through 9 and denominators from 2 through 24.
17	$\dfrac{1}{3} + \dfrac{7}{12} = \ ?$	Finding the least common denominator (one denominator is a multiple of the other) with numerators from 1 through 9 and denominators from 2 through 20.
18	$\begin{array}{r} \dfrac{3}{8} \\ +\ \dfrac{1}{4} \\ \hline ? \end{array}$	Adding unlike fractions. Finding least common denominator (one denominator is a multiple of the other) with numerators from 1 through 9 and denominators from 2 through 20.
19	$\begin{array}{r} \dfrac{7}{10} \\ -\ \dfrac{1}{5} \\ \hline ? \end{array}$	Subtracting unlike fractions. Finding least common denominator (one denominator is a multiple of the other) with numerators from 1 through 9 and denominators from 2 through 20.

Level	Sample Problem	Skill Description
20	$\dfrac{1}{6} + \dfrac{1}{8} = \; ?$	Finding least common denominator (denominators are not multiples of each other) with numerators from 1 through 12 and denominators from 2 through 24
21 – 22	$\begin{array}{r} \dfrac{7}{9} \\ + \dfrac{1}{6} \\ \hline ? \end{array}$	Adding unlike fractions. Finding least common denominator with numerators from 1 through 12 and denominators from 2 through 24.
23 – 24	$\begin{array}{r} \dfrac{7}{9} \\ - \dfrac{1}{6} \\ \hline ? \end{array}$	Subtracting unlike fractions. Finding least common denominators with numerators from 1 through 12 and denominators from 2 through 24.
25	$\begin{array}{r} 3\dfrac{7}{8} \\ + 5\dfrac{1}{6} \\ \hline ? \end{array}$	Adding unlike mixed numbers. Finding least common denominators (whole numbers from 1 through 9) with numerators from 1 through 12 and denominators from 2 through 20.
26	$\begin{array}{r} 4 \\ - 2\dfrac{2}{3} \\ \hline ? \end{array}$	Subtracting a mixed number from a whole number (regrouping involved) with whole numbers from 1 through 9 and fractional numbers from 2 through 24.

TEXAS INSTRUMENTS **HOME COMPUTER**

Level	Sample Problem	Skill Description
27	$6\frac{5}{12}$ $-\ 3\frac{7}{9}$ $\overline{?}$	Subtracting mixed numbers. Finding least common denominator (regrouping involved) with whole numbers from 1 through 9 and fractional numbers from 1 through 24.
28	$\frac{3}{4} \times 20 = ?$	Multiplying fractions by whole numbers (whole numbers from 8 through 99), with numerators from 1 through 9 and denominations from 2 through 10.
29	$\frac{2}{3} \times \frac{5}{8} = ?$	Multiplying fractions with numerators from 1 through 12 and denominators from 2 through 24.
30	$2\frac{3}{4} \times \frac{7}{11} = ?$	Multiplying mixed numbers by fractions, with whole numbers from 1 through 9 and fractional numbers from 1 through 24.
31	$1\frac{1}{2} \times 2\frac{2}{3} = ?$	Multiplying mixed numbers, with whole numbers from 1 through 9 and fractional numbers from 1 through 24.
32	$\frac{8}{7} \times\ ? = 1$	Finding reciprocals with fractional numbers from 1 through 20.
33	$20 - \frac{2}{3} = ?$	Dividing whole numbers by fractions, with whole numbers from 2 through 20 and fractional numbers from 1 through 9.

Level	Sample Problem	Skill Description
34	$\dfrac{3}{4} \div \dfrac{5}{6} = ?$	Dividing fractions by fractions, with numerators from 1 through 9 and denominators from 2 through 24.
35	$1\dfrac{1}{6} \div 3\dfrac{2}{3} = ?$	Dividing mixed numbers with whole numbers from 1 through 9 and fractional numbers from 1 through 24.
36	Change $\dfrac{4}{5}$ to a decimal. (multiple choice)	Changing fractions to decimals, with numerators from 1 through 9 and denominators from 2 through 12.

GLOSSARY

denominator: The bottom number of a fraction, which indicates into how many parts a unit is divided.

numerator: The top number of a fraction, which indicates the number of parts in relation to the denominator.

mixed number: A number comprised of both a whole number and a fractional number.

multiple: A number into which another can be divided with zero remainder.

reciprocal: One of a pair of numbers whose product is one; for example,

$$\frac{1}{7} \times \frac{7}{1} = 1$$

regrouping: A process in arithmetic in which numbers are formed into a new grouping.

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 Solid State 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 desklamp, 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*.

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

TEXAS INSTRUMENTS
INCORPORATED