

Amazing Arithmetricks™

No. A-336
Instructional Computing Courseware
for Apple® II Series Computers

for the love of learning



This manual is compatible
with
the *Amazing Arithmetricks*[™] disk
Version 1.x

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System requirements: Apple II series; 128K RAM; 1 disk drive; monochrome or color monitor (color recommended).

Title from title screen.

Ed. statement from disk label.

Copy-protected.

Audience: Grades 5-12.

Issued also on 5 1/4 in. computer disk.

Summary: Using the motivating environment of a carnival setting, students are challenged to solve a variety of puzzles intended to improve logic and mathematical problem-solving skills. Includes a provision allowing students to choose a level of difficulty matched to ability.

"A-336"—Disk label.

1. Mathematical recreations—Juvenile software.

2. Problem solving—Juvenile software. [1. Mathematical recreations—Software. 2. Problem solving—Software.]

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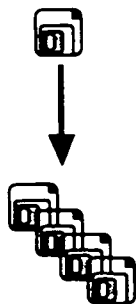
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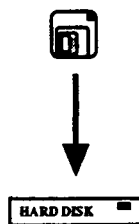
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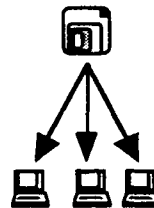
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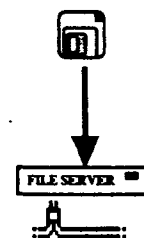
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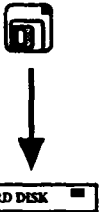
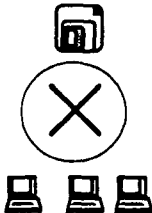
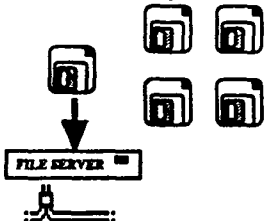
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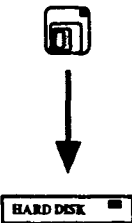
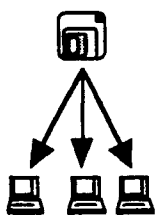
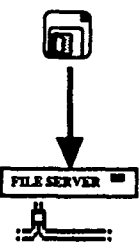
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Product Instructions

This part of the manual explains basic product operations.

The Product at a Glance provides a brief summary of the product, including grade range, hardware requirements, and learning objectives.

The Product in Detail gives step-by-step product instructions. You may refer to this section to help you answer students' questions about how the product works.

Management Options explains how to customize *Amazing Arithmetricks* to fit your precise curriculum needs.

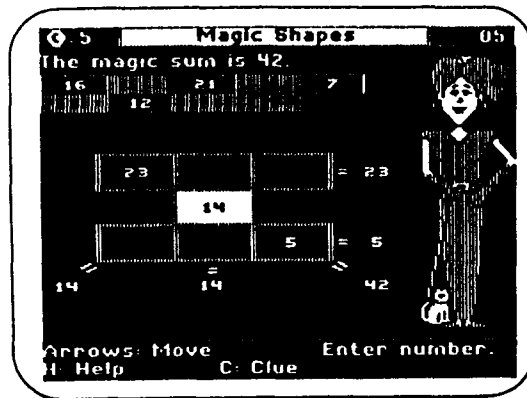
The Product at a Glance



The *Amazing Arithmetricks*TM software programs provide students with engaging activities that help them develop and strengthen their logic and problem-solving skills. Within the motivating environment of a carnival, students are challenged to solve a variety of puzzles in different puzzle tents. **Puzzle Practice** allows students to work with the puzzles in an open-ended environment, while **Visit the Carnival** requires students to solve a set number of puzzles. In both programs, students can choose the level of difficulty for each puzzle and, therefore, can work at their own ability level.

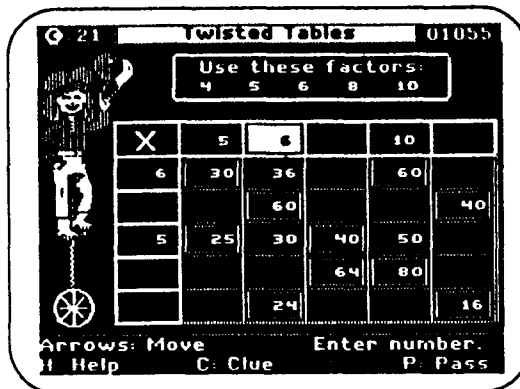
| | |
|-----------------------------|---|
| Title: | <i>Amazing Arithmetricks</i> |
| Subject: | Mathematics |
| Topic: | Puzzles, problem-solving, logic |
| Grade Range: | Grades 5–12 |
| Program Type: | Problem-solving games |
| Required Hardware: | Apple II series computer with 128K RAM; color monitor recommended but not required |
| Classroom Use: | Individual students or pairs of students |
| Learning Objectives: | <ul style="list-style-type: none">• to apply an understanding of the processes involved in the basic computation skills• to apply knowledge of basic math facts using positive and negative whole numbers and decimal numbers• to practice logical deduction skills• to develop problem-solving strategies |

The Product at a Glance



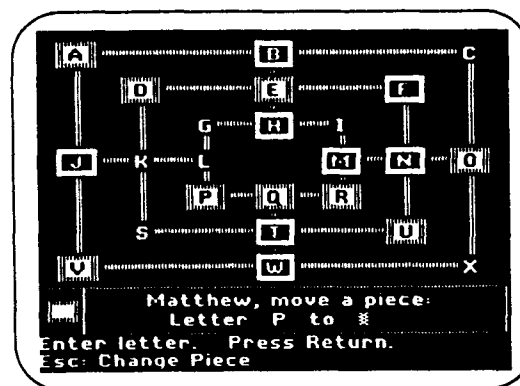
Magic Shapes

- Fill in the empty cells of the square or other shape so that the sum of all complete rows, columns, and diagonals is equal to the magic sum.
- Often, there is more than one possible solution.



Twisted Tables

- Arrange the five provided numbers in any order along the top row and left-most column of the table so that all resulting sums are correct.
- Other puzzles are based on multiplication tables.



Nine Men's Morris

- Play a computer opponent in this ancient position-and-strategy game.
- All required puzzles must be solved before this game can be played.

The Product in Detail

Introduction

Amazing Arithmetricks presents a variety of problem-solving puzzles that have long been popular with mathematics students and teachers. These puzzles are also commonly found in game and puzzle books and magazines.

Although students have been working these types of puzzles for years, solving them with paper and pencil can be quite frustrating since it often requires a trial-and-error approach. Each adjustment means erasing part or all of your work and entering a new attempt. Working these puzzles on the computer eliminates much of this frustration and frees students to explore and experiment with different approaches.

In *Amazing Arithmetricks*, students meet the Arithmetricks—a carnival family that travels the world, perplexing people with their mathematical puzzles. Students enter the carnival and are free to move from tent to tent solving the puzzles presented to them.

The puzzles presented in *Amazing Arithmetricks* can be quite challenging and require time for experimenting and finding solutions. Students can work puzzles in one of two ways. For students who want to explore the various puzzles, practice solving a particular type of puzzle, or simply see how many total puzzles they can solve, the program **Puzzle Practice** can be used. Students who want to solve puzzles in a more directed manner can run **Visit the Carnival**. In this program, students are required to solve a set number of puzzles and they try to score enough points to make the Puzzle Pros list. It is not expected that all students will complete the required number of puzzles within a given computer session. Therefore, students may save a game and continue it at a later time.

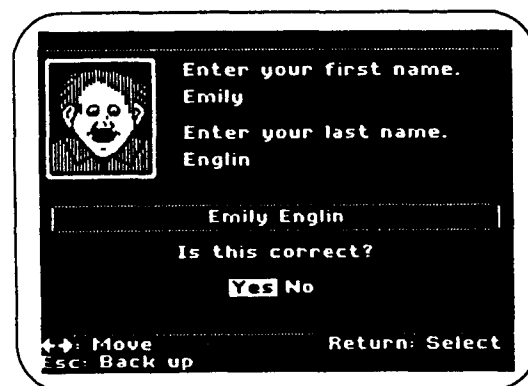
Before using *Amazing Arithmetricks* with your students, you should first play the game and familiarize yourself with the various types of puzzles. Also, examine the settings available in Management Options and, if necessary, modify the settings to fit the needs of your students. Refer to Management Options on page 33 for more information.

Puzzle Practice

Puzzle Practice allows students to explore the various puzzle types, spend time solving their favorite types of puzzles, or gain experience with the puzzles that are most difficult for them. **Puzzle Practice** is open-ended and students are free to move among the four puzzle tents, working as many puzzles as they wish. At the beginning of each puzzle, students receive five clue coins, which may be used to buy clues for the puzzle. Students do not score points for solving puzzles, but their accomplishments are noted on a Certificate of Achievement found in Tent 6.



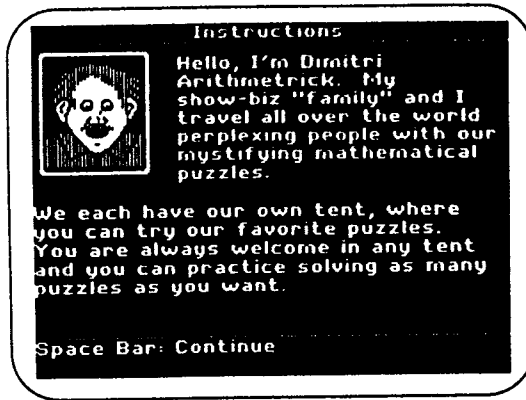
From the Main menu, students can choose **Puzzle Practice** or **Visit the Carnival**, continue a saved game, see general information about the product, or quit.



If students choose **Puzzle Practice**, they must enter their first and last names.

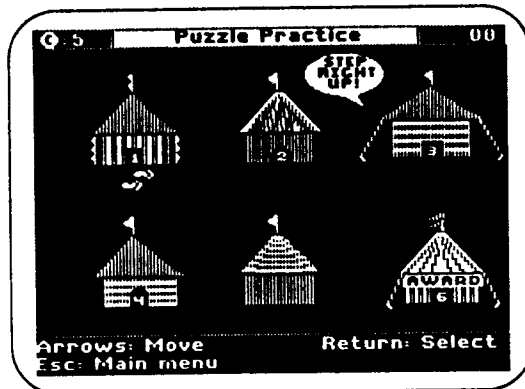
The Product in Detail

Puzzle Practice



Students may choose to see instructions before beginning.

The first of two instruction screens is shown here.



This is the main carnival screen. The tents are:

Tent 1: Number Challenge puzzles

Tent 2: Math-O-Grams puzzles

Tent 3: Magic Shapes puzzles

Tent 4: Twisted Tables puzzles

Tent 5: Closed in this program

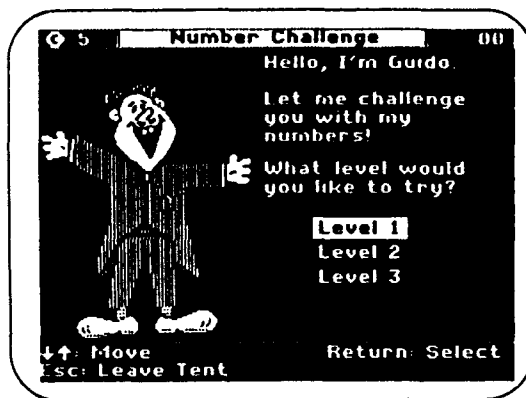
Tent 6: Certificate of Achievement

The number of available clue coins is shown in the upper left-hand corner of the screen, while the number of puzzles solved is displayed in the upper right-hand corner.

Students may enter any of the open tents in any order they wish. To enter a tent, students use the arrow keys (or enter the number on the tent) to move the pair of feet to the doorway of the tent and then press Return. Tent 5 is the Master Tent and is only available while playing Visit the Carnival.

The Product in Detail

Puzzle Practice

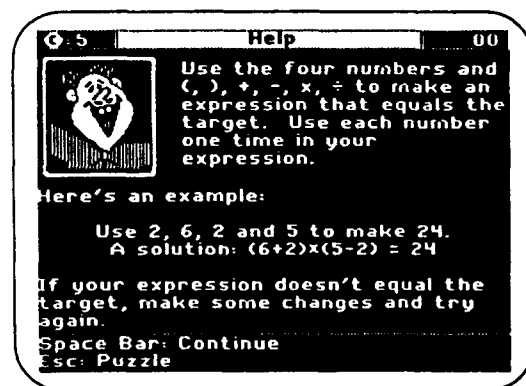


When students first enter a puzzle tent, they choose the level of difficulty they wish to try. Level 1 puzzles are the easiest and Level 3 puzzles are the most difficult.



When students first enter a tent, they are presented with a new puzzle. If they are returning to the tent, they return to the puzzle they were working on when they left; however, work in progress and any clues that had been bought are not retained.

This screen shows a Number Challenge puzzle. Each of the puzzle types is discussed in further detail in the following sections.



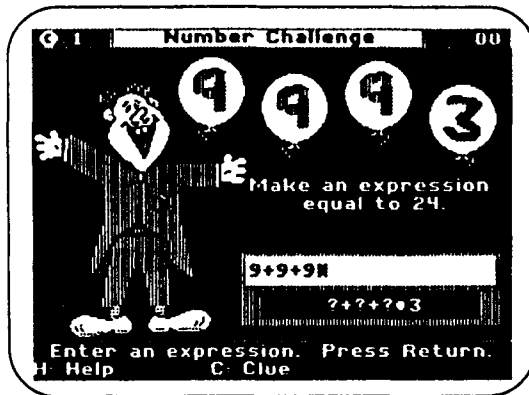
From any puzzle screen, students can press:

- the H key to see specific instructions for the puzzle;
- the C key to buy a clue for the puzzle;
- the Escape key to leave the puzzle tent.

This screen shows the first of two Help screens for the Number Challenge puzzles.

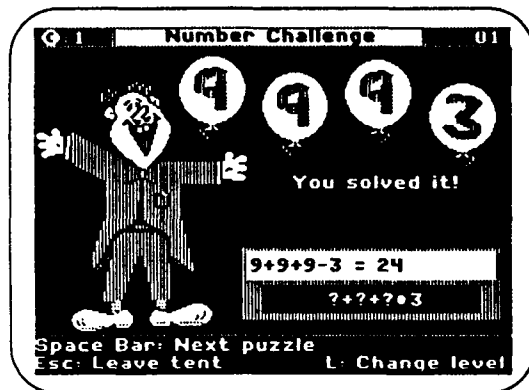
The Product in Detail

Puzzle Practice



Each time students begin a new puzzle, they receive five clue coins they can use to buy clues for the puzzle.

Five clues are usually not enough to completely solve the puzzle for the student. The five clues are intended to provide students who are new to a puzzle type with guidance and the necessary confidence to develop strategies for solving the puzzles. As students gain experience with a puzzle type, it is expected that they will use fewer clues.



When a puzzle has been solved, students receive a congratulatory message and the counter at the top right-hand corner of the screen increases by one.

Students can work any number of puzzles in any of the puzzle tents. **Puzzle Practice** is ideal for students who have a favorite type of puzzle, for students who want to gain experience with the puzzles that are most difficult for them, or for students who are motivated to simply see how many puzzles they can solve.



At any time, students can enter Tent 6 to see a Certificate of Achievement. This certificate displays their name, the number of puzzles solved, and the number of clues used.

Students may transfer this information to the Certificate of Achievement on page 53. This certificate can provide a record of the student's achievement.

Visit the Carnival

At the Carnival is an activity that provides students with an opportunity to solve puzzles and score points. It is suggested that students have gained some experience with the puzzles through **Puzzle Practice** before they run **At the Carnival**. In **At the Carnival**, students are required to solve a set number of puzzles in each of the four puzzle tents and they play for points. They receive a set number of clues they can use in any way to help them solve the required puzzles. When all required puzzles have been solved, students can enter their initials on the Puzzle Pros list if their score is high enough. They can also enter the Master Tent to play a strategy game.



From the Main menu, students can choose **Puzzle Practice** or **Visit the Carnival**, continue a saved game, see general information about the product, or quit.

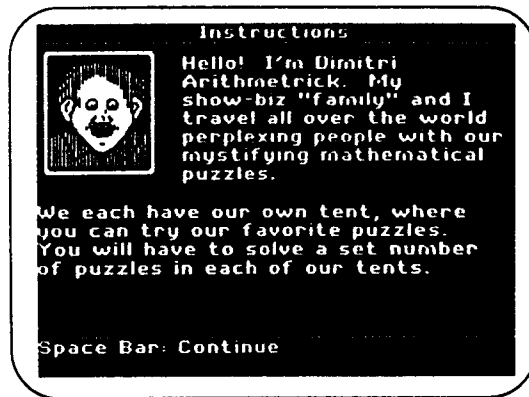


If students choose **Visit the Carnival**, they will need to enter their first and last names for game-saving purposes.

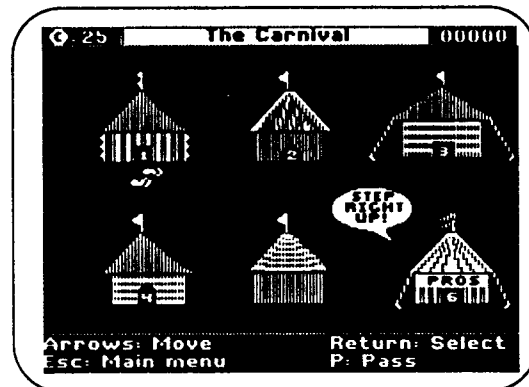
Because students are required to solve a set number of puzzles and not all students will be able to complete the task within one session, students may save their games to be continued at a later time.

The Product in Detail

Visit the Carnival



Students can choose to see instructions before beginning. These instructions explain the use of clue coins and the Master Tent entry pass as well as how points are scored. The first of four instruction screens is shown here.



This is the main carnival screen. The six tents on the screen are:

- Tent 1: Number Challenge puzzles
- Tent 2: Math-O-Grams puzzles
- Tent 3: Magic Shapes puzzles
- Tent 4: Twisted Tables puzzles
- Tent 5: Master Tent game
- Tent 6: Puzzle Pros list

When playing **Visit the Carnival**, students are given clue coins and a Master Tent entry pass. Clue coins can be used in any way students wish in order to buy clues for puzzles. Students are encouraged to use as few clues as possible because the clue coins are limited in supply and unused clue coins are worth points.

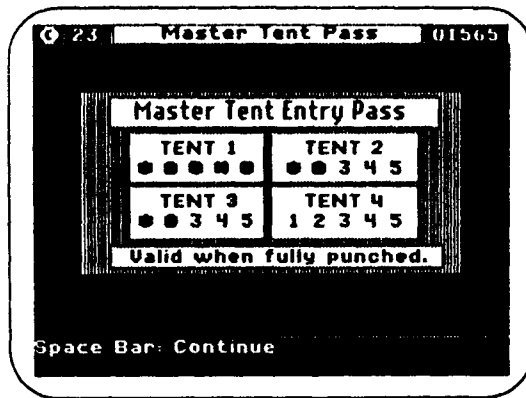
The number of remaining clue coins is shown in the upper left-hand corner of the screen, while the score is displayed in the upper right-hand corner.

Students may enter any of the open tents in any order they wish. To enter a tent, use the arrow keys (or enter the number on the tent) to move the pair of feet to the doorway of the tent and press Return.

When students press Escape to return to the Main menu, they will be given the option to save their current game.

The Product in Detail

Visit the Carnival

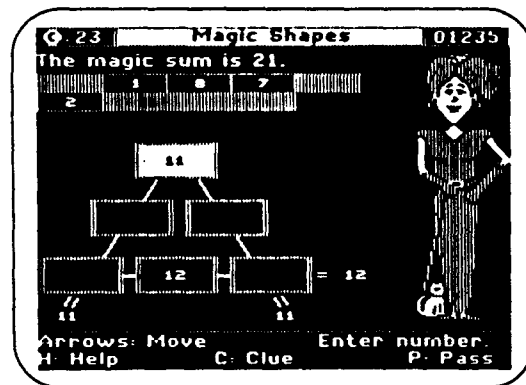


Students can press the P key to view their Master Tent entry pass. The pass shows how many puzzles must be solved in each of the puzzle tents. Each time a required puzzle is solved, the appropriate number is punched on the pass. When the pass is fully punched, the door to the Master Tent opens and students may enter.

The pass in this screen shows that all required puzzles have been solved in Tent 1, two have been solved in both Tent 2 and Tent 3, and none have been solved in Tent 4.



When students first enter a puzzle tent, they can choose the level of difficulty they wish to try. Level 1 puzzles are the easiest, while Level 3 puzzles are the most difficult.



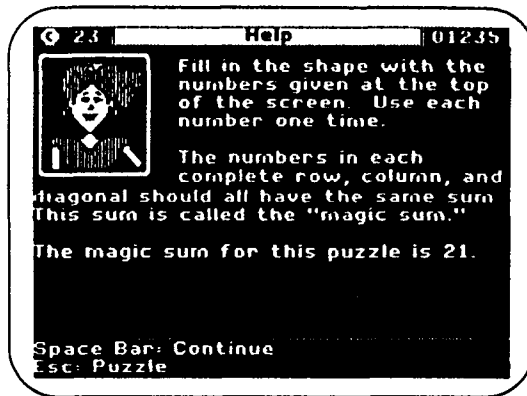
When students first enter a tent, they are presented with a new puzzle. If they are returning to the tent, they return to the puzzle they were working on when they left; however, work in progress and any clues that had been bought are not retained.

Once the required number of puzzles in a tent have been solved, students must move on to another puzzle tent.

This screen shows a Magic Shapes puzzle. Each of the individual puzzle types is discussed in further detail in the following sections.

The Product in Detail

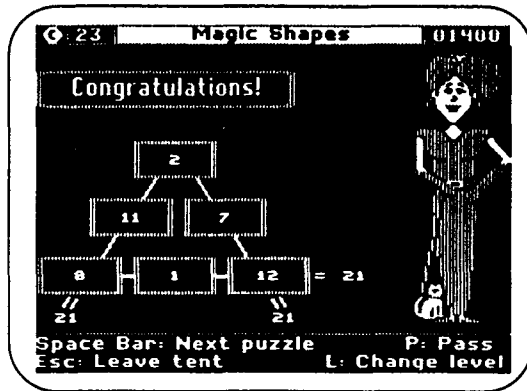
Visit the Carnival



From any puzzle screen, students can press:

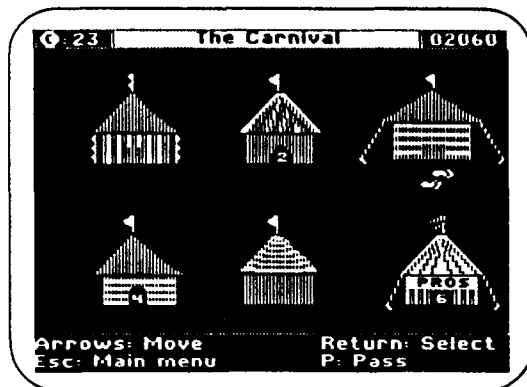
- the H key to see specific instructions for the puzzle;
- the C key to buy a clue for the puzzle;
- the P key to view their entry pass;
- the Escape key to leave the puzzle tent.

This screen shows the Help screen for the Magic Shapes puzzles.



When a puzzle has been solved, students receive a congratulatory message and points. The points received for each puzzle are based on the difficulty level of the puzzle and the number of remaining clue coins.

- Level 1 puzzle = 50 points
- Level 2 puzzle = 75 points
- Level 3 puzzle = 100 points
- each remaining clue coin = 5 points



When students solve all required puzzles in Tent 1, 2, 3, or 4, they will leave that tent, and the door to that tent will be closed.

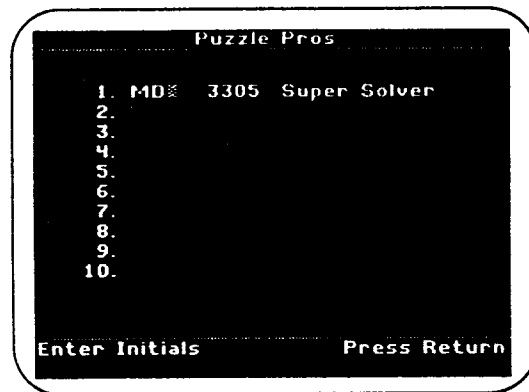
The Product in Detail

Visit the Carnival



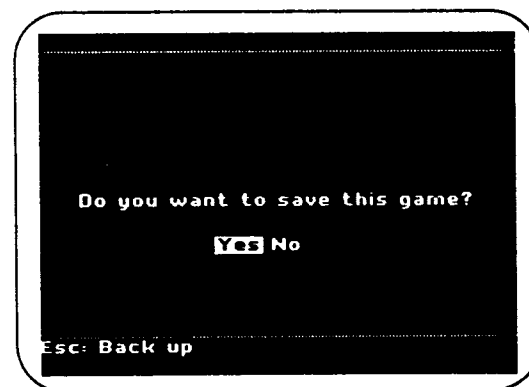
Students will be denied entry to the Master Tent if they try to enter before they have solved all of the required puzzles (since their Master Tent entry pass would not be fully punched).

Once the Master Tent entry pass is valid (fully punched), students can enter the Master Tent and play against one of the Arithmetricks in a game of Nine Men's Morris.



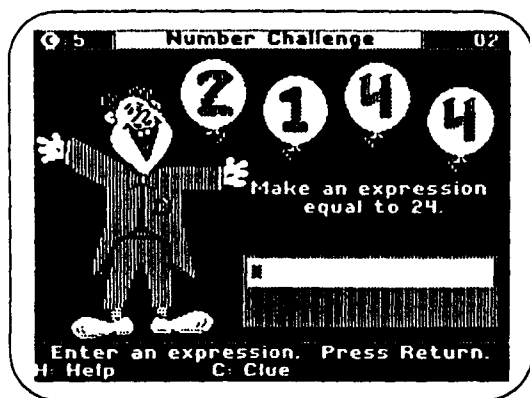
At any time, students can enter Tent 6 to view the Puzzle Pros list. Once students have solved all required puzzles, they can enter their initials on the Puzzle Pros list if their score is high enough.

The possible titles, based on total score, are Number Cruncher, Super Solver, and Math Master.

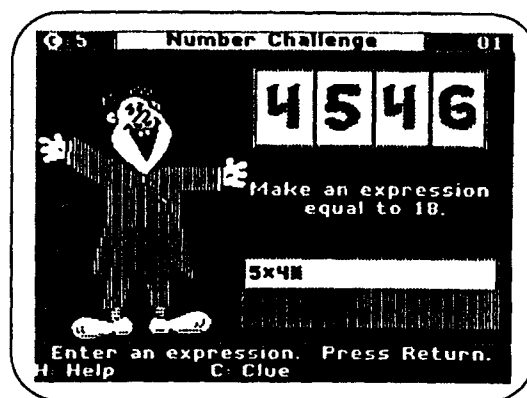


When students press the Escape key to return to the Main menu, they will be given the option to save their current game.

Number Challenge



Type A



Type B

Introduction

This popular activity helps students practice basic facts while introducing them to pre-algebra concepts. This activity involves students in:

- using basic computational skills;
- thinking about fact families, factors, and multiples;
- considering the order of operations;
- applying the commutative, associative, and distributive properties; and
- developing problem-solving strategies.

Rules of Play

- Students are presented with four numbers 0 through 9 and a target value.
- Students must use the four numbers one time each to create an expression equal to the target value.
- Students can use parentheses, addition, subtraction, multiplication, and division in their expressions.
- There may be more than one correct solution.

Puzzle Types

These puzzles are presented in the two ways shown in the screens above. In Type A, the target value is always 24. In Type B, the target value can be any number between 1 and 100. Typically, the easier levels of play can be solved with simpler expressions.

The Product in Detail

Number Challenge



In Tent 1, Guido Arithmetrick presents students with four numbers they must use to create an expression equal to the target value.

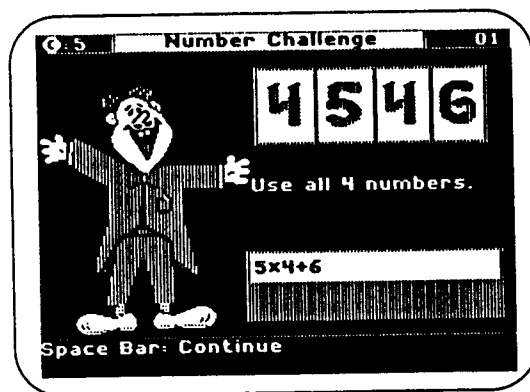
Each number must be used one time. Students can use addition, subtraction, multiplication, division, and parentheses in their expressions.

To enter multiplication, press * or Shift-8. To enter division, press /. To enter the parentheses, press Shift-9 or Shift-0.



Once an expression is entered and the student presses Return or the Equal Sign (=) key, the computer automatically computes the answer.

If the answer is not equal to the target value, students can use the Delete key to erase part or all of their expression and make adjustments.

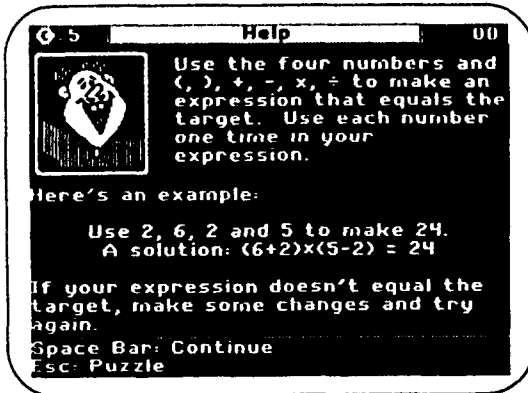


If students have not used all numbers, have not used all four numbers one time each, or have entered an expression resulting in division by 0, they will receive an appropriate message and have the opportunity to change their expression.

Fractional results to expressions are displayed as decimal numbers. These decimals are truncated to the thousandth place when necessary.

The Product in Detail

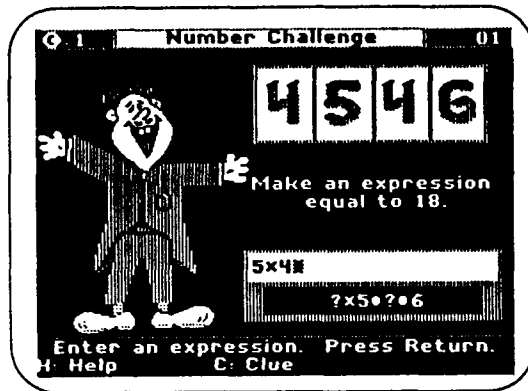
Number Challenge



From the puzzle screen, students can press:

- the C key to buy a clue;
- the H key to see puzzle instructions;
- the P key to see their pass (in Visit the Carnival); and
- the Escape key to leave the tent.

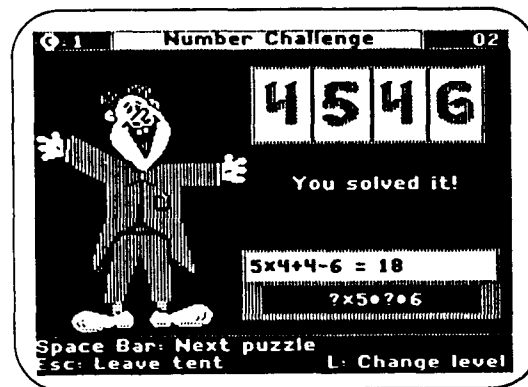
This is the first of two Help screens for Number Challenge puzzles.



If students buy a clue, the clue will appear below the box in which they enter their expression.

Although there is often more than one solution, the clues given are based on one particular solution.

The first clue gives the format of the expression: question marks indicate numbers; dots indicate operations. When additional clues are bought, numbers or operators are filled into the expression format. Each time a clue coin is used, the total number of clues available decreases by one.



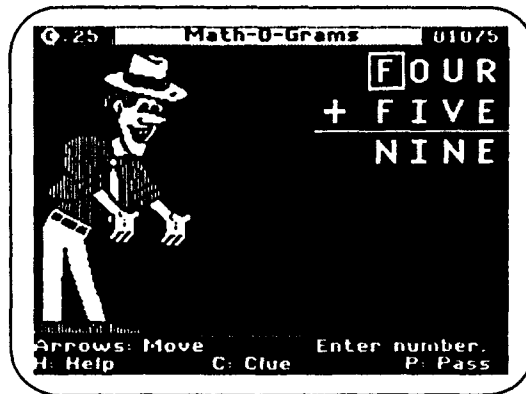
The puzzle is solved when an expression yielding the target value has been entered.

If students are in Visit the Carnival, they will receive points for solving the puzzle.

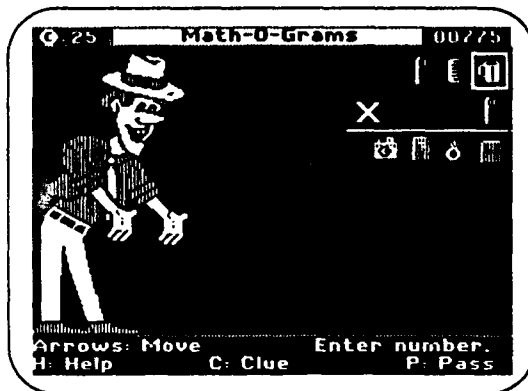
Students can press:

- the Space Bar to get a new puzzle of the same level of difficulty;
- the P key to see their pass (Visit the Carnival only);
- the Escape key to leave the tent and return to the carnival menu; or
- the L key to change the difficulty level for the next puzzle.

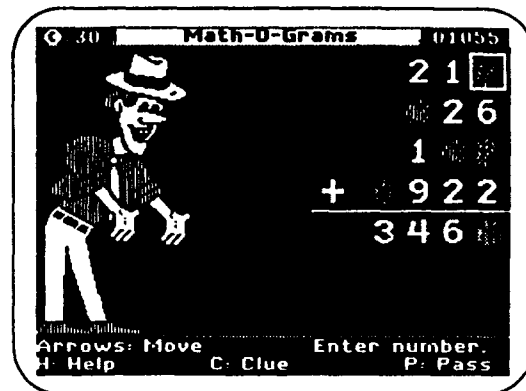
Math-O-Grams



Type A



Type B



Type C

Introduction

These puzzles are often referred to as cryptarithms and can be found in many puzzle and game books and magazines. These puzzles, especially the ones involving words (SEND + MORE = MONEY), are popular and well known. While working these puzzles, students become involved in:

- using basic computation skills and fact families;
- analyzing patterns; and
- developing problem-solving strategies.

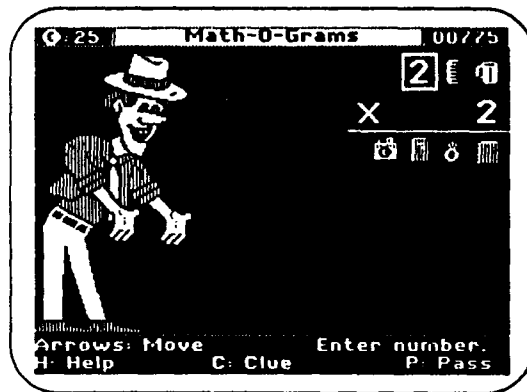
Rules of Play

- Students must replace each letter, icon, or missing digit with a number between 0 and 9 so that the problem is true.
- In puzzles using letters or icons, every occurrence of a particular digit has been replaced by the same letter or icon.
- There may be more than one correct solution.

Puzzle Types

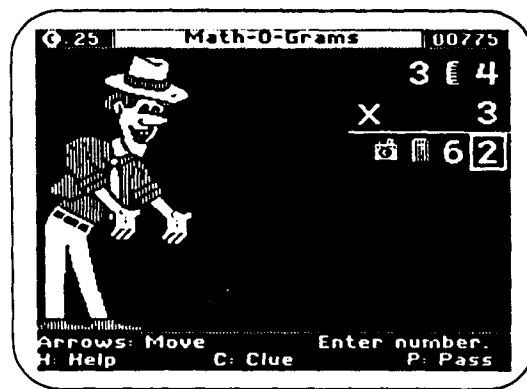
These puzzles are presented in the three ways shown in the screens on the previous page. In Type A, the digits of the problem are replaced with letters, and words and phrases are often formed. In Type B, the numbers are replaced with icons. In Type C, some of the digits of the original problem are covered.

The easier levels of play involve fewer unique digits in each problem or more possible solutions. The easier levels also involve simpler operations. For example, Level 1 presents only addition and subtraction puzzles; Level 2 presents addition, subtraction, and multiplication puzzles; and Level 3 presents addition, multiplication, and division puzzles.



In Tent 2, Gunther Arithmetrick sometimes presents students with a problem in which all of the digits have been replaced by letters or icons.

Students use the arrow keys to move the cursor through the problem. Entering a digit between 0 and 9 will replace all occurrences of the icon or letter highlighted by the cursor with that digit.



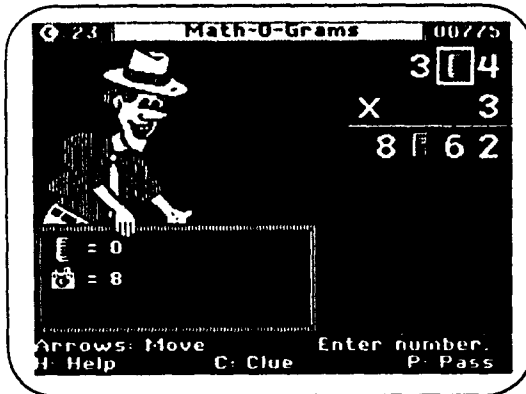
A digit, and all its occurrences, may be changed back to its original letter or icon by highlighting it with the cursor and pressing the Space Bar.

If students decide an incorrect digit has been entered, they simply need to enter a new digit in its place. Again, all occurrences of that digit will be changed to the new digit.

If students enter a number that has already been entered, all previous occurrences of that number will be changed back to the original letter or icon.

The Product in Detail

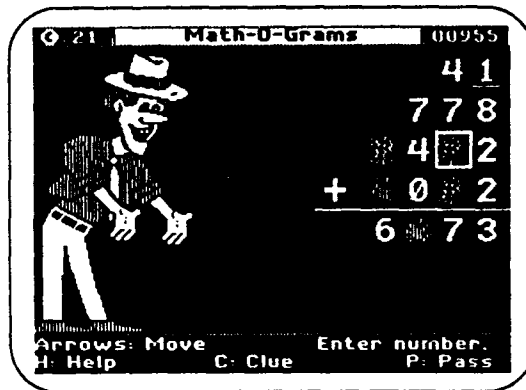
Math-O-Grams



If students buy a clue, it will appear on a chalkboard held by Gunther.

Although there is often more than one solution, the clues given are based on one particular solution.

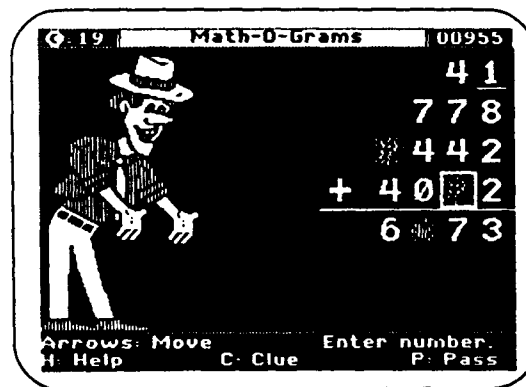
Each clue reveals the digit with which a letter or icon should be replaced. Each time a clue coin is used, the total number of clues available decreases by one.



Sometimes Gunther Arithmetrick will present students with a problem in which some of the digits have been obscured by paint splatters.

Students use the arrow keys to move the cursor through the problem. Entering a digit between 0 and 9 will place the digit at the current location only, and no other missing digits are affected.

Entered digits are underlined to indicate they were originally covered. Students may change any underlined digit back to the "paint splatter" by highlighting it with the cursor and pressing the Space Bar.



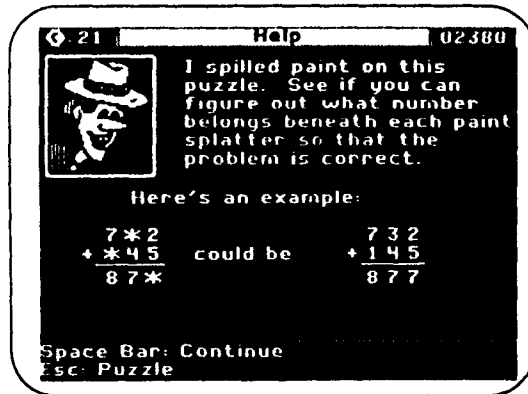
If students buy a clue for this type of puzzle, one digit will be placed in the problem.

First, paint splatters are replaced by digits. If no paint splatters remain, an underlined digit will be replaced by the correct digit. Digits added to the equation as a clue are not underlined and cannot be changed. Each time a clue coin is used, the total number of clues available decreases by one.

Although there is often more than one solution, the clues given are based on one particular solution.

The Product in Detail

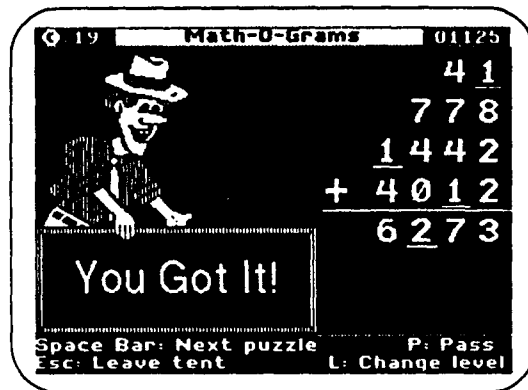
Math-O-Grams



From the puzzle screen, students can press:

- the C key to buy a clue;
- the H key to see puzzle instructions;
- the P key to see their pass (in Visit the Carnival); and
- the Escape key to leave the tent.

This is the first of two help screens for puzzle Type B.



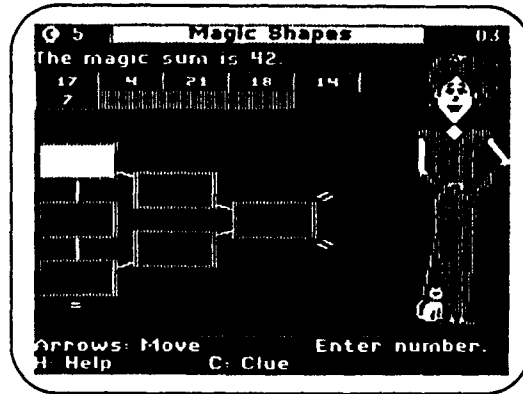
Students continue entering numbers and trying numbers in various positions until they find an arrangement of numbers that makes the problem true.

If students are in Visit the Carnival, they will receive points for solving the puzzle.

Students can press:

- the Space Bar to get a new puzzle of the same level of difficulty;
- the P key to see their pass (Visit the Carnival only);
- the Escape key to leave the tent and return to the carnival menu; or
- the L key to change the difficulty level for the next puzzle.

Magic Shapes



Introduction

Magic squares are not only popular activities in mathematics classes but can also be found in many puzzle and game books and magazines. In fact, magic squares have captured the imagination since the origins of arithmetic and geometry. The *Lo shu* is a Chinese magic square known since the fourth century B.C. Magic squares were known in India and were probably brought to the West by the Arab people.

Magic squares were often accorded special significance. Copies of magic squares cut in wood or other materials once served as amulets. In the sixteenth and seventeenth centuries, people believed a magic square engraved on a small silver tablet could protect them from the plague. The aura of magic surrounding these squares is partly based on the surprising number of combinations that can be fashioned with them.

Solving puzzles based on the magic square involves students in:

- using basic computational skills;
- thinking about fact families; and
- developing problem-solving strategies.

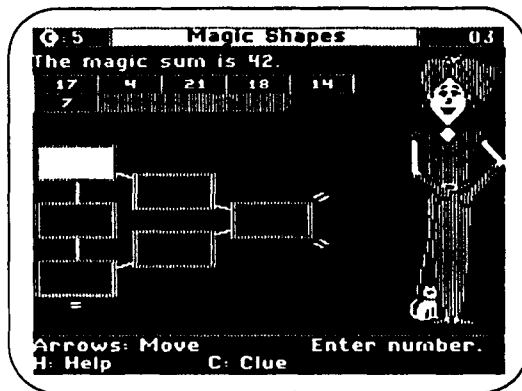
Rules of Play

- Students must place the numbers provided in the cells of the magic shape. Each number must be used one time.
- All complete rows, columns, and diagonals must add up to the "magic sum."
- The "magic sum" is different for each puzzle.

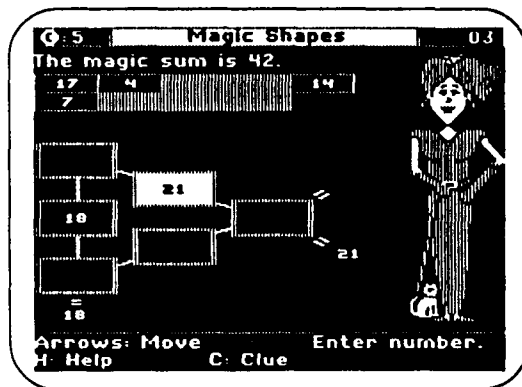
Puzzle Types

These puzzles are presented using several shapes, including squares and triangles. Each shape is derived from the traditional 3×3 magic square. The "magic sum" is different for each puzzle.

All Level 1 puzzles involve positive numbers less than 100. Level 2 puzzles involve positive and negative whole numbers. Level 3 puzzles involve positive and negative decimal numbers.



In Tent 3, Amelda Arithmetrick presents students with one of several shapes based on a 3×3 magic square. Students must place the numbers given at the top of the screen into the cells of the shape. Each number must be used one time.



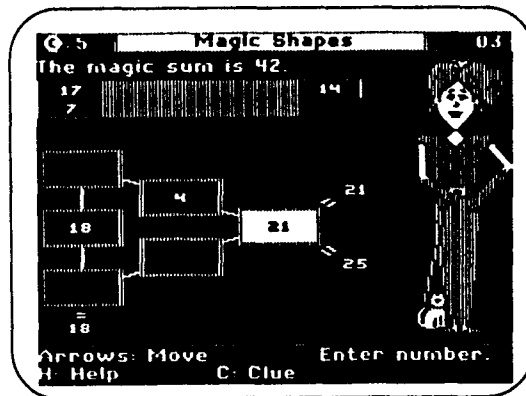
Students use the arrow keys to move the cursor through the cells of the shape. When they enter a number, that number is entered at the location of the cursor. Only the numbers given are accepted.

As a number is entered into the puzzle, it is removed from the list of numbers shown above.

As numbers are entered into the shape, the sums of the rows, columns, and diagonals are automatically calculated and displayed.

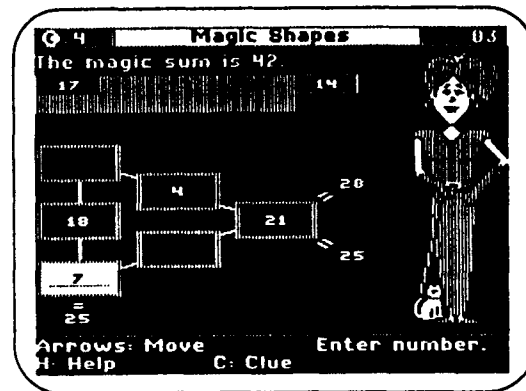
The Product in Detail

Magic Shapes



If students enter a number that they have placed in the shape in another location, the number is removed from its previous position and placed in the new position.

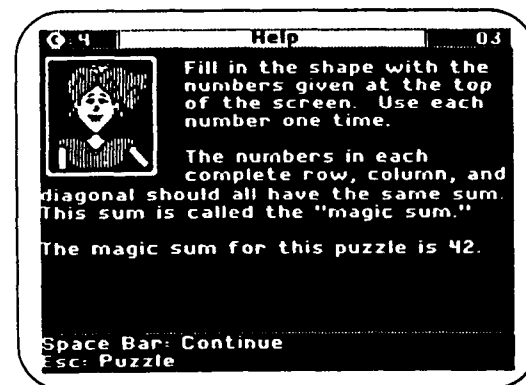
The sums of the rows, columns, and diagonals are automatically recalculated and updated.



If students buy a clue for this type of puzzle, one digit will be placed in the magic shape.

First, digits are placed in empty cells. If no empty cells remain, a digit replaces one already in the shape. Digits added to the equation as a clue are underlined to indicate they are in the correct position. Each time a clue coin is used, the total number of clues available decreases by one.

Although there is more than one possible solution, the clues given are based on one particular solution.



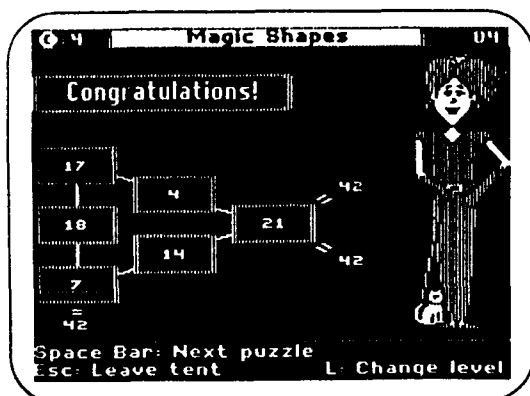
From the puzzle screen, students can press:

- the C key to buy a clue;
- the H key to see puzzle instructions;
- the P key to see their pass (in Visit the Carnival); and
- the Escape key to leave the tent.

This is the Help screen for the Magic Shapes puzzles.

The Product in Detail

Magic Shapes



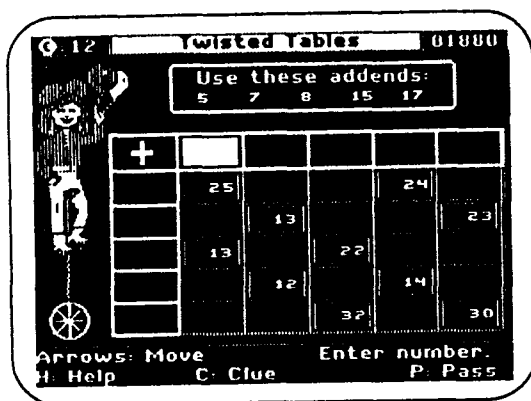
Students continue placing and rearranging numbers within the shape until the sum of each complete three-cell row, column, and diagonal is equal to the magic sum. When this happens, the puzzle has been solved.

If students are in **Visit the Carnival**, they will receive points for solving the puzzle.

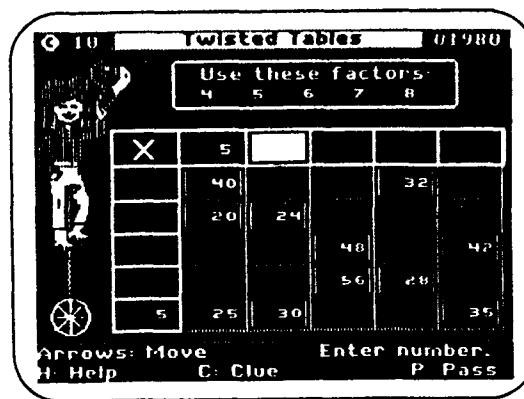
Students can press:

- the Space Bar to get a new puzzle of the same level of difficulty;
- the P key to see their pass (**Visit the Carnival** only);
- the Escape key to leave the tent and return to the carnival menu; or
- the L key to change the difficulty level for the next puzzle.

Twisted Tables



Type A



Type B

Introduction

These puzzles add a new twist to the familiar addition and multiplication tables students often work with while learning basic facts. Solving these puzzles involves students in:

- using basic computational skills;
- thinking about fact families; and
- developing problem-solving strategies.

Rules of Play

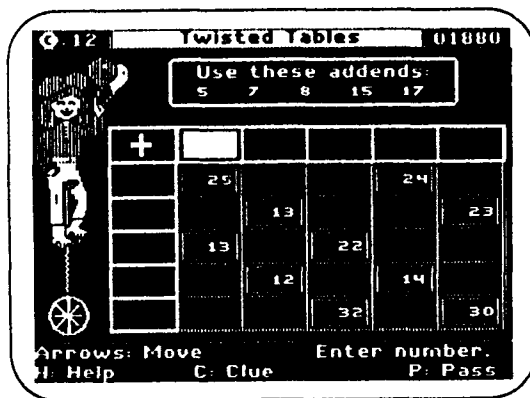
- Students must use the five numbers provided, one time each, across the top row of the table. These numbers may be placed in any order.
- Students must use the five numbers provided, one time each, down the left-most column of the table. These numbers may be placed in any order.
- The numbers must be arranged in the top row and left-most column so that all resulting sums or products are true.

Puzzle Types

These puzzles can involve either addition or multiplication. Level 1 puzzles involve only positive whole numbers. Level 2 puzzles involve positive and negative whole numbers for addition and positive whole numbers for multiplication. Level 3 puzzles involve positive and negative whole numbers for both addition and multiplication.

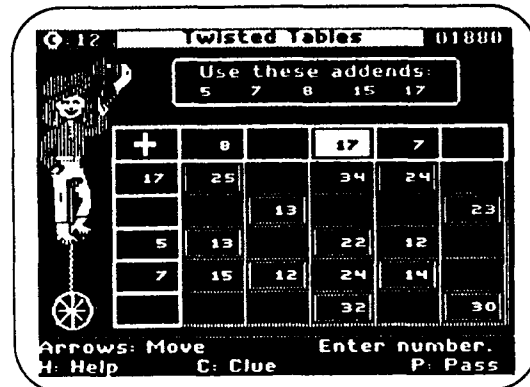
The Product in Detail

Twisted Tables



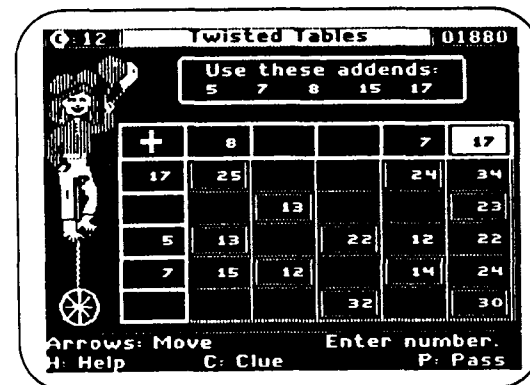
In Tent 4, Ramona Arithmetrick presents students with a 5 x 5 addition or multiplication table. Students place the numbers given for the puzzle in any order, as long as each number is used one time in the top row and one time in the left-most column. The numbers must be arranged so that all resulting sums or products in the middle of the table are correct.

Initially, ten sums or products are given in the table. These are framed in green to indicate they are correct. Regardless of the addends or factors that students enter, these sums or products do not change.



Students use the arrow keys to move the cursor through the top row and left-most column of the table. When they enter a number, that number is placed at the location of the cursor.

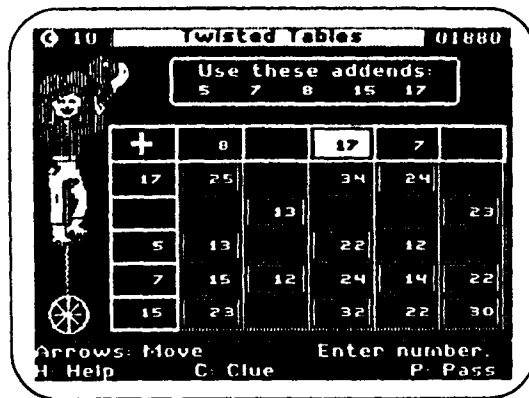
As numbers are entered, any resulting sums/products that can be calculated are entered into the blank cells of the table. These calculated sums/products will change to reflect modifications the students make in the arrangement of the addends or products.



If students enter a number in the top row that has already been used in the top row (or a number in the left-most column that has already been used in that column), the number is removed from its previous position. Any previously calculated results are removed and new ones are added to the table.

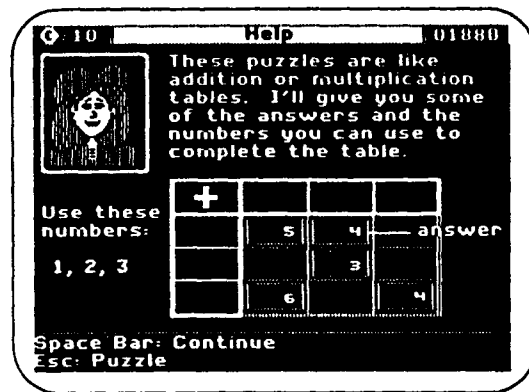
The Product in Detail

Twisted Tables



If students buy a clue for this type of puzzle, one correct sum or product will be placed in the middle section of the table. This newly added sum or product will be framed in green to indicate it is correct and will not change.

Each time a clue coin is used, the total number of clues available decreases by one.



From the puzzle screen, students can press:

- the C key to buy a clue;
- the H key to see puzzle instructions;
- the P key to see their pass (in Visit the Carnival); and
- the Escape key to leave the tent.

This is the first of the four Help screens for Twisted Table puzzles.



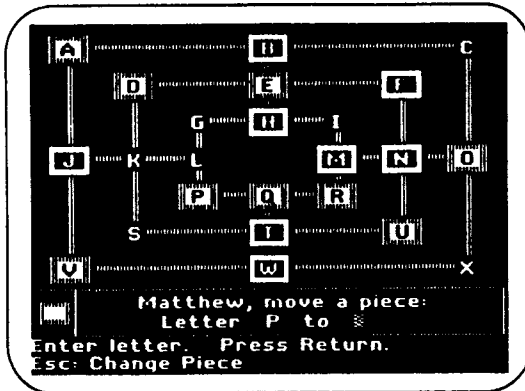
Students continue placing and rearranging the numbers within the table until all resulting sums or products are correct. When this happens, the puzzle has been solved.

If students are in Visit the Carnival, they will receive points for solving the puzzle.

Students can press:

- the Space Bar to get a new puzzle of the same level of difficulty;
- the P key to see their pass (Visit the Carnival only);
- the Escape key to leave the tent and return to the carnival menu; or
- the L key to change the difficulty level for the next puzzle.

Nine Men's Morris



Introduction

The game of Nine Men's Morris, also known as Mill, has been popular for over 3000 years. The first game board ever discovered was carved into a temple in ancient Egypt. The game has also been traced to Rome and Greece, and it was very popular in Elizabethan England. Over the years, it has been a fad in numerous cultures throughout the world.

This game, found in the Master Tent, is available only when all required puzzles have been solved in **Visit the Carnival**. Nine Men's Morris is a game for players of all ages. Its rules are simple, yet it is multi-layered so that players of different experience levels can enjoy it. The game offers plenty of opportunity for players to develop strategies as they gain experience.

Rules of Play

- Players start with nine game pieces each and an empty game board.
- Taking turns, players put all nine of their pieces, one at a time, on the vacant points on the board.
- Once all pieces are placed on the board, players take turns moving one of their pieces one position along a line to an adjacent and empty point.
- A "mill" occurs when a player's pieces fill all three points of a line. Any line counts. Mills can be made anytime—during setup or during play.
- When a player makes a mill, he or she can immediately remove one opponent piece. But the piece cannot be from an opponent's mill unless no other piece is available.

The Product in Detail

Nine Men's Morris

- A player can, on one turn, move a piece out of a mill and on another turn move it back to re-form the same mill and claim another opponent's piece.
- A player wins by getting his or her opponent down to two pieces or by blocking the opponent so that no move can be made.
- An innocent newcomer to this game is a sure loser. However, good players usually have difficulty beating each other and the typical game ends in a draw.
- Hint: The most important tactical points are E, N, T, and K because they offer the most opportunities for forming a mill. Good players strive for a double mill. For example, having pieces on points A, B, C, D, and F allows the player to form a mill with each move between points B and E.



Once a player has solved all required puzzles in **Visit the Carnival**, and their Master Tent entry pass is fully punched, they have access to the Master Tent.

Upon entering the Master Tent, players may choose to see the instructions for playing the game.



Players choose one of the Arithmetricks as their opponent. Some of the Arithmetricks play with a more highly developed strategy than others.

Guido is new to the game and is still developing a strategy.

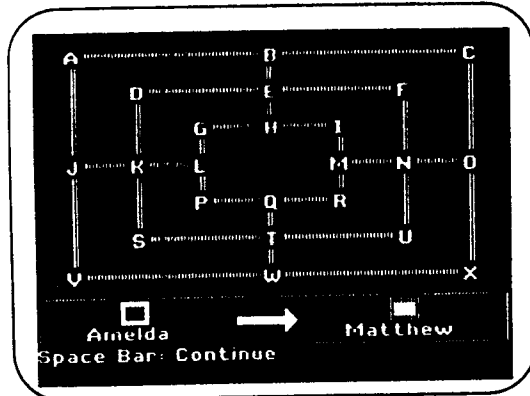
Amelda is a fairly skilled player who will keep you on your toes.

Gunther is a tough competitor.

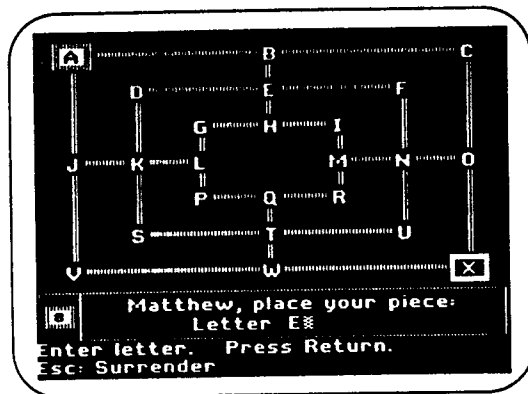
Ramona is the Arithmetrick's long-time champion of Nine Men's Morris. Watch out—make one mistake and Ramona will win!

The Product in Detail

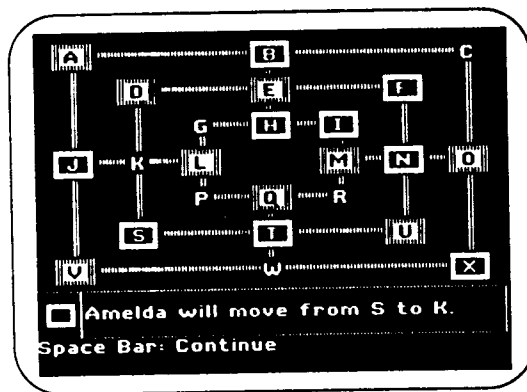
Nine Men's Morris



The computer randomly chooses a player to start the game.



The players take turns placing their game pieces onto vacant points on the game board.



Once all of the pieces have been placed on the game board, players take turns moving their pieces.

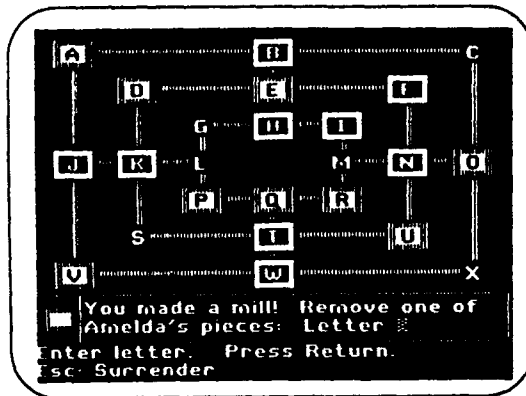
A piece may be moved one point along a line to an adjacent and empty point.

For example, Amelda can move her piece from S to K because K is both empty and adjacent to S.

Amelda could not move the piece on X to C because C is not adjacent to X. Also, Amelda could not move the piece from B to E because E is not an empty point.

The Product in Detail

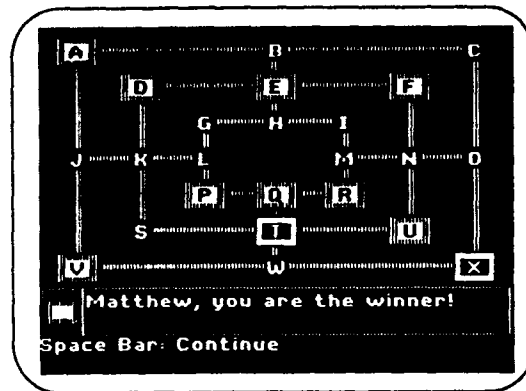
Nine Men's Morris



If a move results in three of a player's pieces being arranged in a row, a "mill" has been formed.

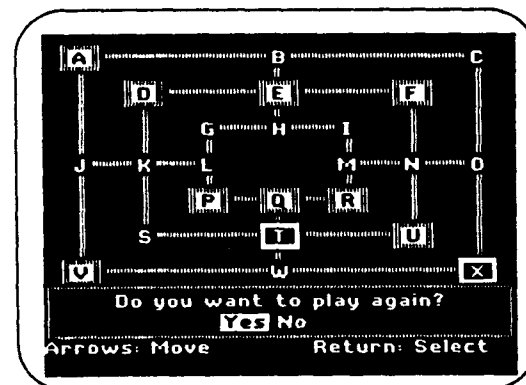
A mill can be formed any time during play—either during the placement of the pieces on the game board or while moving pieces on the game board.

If a mill is formed, the player may remove one opponent piece. The piece removed cannot break up an opponent's mill unless no other move is possible.



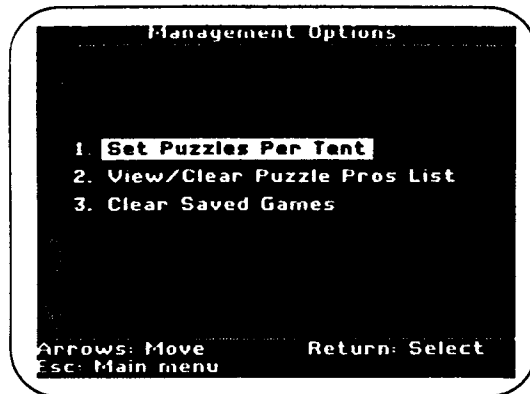
The winner is the player that gets the opponent down to two remaining pieces or blocks the opponent's pieces so that no move can be made.

The game can also end in a draw.



After finishing a game, players may choose to play the same opponent again, play a new opponent, or leave the tent.

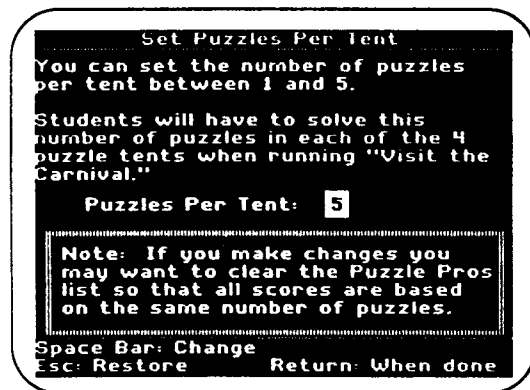
Management Options



Accessing Management Options

Amazing Arithmetricks contains three Management Options that can be accessed from the Main menu by pressing Control-A (hold down the Control key and press the A key).

These options will allow you to tailor the program to fit the needs and abilities of your students.



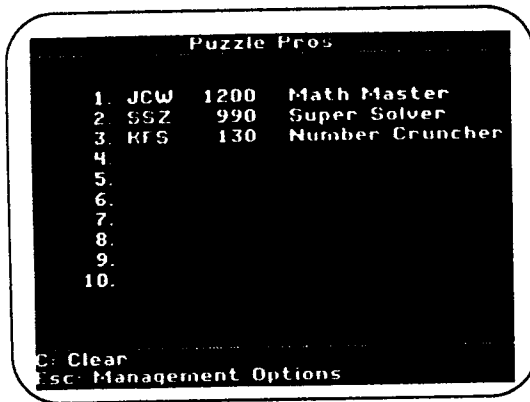
Option 1: Set Puzzles Per Tent

This option allows you to set the number of puzzles students must solve. The number of puzzles per tent can be set from 1 to 5. Remember to multiply this number by 4 (the four tents) to get the total number of puzzles that students will be required to solve.

The default setting is shown here. Any changes you make to this setting will be saved. Press Escape to restore the previous setting.

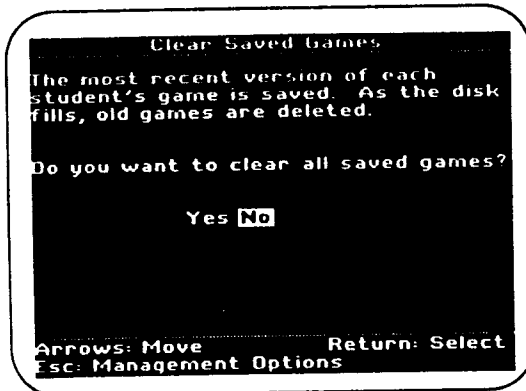
Since the number of puzzles students are required to solve directly affects the total number of points students can score, the Puzzle Pros list should be cleared if you change the number of required puzzles.

Management Options



Option 2: View/Clear Puzzle Pros List

This option allows you, by pressing the C key, to view or clear the current high-score list.



Option 3: Clear Saved Games

Student games can be saved on the disk. This option allows you to clear all of the saved games from the disk.

Classroom Resources

*This part of the manual provides a variety of materials to help you use **Amazing Arithmetricks** in the classroom.*

***Classroom Ideas** provides tips for student use of the program, lesson plan ideas, and a list of magazine articles about magic squares.*

***Thinking Skills** defines core thinking skills and indicates how **Amazing Arithmetricks** addresses them.*

***Student Worksheets** are information handouts and activity sheets to use with the lesson plans.*

Classroom Ideas

Preparation

Amazing Arithmetricks is designed to provide a motivating supplemental activity for mathematics students developing their problem-solving skills; it is not intended to teach problem-solving or logic.

The puzzles included in *Amazing Arithmetricks* are familiar and popular with students and adults of all ages. The product is intended to be used primarily with students in grades 5 and up. However, younger students, proficient in basic computation skills, may also enjoy working some of the puzzles. Students new to *Amazing Arithmetricks* may benefit from a short demonstration of the product. The **Puzzle Practice** program may be used for classroom demonstrations of the various puzzles.

Using the Programs

It is suggested that students begin with the **Puzzle Practice** program. This program will allow them to gain familiarity with the various puzzles and begin developing strategies for solving them. If time permits, allow students to spend several sessions in **Puzzle Practice**. Encourage students to record the information as tangible evidence of their progress. Students can use the Certificate of Achievement on page 53 for this purpose.

Once students are comfortable with the various puzzles and are ready for a new challenge, let them run **Visit the Carnival** and play for points. Students may require more than one session to solve all the required puzzles, so you may need to plan for students to save their games and return at a later time. (You may want to check and see how many games are currently saved on the disk before students begin. See Option 2: View/Clear Puzzle Pros List on page 34 for instructions.)

Student Strategies

Amazing Arithmetricks provides students with an environment for experimenting with and developing successful problem-solving strategies. Students may exhibit a wide variety of approaches to solving the various types of puzzles.

Since most of the puzzles have more than one correct answer, encourage students to experiment. Students who are used to having to find "the right

answer" may feel compelled to use a calculator or even paper and pencil to find a solution before entering it into the computer. Remind students that the computer will do the calculating for them and that they should not be afraid to try something and see what happens. The power of this program lies in its ability to quickly make calculations and adjustments, freeing students to try different strategies.

Some students may prefer to work in cooperative groups or pairs. In many instances, these students tend to be more successful, or at least successful sooner, than students who work alone.

Some students may not readily develop a successful strategy. Classroom discussions can, however, encourage students to share both successful and unsuccessful strategies.

Classroom Activities and Extensions

Several additional classroom activities can be used to complement and strengthen the instructional objectives presented in *Amazing Arithmetricks*. In many cases, the activities listed in this section can be used before or after students have used *Amazing Arithmetricks*. The selection of the activities depends on your specific classroom environment.

The true value of these activities lies in the ideas, comments, and questions that arise from discussing the experience. Allow sufficient time for students to share their observations and approaches.

Number Challenge Activities

- Have students count off from 1 to 9. Students should write their numbers on a piece of notebook paper and tape it to themselves. Let students mingle around the room. Call out a target number. Allow students a limited amount of time to find a partner whose number, along with theirs, will yield the target number.

First, try this activity with students using only one operation, such as addition. Use a basic fact for the target number. For example, if you are using addition, the target number should be a sum between 2 and 18. Not all students will be able to find a partner with whom they can form the target number. Obviously, more pairs can be formed that yield a target sum of 7 than a target sum of 3. See how many different pairs students are able to form.

You can also try this activity by using another operation, by allowing students to use any operation they want when forming their pair, or by allowing students to group with more than one other student.

- Arrange students in small groups. Give each group three or four numbers or have them draw the numbers from slips of paper numbered 1 through 9. Challenge each group to see how many equations with different whole-number solutions they can come up with using those numbers and the four basic mathematical operations.

Math-O-Gram Activities

- Create your own missing-digits puzzle and have students solve it. Compare and discuss the different solutions that were found. Then have students work individually to create their own missing-digits puzzles. Let students exchange problems and try to solve each other's puzzles. Give them time to discuss the different solutions found for a particular puzzle.
- Have students work in pairs to create math-o-grams by replacing the numbers in a problem with pictures. Have students exchange puzzles and try to solve each other's puzzles.
- Have students work in small groups and challenge them to create math-o-grams by using letters that will form words or expressions. Put the collection of student-created math-o-grams together into a booklet and give each student a copy. (For further information on creating your own puzzles, see "Cryptarithms: Math Made Me Daft, Momma" by William A. Ewbank, in the January 1988 issue of *Mathematics Teacher*.)

Magic Square Activities

- The classic magic square uses the numbers 1 to 9 in such a way that the sum of each row, column, and diagonal is 15. In this activity, students learn to make the classic magic square. If desired, students can use Worksheet 1 on page 46.

In small groups, have students come up with the eight different ways that three numbers (between 1 and 9) can be added together to total 15:

$$9 + 5 + 1 = 15 \qquad 8 + 4 + 3 = 15$$

$$9 + 4 + 2 = 15 \qquad 7 + 6 + 2 = 15$$

$$8 + 6 + 1 = 15 \qquad 7 + 5 + 3 = 15$$

$$8 + 5 + 2 = 15 \qquad 6 + 5 + 4 = 15$$

Notice that each number appears only once in each equation. Challenge students to arrange the triplets in the rows, columns, and diagonals of a 3×3 magic square. Remind them that each number can only be used once in the magic square.

Hint: To figure out how to place the numbers in the magic square, determine how many times a number in a given cell will be used. For example, the number in the center cell will be used four times: in one row, one column, and two diagonals. The only number that appears in the triplets four times is 5, so 5 should be placed in the center cell. Next, consider the corner cells. Each corner cell must contain a number that appears in three triplets: in one row, one column, and one diagonal. Those numbers are 8, 6, 4, and 2.

- Have students create their own 3×3 magic square. Start by choosing any nine consecutive whole numbers. For example, 11, 12, 13, 14, 15, 16, 17, 18, and 19.

To determine the magic sum, multiply the order of the square (the height or width) by the median number in the set of nine numbers. For this example, the order of the magic square is 3 and the median number in the set is 15. Therefore, the magic sum is 45 (or 3×15).

Following the procedure outlined in the previous activity, have students find the eight triplets that can be formed with their nine numbers in order to create the magic sum. Then, have them arrange the numbers in the 3×3 magic square.

Allow students time to share and solve each other's magic squares.

- There are many printed resources available that provide further information on magic squares. Here are some examples that can be found in *Arithmetic Teacher* and *Mathematics Teacher*:

Atkinson, Thomas P. "Guided Discovery with Magic Squares." *Arithmetic Teacher* 22 (April 1975): 288–92.

Bernard, John. "Constructing Magic Square Number Games." *Arithmetic Teacher* 26 (October 1978): 36–38.

Kenney, Margaret. "An Art-full Application Using Magic Squares." *Mathematics Teacher* 75 (January 1982): 83–89.

Lyon, Betty Clayton. "Magic Squares." *Arithmetic Teacher* 37 (December 1990): 48–53.

Lyon, Betty Clayton. "Using Magic Borders to Generate Magic Squares." *Mathematics Teacher* 77 (March 1984): 223–26.

McCranie, Judson. "Magic Squares of All Orders." *Mathematics Teacher* 81 (November 1988): 674–678.

Paterno, James X. "The Odd-numbered Magic Square." *Mathematics Teacher* 82 (February 1989): 139–41.

Pizarro, Antonio. "Computer-generated Magic Squares." *Mathematics Teacher* 79 (September 1986): 471–76.

Pizarro, Antonio. "Generating Magic Squares Whose Orders Are Multiples of 4." *Mathematics Teacher* (March 1989): 216–21.

Reiter, Harold B. "Problem Solving with Magic Rectangles." *Mathematic Teacher* 79 (April 1986): 242–25.

Schwartzman, Steven. "Multiplicative Squares: Magic and Special." *Mathematic Teacher* 80 (January 1987): 51–54.

Wills, Herbert III. "Magic with Magic Squares." *Arithmetic Teacher* 36 (April 1989): 44–49.

Wood, Eric F. "More Magic with Magic Squares." *Arithmetic Teacher* 36 (December 1989): 42–46.

Twisted Tables Activities

- Have students create their own twisted tables for other students to solve. Students can use Worksheet 2a (page 47) to create a 5 x 5 addition table, or Worksheet 3a (page 49) to create a 5 x 5 multiplication table. They may also draw their own tables if they wish to use different square dimensions.

Students should fill in the top row of their table with whole numbers, making sure that each number is used only once. These same numbers should be used (in any order) to fill in the left column of the table. The resulting sums or products should be figured and entered into the middle section of the table.

Students can use Worksheet 2b (page 48) or Worksheet 3b (page 50) to turn the table into a puzzle for others to solve. If students are not using the worksheets, they should make a new copy of their table, filling in only the sums or products from one of the diagonals in the table and one more answer in each row. A few more answers can be given if the student desires. Students should *not* place the numbers they used to generate the puzzle in the top row or left column of the table. Instead, they should simply list the numbers used above the puzzle.

Allow students time to share and solve each other's puzzles.

- Have students create twisted tables by using positive as well as negative numbers or by using decimals or fractions.

Nine Men's Morris Activities

- Let students work in pairs to create and decorate their own Nine Men's Morris game board and game pieces. Give students time to play the game on each other's game boards. Worksheets 4a (page 51) and 4b (page 52) can be used for this purpose.
- Hold a Nine Men's Morris tournament using student-made game boards.
- Refer to the following article for a discussion of Nine Men's Morris and other problem-solving games:

Williford, Harold. "Games for Developing Mathematical Strategy."
Mathematics Teacher 85 (February 1992): 96-98.

Thinking Skills

Using Computer Software in a Thinking Skills Environment

Teachers are faced with the tremendous task of preparing today's students for tomorrow's world—a world characterized by change in an information-rich environment. Thinking skills are at the heart of this thriving, changing environment, for these are the behaviors students must practice in school and continue to apply for the rest of their lives.

It wasn't long ago that thinking skills were considered exclusive to gifted and enrichment classes. Today, however, thinking skills are viewed as an essential component of the total school curriculum. Developing these skills is the goal of each individual discipline. Many educators have, in fact, come to view thinking skills as perhaps the most basic of the basic skills because they facilitate the acquisition of all other learning.

At MECC, we view computer software as a vehicle for fostering students' thinking. Our products are curriculum-based, with thinking skills as a thread within subject areas. This provides an environment with many opportunities for teachers to highlight and reinforce thinking skills.

We believe teachers play a critical role in determining the classroom environment for thinking. Naturally, many teachers have taught thinking skills and will continue to do so using a variety of strategies. Our commitment is to provide teachers with the materials that help them do their job well: high-quality software that promotes the application of thinking skills.

Our approach to thinking skills reflects what both research and effective classroom practice has shown. That is, the approach that is most effective and appeals to most teachers is one that infuses thinking skills into existing content areas. Educators have told us they are interested in thinking skills as a method used in the instruction of a topic, not as a subject. By infusing thinking skills into existing content areas, MECC products integrate easily into teachers' curricula while providing a rich environment for students to practice skillful thinking. We strive to meet the challenge teachers face in promoting the skills that students need.

If schools are to integrate the teaching of thinking with regular academic instruction, they need to know what aspects of thinking to teach. After exploring the research that has been done in the area of thinking skills, MECC has chosen as a base the *Dimensions of Thinking* framework, published in 1988 by the Association of Supervision and Curriculum Development (ASCD). We chose this framework because it pulls together research and models from a variety of sources and brings the theory to the classroom level, applying it to that environment. In addition to knowing the subject matter that is covered, teachers now can see the specific thinking skills that are challenged within a product.

This section highlights ways in which teachers can use *Amazing Arithmetricks* to promote thinking skills with their students. The following pages provide examples of how *Amazing Arithmetricks* relates to the ASCD core thinking skills framework. Although only one thinking skill per category is correlated to a specific part of the product, each skill can be practiced on many levels and in many aspects of the product.

We realize the importance of thinking skills in the curriculum. We believe it is essential that students be taught thinking skills so that they have the tools to understand the past, deal with the present, and prepare for the future. We are confident that you will find *Amazing Arithmetricks* of considerable value in your classroom as you foster student thinking.

A Framework for Thinking

The components used in thinking are referred to as *core thinking skills*. This framework defines those skills that appear in the repertoire of the model learner. Each skill selected is documented in research as important to learning or thinking, is teachable, and is valued by educators as important for students to learn.

The core skills of the ASCD framework are listed and defined below with examples of applications within *Amazing Arithmetricks*. The skills are neither discrete nor hierarchical. In fact, individual skills draw on other skills and can be used repeatedly in the thinking process. The selected examples are not exhaustive but highlight ways in which these thinking skills are used in *Amazing Arithmetricks*.

Source: *Dimensions of Thinking*, Association for Supervision and Curriculum Development (ASCD), 1988.

| Definition of Core Thinking Skills Categories | Core Thinking Skills Components | <i>Amazing Arithmetricks</i> Application |
|--|--|---|
| Focusing Skills allow students to attend to selected pieces of information and ignore others. Focusing occurs when students sense a problem, an issue, or a lack of meaning. | Focusing Skills <ul style="list-style-type: none"> • Defining Problems • Setting Goals | In <i>Amazing Arithmetricks</i> , students develop logic and problem-solving skills while applying mathematical concepts such as basic computation and basic math facts using positive and negative whole numbers and decimal numbers. |
| Information Gathering Skills involve obtaining information and clarifying issues and meanings through inquiry. | Information Gathering Skills <ul style="list-style-type: none"> • Observing • Formulating Questions | As students solve the puzzles Number Challenge, Math-O-Grams, Magic Shapes, Twisted Tables, and Nine Men's Morris, they observe how various choices and strategies lead to success. |
| Remembering Skills are those activities or strategies that students consciously engage in to store and retrieve information from long-term memory. Activating prior knowledge falls under this category. | Remembering Skills <ul style="list-style-type: none"> • Encoding • Recalling | In Puzzle Practice , students work with the puzzles in an open-ended environment. The knowledge and understanding they gain can be applied to Visit the Carnival , where students are required to solve a set number of puzzles. In both programs, students choose the level of difficulty for each puzzle, allowing them to work at their own ability level. |

| Definition of Core Thinking Skills Categories | Core Thinking Skills Components | Amazing Arithmetricks Application |
|---|---|--|
| Organizing Skills are used to arrange information so that it can be understood or presented more effectively. | Organizing Skills <ul style="list-style-type: none"> • Comparing • Classifying • Ordering • Representing | In Tangled Tables, students must arrange the five provided numbers in any order along the top row and left-most column of the table so that all result sums are correct. |
| Analyzing Skills are used to clarify existing information by examining parts and relationships. Through analysis, students identify and distinguish components, attributes, claims, assumptions, or reasoning. | Analyzing Skills <ul style="list-style-type: none"> • Identifying Attributes and Components • Identifying Relationships and Patterns • Identifying Main Ideas • Identifying Errors | When playing the game Nine Men's Morris in Visit the Carnival, students must develop a strategy and then analyze and adjust their strategy based on the moves of their opponent. |
| Generating Skills involve using the students' prior knowledge to add information beyond what is given. Connections between new ideas and prior knowledge are made as new information and ideas are recast into new structures. | Generating Skills <ul style="list-style-type: none"> • Inferring • Predicting • Elaborating | In Math-O-Grams, students replace missing digits to make the problem true. Variations of this puzzle involve replacing letters or symbols to make the problem true. Since there is often more than one solution, controlled manipulation of variables allows students to use information from previous trials. |
| Integrating Skills involve putting together the relevant parts or aspects of a solution, understanding, principle, or composition and incorporating this integrated information into a new understanding. | Integrating Skills <ul style="list-style-type: none"> • Summarizing • Restructuring | As students explore mathematical concepts through the various puzzles—Number Challenge, Math-O-Grams, Magic Shapes, Twisted Tables, and Nine Men's Morris—they can apply their understandings to Visit the Carnival. |
| Evaluating Skills involve assessing the reasonableness and quality of ideas. | Evaluating Skills <ul style="list-style-type: none"> • Establishing Criteria • Verifying | As students develop strategies for success in solving the puzzles, they are encouraged to think through a variety of possible approaches. Immediate feedback is provided to verify decisions and actions. |

Student Worksheets

On the following pages are the student worksheets mentioned in "Classroom Ideas." Each worksheet is briefly described below.

Worksheet 1: A Magic Square **page 46**

With this worksheet, students will be able to construct the classic 3 x 3 magic square.

Worksheet 2a: Making a Twisted Table (Addition) **page 47**

This worksheet is designed to help students create their own mixed-up 5 x 5 addition table. Students can transfer information from this worksheet to Worksheet 2b in order to create a puzzle for their friends to solve.

Worksheet 2b: A Twisted Table Puzzle (Addition) **page 48**

This worksheet presents the information created in Worksheet 2a in the form of a puzzle.

Worksheet 3a: Making a Twisted Table (Multiplication) **page 49**

This worksheet is designed to help students create their own mixed-up 5 x 5 multiplication table. Students can transfer information from this worksheet to Worksheet 3b to create a puzzle for their friends to solve.

Worksheet 3b: A Twisted Table Puzzle (Multiplication) **page 50**

This worksheet presents the information created in Worksheet 3a in the form of a puzzle.

Worksheet 4a: Nine Men's Morris **page 51**

Students can use this worksheet to review the rules for the game and to cut out and decorate their own Nine Men's Morris game pieces.

Worksheet 4b: Nine Men's Morris **page 52**

This worksheet provides a game board that students can decorate and use for playing Nine Men's Morris.

Certificate of Achievement **page 53**

Students can use this worksheet to record their accomplishments in the program **Puzzle Practice** by copying the information presented in Tent 6.

A Magic Square

In this Magic Square, the sum of each row, column, and diagonal must equal 15. The center-square number is provided. Use each of the numbers 1, 2, 3, 4, 6, 7, 8, and 9 only once within the square to complete it.

| | | |
|--|---|--|
| | | |
| | 5 | |
| | | |

Hint: Find the eight different ways you can combine any three of the numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9 so that their sum is 15.

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

$$\underline{\quad} + \underline{\quad} + \underline{\quad} = 15$$

Making a Twisted Table

(Addition)

What five numbers will you use to create your table?

Place the five numbers across the top row of the table. Then place the same five numbers—in a different order—down the left side of the table. The numbers can be placed in any order you want.

Fill in the middle of the table by figuring out all of the sums.

| | | | | | |
|---|--|--|--|--|--|
| + | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

To make this table into a puzzle, copy the answers in the shaded squares onto the table on Worksheet 2b. Also, at the top of the worksheet, list the numbers you used to create the table. Then have a friend try to solve your puzzle!

A Twisted Table Puzzle

(Addition)

Use these five numbers to solve the puzzle:

Place the five numbers across the top row of the table. Then place the same five numbers down the left side of the table. Place the numbers so that all the sums are correct. You can fill in the missing sums as you work.

| | | | | | |
|---|--|--|--|--|--|
| + | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Making a Twisted Table

(Multiplication)

What five numbers will you use to create your table?

Place the five numbers across the top row of the table. Then place the same five numbers—in a different order—down the left side of the table. The numbers can be placed in any order you want.

Fill in the middle of the table by figuring out all of the products.

| | | | | | |
|---|--|--|--|--|--|
| X | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

To make this table into a puzzle, copy the answers in the shaded squares onto the table on Worksheet 3b. Also, at the top of the worksheet, list the numbers you used to create the table. Then have a friend try to solve your puzzle!

A Twisted Table Puzzle

(Multiplication)

Use these five numbers to solve the puzzle:

Place the five numbers across the top row of the table. Then place the same five numbers down the left side of the table. Place the numbers so that all the products are correct. You can fill in the missing products as you work.

| X | | | | | |
|---|--|--|--|--|--|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

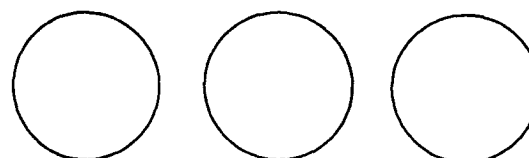
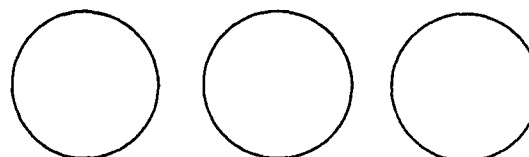
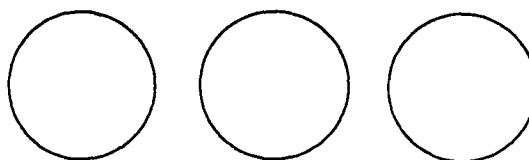
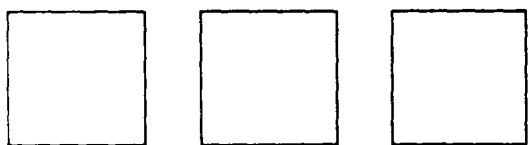
Nine Men's Morris

Color or decorate the game pieces found below. Cut out the game pieces and use the game board to play the game with a friend.

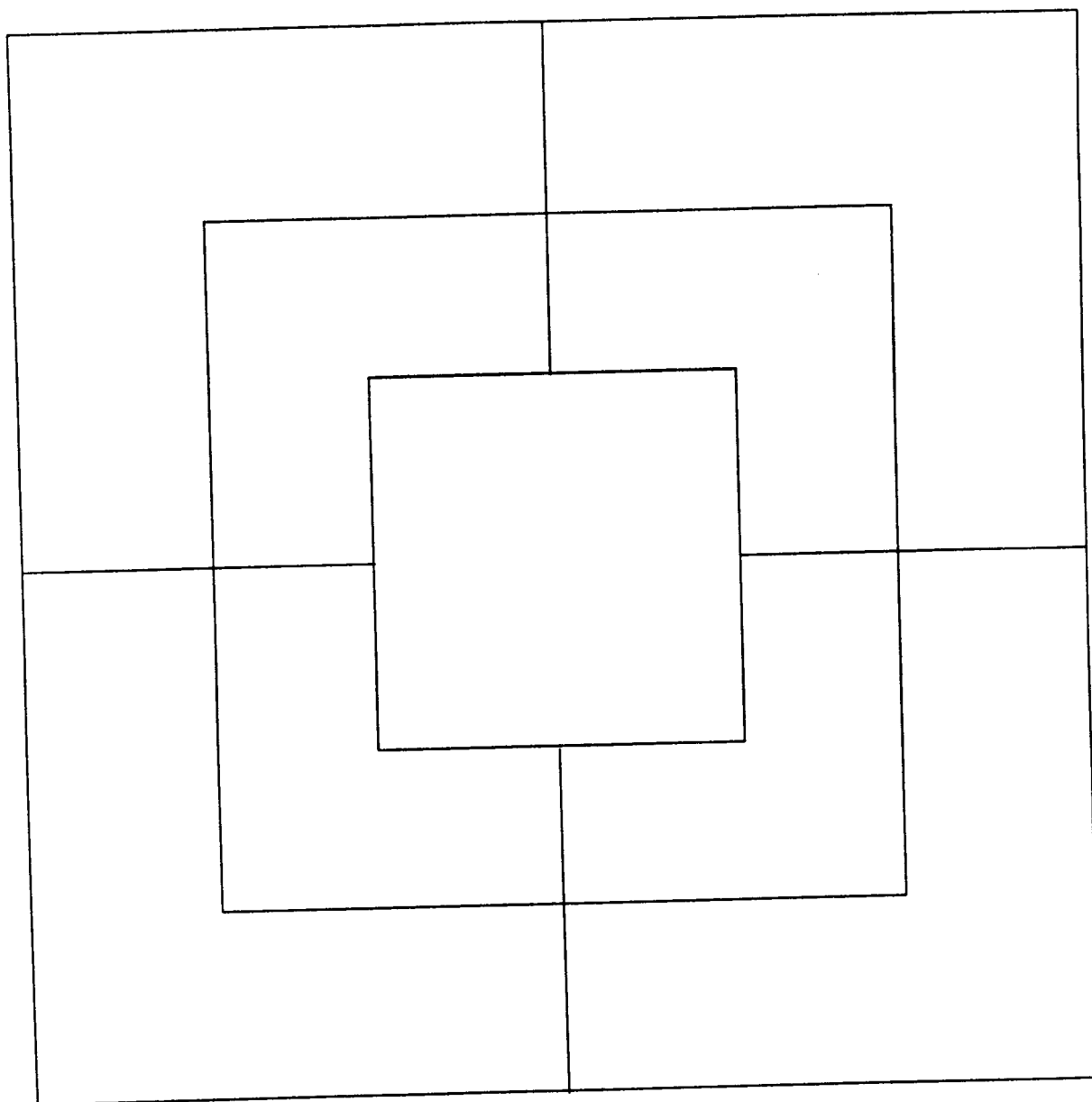
Rules:

1. Both players start with nine pieces and an empty game board.
2. Take turns placing your pieces on the vacant points of the game board.
3. Once all of your pieces are placed on the game board, take turns moving a piece. You can only move your piece one position along a line and you can only move to an empty point.
4. A "mill" occurs when your pieces fill all three points on a line. Any line counts. A mill can be made while you are placing pieces on the game board or while you are moving your pieces around the game board.
5. When you make a mill, you can remove one of your opponent's pieces. The piece you remove cannot be from an opponent's mill unless there is no other piece to remove.
6. You can move a piece out of a mill and then, on another turn, move it back to re-form the same mill and take another of your opponent's pieces.
7. You win by getting your opponent down to two pieces or by blocking your opponent so no move can be made.

Game Pieces



Nine Men's Morris



AMAZING ARITHMETRICKS
CERTIFICATE OF ACHIEVEMENT

presented to:

who

• solved puzzles

• used clues

Notes

Presentation Materials

*This part of the manual provides materials that help you demonstrate **Amazing Arithmetricks** to teachers, curriculum specialists, and administrators. The materials are designed to enable you to give an effective presentation with a minimum of preparation.*

How to Use the Presentation Materials provides tips for using the other two sections.

Product Information includes annotated transparency masters that you can use to provide a quick overview of **Amazing Arithmetricks**.

Product Demonstration provides step-by-step instructions for a live demonstration of **Amazing Arithmetricks**.

How to Use the Presentation Materials

Introduction

This section is designed for instructional computing coordinators, curriculum coordinators, training specialists, and other educators who want a quick yet detailed review of *Amazing Arithmetricks*. These materials can be used as leaders' pages for staff-development workshops or for individual study.

Organization

There are two subsections—Product Information and Product Demonstration.

The Product Information subsection has two parts—Overview and Features. Each part consists of a copy master that you can use to make transparencies or handouts and suggested commentary that you can use in a presentation.

The Product Demonstration subsection contains step-by-step instructions for demonstrating *Amazing Arithmetricks* with simple notes on what to do, what you will see, and what to explain. It can also be used as a self-study guide.

To prepare for a workshop demonstration, sit down at your computer and go through the Product Demonstration once or twice. The step-by-step instructions are written with the assumption that you know how to use an Apple computer. Feel free to edit the notes. The Product Demonstration is designed to show the essentials of the product as concisely as possible. If you want to prepare a more in-depth demonstration, you can consult previous sections of this manual.

Planning Your Time

You can use these materials for a range of activities:

| | |
|----------------------------------|--|
| <i>1-Minute Spot</i> | Use the Overview transparency for a quick overview of the product. |
| <i>5-Minute Overview</i> | Use the Overview transparency with its accompanying commentary for a more detailed overview of the product. |
| <i>10-Minute In-Depth Review</i> | Use the Overview and Features transparencies with their accompanying commentary for an in-depth product review. |
| <i>20-Minute Walk-Through</i> | Add the Product Demonstration section to the 10-Minute In-Depth Review for a product walk-through. |
| <i>60-Minute Hands-On Review</i> | Do the 10-Minute In-Depth Review; then give the Product Demonstration section to the participants for a hands-on review. |

Equipment Required

If you make transparencies of the Overview and Features masters, you'll need an overhead projector.

If you intend to use the Product Demonstration in a workshop, a display device such as a large-screen color monitor or LCD palette is very helpful.

If you want workshop participants to use the product, we recommend one computer for every two participants.

Amazing Arithmetricks

Overview

An educational program encouraging students to practice challenging mathematical puzzles.

Curriculum Area: Mathematics

Subject: Mathematics

Grade Levels: 5–Adult

Topic: Computation, problem-solving, and logic



Menu Options

- In **Puzzle Practice**, students practice a variety of math puzzles in an open-ended environment
- In **Visit the Carnival**, students practice the same puzzle types in a teacher-directed environment
- **Puzzle Pros** displays the high-score list for **Visit the Carnival**
- **Information** gives general information about *Amazing Arithmetricks*

Students

- Choose from four mathematical puzzle types
- Decide how many puzzles to solve in **Puzzle Practice**
- Select levels of difficulty for their puzzles
- Can save their games in **Visit the Carnival** and continue playing at a later time
- Can earn high scores and enter their initials in the **Puzzle Pros** list

Teachers

- Use *Amazing Arithmetricks* to motivate students to practice math computation, logic, and problem-solving skills
- Control the number of puzzles that students complete in **Visit the Carnival**
- View, and clear, the **Puzzle Pros** high-score list
- Clear the saved games

Amazing Arithmetricks: Overview Commentary

Description

Amazing Arithmetricks is an educational program in which students use logic and problem-solving skills to complete challenging mathematical puzzles.

The program is designed for students in grades five and up.

Amazing Arithmetricks has the following hardware and software requirements:

- Apple II series computers with 128K memory
- Corvus Omninet, Digicard, and AppleShare networks, if you plan to use a network
- A color monitor is recommended.

Menu Options

- **Puzzle Practice** lets students explore a variety of mathematical puzzles in an open-ended environment.
- **Visit the Carnival** challenges students to solve a required number of puzzles and earn points before they enter the Master Tent and play a game of Nine Men's Morris with one of the Arithmetricks.
- **Play Saved Game** allows students to continue a game they previously saved in **Visit the Carnival**.
- **Puzzle Pros** displays the high-scores list for **Visit the Carnival**.
- **Information** gives information about *Amazing Arithmetricks* and other MECC products.
- **Quit** allows students to exit from the program.

Students

In **Puzzle Practice**, students move freely among carnival tents to select which mathematical puzzles to solve. Students decide how many of each puzzle type to solve and have the opportunity to buy five clues for each puzzle.

In **Visit the Carnival**, students solve puzzles to earn points and get their passes punched before they can enter the Master Tent to play the strategy game of Nine Men's Morris. Students have a limited number of clues to buy.

Teachers

Teachers can use *Amazing Arithmetricks* to motivate students to practice math computation and problem-solving skills.

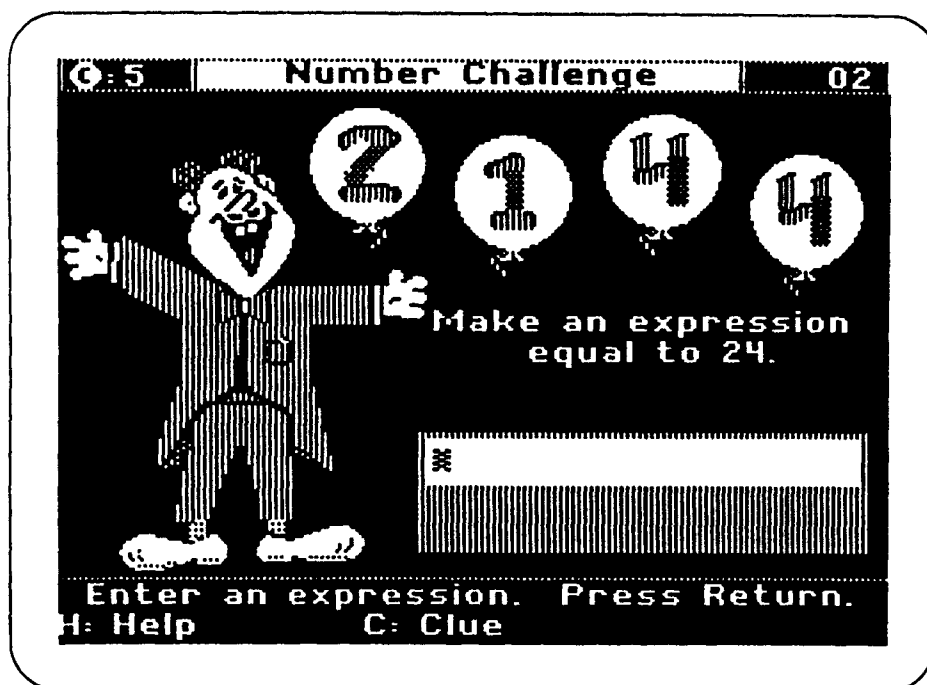
In **Visit the Carnival**, teachers can control the total number of puzzles a student must complete in each tent.

Teachers should refer to the manual for complete instructions on how to use *Amazing Arithmetricks*, as well as for classroom ideas, resources, and background information.

Teachers can view and clear the high-score list and can remove the saved games.

Amazing Arithmetricks

Features



An Amazing Arithmetricks Game Screen

Program Elements

- Provides a game-like atmosphere to motivate students to practice mathematical problem-solving skills
- Displays bright, colorful, humorous graphics
- Gives reinforcing feedback
- Rewards success in **Visit the Carnival** with entry into the Master tent and a place on the **Puzzle Pros** high-score list
- Includes a manual with complete instructions for using the program, classroom activities, textbook correlations, and more

Learning Objectives

- To practice math computation skills in an engaging environment
- To apply knowledge of basic math facts
- To practice logical deduction skills
- To develop problem-solving strategies

Amazing Arithmetricks: Features Commentary

Program Elements

Educational Game: Game-like setting motivates students to practice math computation and problem-solving skills.

Graphics: Students are shown bright, colorful graphics within humorous, imaginative settings.

Feedback: Students are given feedback and encouragement as they solve puzzles.

Rewards success: Success is rewarded in **Visit the Carnival** by entry into the Master tent where the student can play one of the Arithmetricks at Nine Men's Morris. Students who score well can enter their initials in the Puzzle Pros high-score list.

Manual: *Amazing Arithmetricks* includes a manual that contains complete instructions for using the program, ideas for classroom use, student handouts, and more.

Learning Objectives

Amazing Arithmetricks motivates students to use their math computation skills to solve puzzles. Students can apply their knowledge of basic math facts, using positive and negative whole numbers and decimal numbers to solve the puzzles.

Amazing Arithmetricks encourages students to develop their logical deduction and problem-solving skills.

Product Demonstration

| | Do | See | Explain |
|---|-------------------|-----------|--|
| 1 | Start the program | Main menu | <p>Puzzle Practice lets students solve a variety of math puzzles in an open-ended environment.</p> <p>Visit the Carnival has students solve a variety of math puzzles in a more directed environment.</p> <p>Play Saved Game allows students to play a previously saved game.</p> <p>Puzzle Pros displays the Visit the Carnival high-score list.</p> <p>Information displays several screens of introductory information about <i>Amazing Arithmetricks</i>.</p> <p>Quit lets you exit the program.</p> <p>We'll start this demonstration by looking at the information screens; then we'll try solving some puzzles. We'll finish by looking at the Management Options.</p> |

| | Do | See | Explain |
|---|---|--------------------------|---|
| 2 | Use the arrow keys to highlight Information , and then press the Return key | First information screen | This is the first of several information screens. |
| 3 | Read the screens, pressing the Space Bar to move from one screen to the next | Main menu | The Main menu is displayed after the last information screen. Now let's try solving some puzzles! |
| 4 | Use the arrow keys to highlight Visit the Carnival and then press Return | Name screen | In Visit the Carnival , you play for points, but you have a limited number of clue coins and must solve a set number of puzzles in each tent. Enter your name so that the computer can keep a record of your score and puzzle-solving progress. |
| 5 | Type in your first name and then press Return; type in your last name and then press Return | Name message | When you've finished entering your name, you have the chance to change it; but for now, let's assume you've typed in the correct name. |
| 6 | Use the arrow keys to highlight Yes and then press Return | Instructions message | Let's go ahead and read the game instructions. |

| | Do | See | Explain |
|----|---|---|---|
| 7 | Use the arrow keys to highlight Yes and then press Return | Instructions screen | This is the first of several instruction screens telling you about Visit the Carnival . |
| 8 | Read the instruction screens, pressing the Space Bar after each one | Carnival screen | Tents 1, 2, 3, and 4 contain Math puzzles. Tent 6 contains the high-score list. The remaining tent is the Master Tent. Let's see what's in Tent 3. |
| 9 | Use the arrow keys to "walk" the white footprints to Tent 3 and then press Return | Magic Shapes level of difficulty screen | Magic Shapes has three levels of difficulty: Level 1 is the easiest and Level 3 is the most difficult. We'll try the easy level for now. |
| 10 | Use the arrow keys to select Level 1 and then press Return | Magic Shapes game screen | On the screen is a Magic Shape made up of empty cells. You solve the puzzle by entering numbers from the list at the top of the screen into the cells; you can only use each number once. The totals of all the rows, columns, and diagonals must reach the magic sum. Don't worry if this sounds confusing—help is available! |

| | Do | See | Explain |
|----|---|--|--|
| 11 | Press the H key | Help screen | Simple instructions explain what you must do to solve the puzzle. As you try to solve the puzzle, you can re-read these instructions by pressing the H key. |
| 12 | Read the instructions and then press the Space Bar | Magic Shapes game screen | Now see if you can solve the puzzle. |
| 13 | Use the arrow keys to move to any cell, type in one of the numbers at the top of the screen, and then press Return; use the arrow keys to move to another cell, type in another of the numbers, and then press Return | Magic Shape beginning to fill with numbers | <p>The computer automatically adds the numbers you enter along the rows, columns, and diagonals and displays the sums when you press the Return key.</p> <p>If you're having trouble solving the puzzle, you can buy a clue with one of your clue coins. You do that by pressing the C key. Let's try buying a clue now.</p> |
| 14 | Press the C key | Number underlined in blue | <p>You've bought one of the numbers in the Magic Shape—the blue line indicates the number is in the correct place in the puzzle.</p> <p>The counter at the top left of the screen shows how many clue coins you have left; the more you save, the more points you earn.</p> |

| | Do | See | Explain |
|----|---|---|--|
| 15 | Move around the magic shape using the arrow keys; enter numbers until you have solved the puzzle—you can change any number you've entered in a particular cell by typing over it; press the Space Bar | Feedback message | <p>You've successfully solved the puzzle when the totals of all the rows, columns, and diagonals equal the magic sum on the screen. The feedback message congratulates you on successfully solving the puzzle.</p> <p>Try solving a few more magic-shape puzzles; then we'll return to the Carnival and try puzzles in a different tent.</p> |
| 16 | <p>If you haven't finished your puzzle but want to return to the Carnival, press the Escape key; use the arrow keys to highlight Yes and then press Return</p> <p>If you have finished your puzzle and want to return to the Carnival, press the Escape key</p> | <p>Escape message and then the Carnival screen</p> <p>or</p> <p>Carnival screen</p> | <p>The Escape message is just a safeguard to make sure you really want to leave the tent before finishing the puzzle.</p> <p>If you had completed the puzzle, you'll exit straight from the tent back to the Carnival.</p> <p>Now let's see what's in Tent 1.</p> |
| 17 | Use the arrow keys to move the footprints to Tent 1 and then press Return | Number Challenge level of difficulty screen | Again, there are three levels of difficulty available; but for now we'll play at the easiest level. |

| | Do | See | Explain |
|-----------|--|---------------------------------------|--|
| 18 | Use the arrow keys to select Level 1 and then press Return | Number Challenge game screen | Guido challenges you to make an expression to equal a target amount, using only the numbers displayed at the top of the screen. |
| 19 | Press the H key; read the instruction screens and press the Space Bar after each one | Help screens and then the game screen | <p>The Help screens explain how to solve the puzzle and what keys to use when typing in the expression. Go ahead and see if you can solve Guido's puzzle.</p> <p>Don't forget that you can buy clues; but be careful not to buy too many clues because saving clues adds points to your score.</p> |

| | Do | See | Explain |
|----|--|------------------------------|--|
| 20 | Use the numbers 0–9, the parentheses keys, and the mathematical sign keys (the asterisk is used to multiply and the backslash to divide) when you enter your expression; use the delete key to change your expression; press Return when your expression is finished | Feedback | <p>If your equation is incorrect, you are given feedback and can try again.</p> <p>If your expression is correct, your score total changes and you see a feedback message.</p> <p>Each time you correctly solve a puzzle in Visit the Carnival, your Master Tent Entry Pass is punched. When you have the correct number of punch marks, you can enter the Master Tent. Let's check to see how many punch marks are on your pass now.</p> |
| 21 | Press the P key | Master Tent Entry Pass | The Pass shows how many puzzles you've solved so far and how many you have left to solve before you can enter the Master Tent. |
| 22 | Press the Space Bar | Number Challenge game screen | Try solving another of Guido's puzzles. |
| 23 | When you've successfully completed the puzzle, press the Escape key | Carnival screen | You can exit from any tent in the middle of a game by pressing the Escape key. |

| | Do | See | Explain |
|----|--|--|--|
| 24 | Press the Escape key | Save game screen | If you run out of time but don't want to lose the punch marks on your pass, you can save your game and continue with it the next time you play. |
| 25 | Use the arrow keys to highlight Yes and then press Return | Main menu | <p>The game is saved under whatever name you entered when you began to play. You can re-open a game from the Play Saved Game option on the Main menu.</p> <p>Let's take a look at the Puzzle Pros high-score list.</p> |
| 26 | Use the arrow keys to highlight Puzzle Pros and then press Return | Puzzle Pros list (or a message if there are no scores in the list yet) | Now let's take a look at the Management Options. |

| | Do | See | Explain |
|----|--|--|---|
| 27 | Press the Space Bar and then hold down the Control key and press the A key | Main menu and then the Management Options screen | <p>Pressing Control-A from the Main menu allows you to see the Management Options screen. Three options are available:</p> <ul style="list-style-type: none"> • you can control the number of puzzles a student must complete in each tent in Visit the Carnival • you can see the Puzzle Pros high-score list or delete scores in it • you can remove all the previously saved games |
| 28 | Press the Escape key | Main menu | <p>This is just a sample of some of the puzzles available in <i>Amazing Arithmetricks</i>. If you have time, try some of the puzzles in Tents 2 and 4.</p> <p>When you've finished exploring <i>Amazing Arithmetricks</i>, choose Quit to exit from the program.</p> <p>Thanks for persisting with our "perfectly puzzling" program!</p> |