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Stein et al.

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[54] **MATHEMATICAL BOARD GAME APPARATUS**

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[21] Appl. No.: **347,564**

[52] **U.S. Cl.**..... **273/131 AC,** 35/31 C, 273/131 AB, 273/131 K, 273/131 KN

[51] **Int. Cl.** **A63f 3/00**

[58] **Field of Search** 273/130, 131, 135; 35/31

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[57] **ABSTRACT**

A mathematical game for play by two or more persons comprises a playing board divided into a series of squares, arranged in rows and columns, each square bearing a number indicia, and a set of playing pieces for each player. Each player piece in a set is marked with at least one number or a non-numeric symbol, at least one playing piece in each set having a non-numeric symbol. Each set of playing pieces is identical to every other set with respect to the number and marking of pieces. The playing pieces are moved from one numbered square to another in a competitive manner, a piece being able to land only in those squares numbered with an integer multiple of at least one of the numerals on the playing piece. The playing piece containing the non-numeric symbol is free to land on any square. Pieces are captured when either: (1) the piece of another player located in the same row or column as the captured piece is moved to the square occupied by the captured piece; or (2) the captured piece was sought to be moved to a square whose number is not an integer multiple of a number on the captured piece, and the incorrect move is challenged by another player.

3 Claims, 3 Drawing Figures

LEGEND FOR COLOR CODE

R= RED (2) A = AQUA (5) Y = YELLOW (8)
N= GREEN (3) T = TORQUOISE (6) O= ORANGE (9) G=GOLD (PRIME)
B= BLUE (4) P = PURPLE (7) W= BROWN (10)

N 141	R 142	G 143	RNB 144 TYO	A 145	R 146	NP 147	RB 148	G 149	RNA 150 TW
G 131	RN 132 BT	P 133	R 134	NAO 135	RBY 136	G 137	RNT 138	G 139	RBA 140 PW
G 121	R 122	N 123	RB 124	A 125	RNT 126 PO	G 127	RBY 128	N 129	RAW 130
N 111	RB 112 PY	G 113	RNT 114	A 115	RB 116	NO 117	R 118	P 119	RNBA 120 TYW
G 101	RNT 102	G 103	RBY 104	NAP 105	R 106	G 107	RNB 108 TO	G 109	BAW 110
P 91	RB 92	G 93	R 94	A 95	RNB 96 TY	G 97	RP 98	ON 99	RB 100 AW
NO 81	R 82	G 83	RNB 84 TP	A 85	R 86	N 87	RBY 88	G 89	RNA 90 TOW
G 71	RNB 72 TYO	G 73	R 74	NA 75	RB 76	P 77	RNT 78	G 79	RBA 80 YW
□ 61	R 62	NPO 63	RBY 64	A 65	RNT 66	G 67	RB 68	N 69	RA 70 PW
N 51	RB 52	G 53	RN 54 TO	A 55	RB 56 PY	N 57	R 58	G 59	RNB 60 ATW
G 41	RN 42 TP	G 43	RB 44	NAO 45	R 46	G 47	RNB 48 TY	P 49	RAW 50
G 31	RBY 32	N 33	R 34	AP 35	RNB 36 TO	G 37	R 38	N 39	RBA 40 YW
NP 21	R 22	G 23	RNB 24 TY	A 25	R 26	NO 27	RBP 28	G 29	RNA 30 TW
G 11	RN 12 BT	G 13	RP 14	NA 15	RBY 16	G 17	RN 18 TO	G 19	RB 20 AW
G 1	GR 2	NG 3	RB 4	AG 5	RNT 6	PG 7	RBY 8	NO 9	RAW 10

10

FIG. 1.

LEGEND FOR COLOR CODE

R = RED (2) A = AQUA (5) Y = YELLOW (8)
N = GREEN (3) T = TORQUOISE (6) O = ORANGE (9) G = GOLD (PRIME)
B = BLUE (4) P = PURPLE (7) W = BROWN (10)

N 141	R 142	G 143	RNB 144 TYO	A 145	R 146	NP 147	RB 148	G 149	RNA 150 TW
G 131	RN 132 BT	P 133	R 134	NAO 135	RBY 136	G 137	RNT 138	G 139	RBA 140 PW
G 121	R 122	N 123	RB 124	A 125	RNT 126 PO	G 127	RBY 128	N 129	RAW 130
N 111	RB 112 PY	G 113	RNT 114	A 115	RB 116	NO 117	R 118	P 119	RNBA 120 TYW
G 101	RNT 102	G 103	RBY 104	NAP 105	R 106	G 107	RNB 108 TO	G 109	BAW 110
P 91	RB 92	G 93	R 94	A 95	RNB 96 TY	G 97	RP 98	ON 99	RB 100 AW
NO 81	R 82	G 83	RNB 84 TP	A 85	R 86	N 87	RBY 88	G 89	RNA 90 TOW
G 71	RNB 72 TYO	G 73	R 74	NA 75	RB 76	P 77	RNT 78	G 79	RBA 80 YW
□ 61	R 62	NPO 63	RBY 64	A 65	RNT 66	G 67	RB 68	N 69	RA 70 PW
N 51	RB 52	G 53	RN 54 TO	A 55	RB 56 PY	N 57	R 58	G 59	RNB 60 ATW
G 41	RN 42 TP	G 43	RB 44	NAO 45	R 46	G 47	RNB 48 TY	P 49	RAW 50
G 31	RBY 32	N 33	R 34	AP 35	RNB 36 TO	G 37	R 38	N 39	RBA 40 YW
NP 21	R 22	G 23	RNB 24 TY	A 25	R 26	NO 27	RBP 28	G 29	RNA 30 TW
G 11	RN 12 BT	G 13	RP 14	NA 15	RBY 16	G 17	RN 18 TO	G 19	RB 20 AW
G 1	GR 2	NG 3	RB 4	AG 5	RNT 6	PG 7	RBY 8	NO 9	RAW 10

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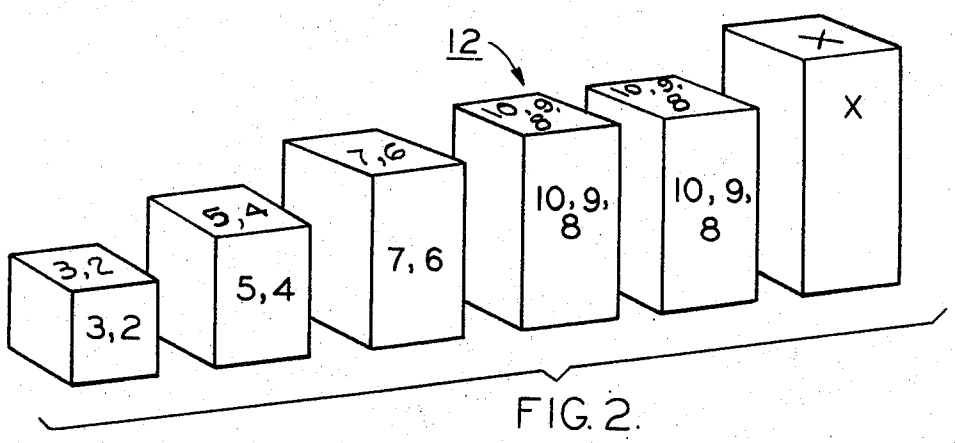
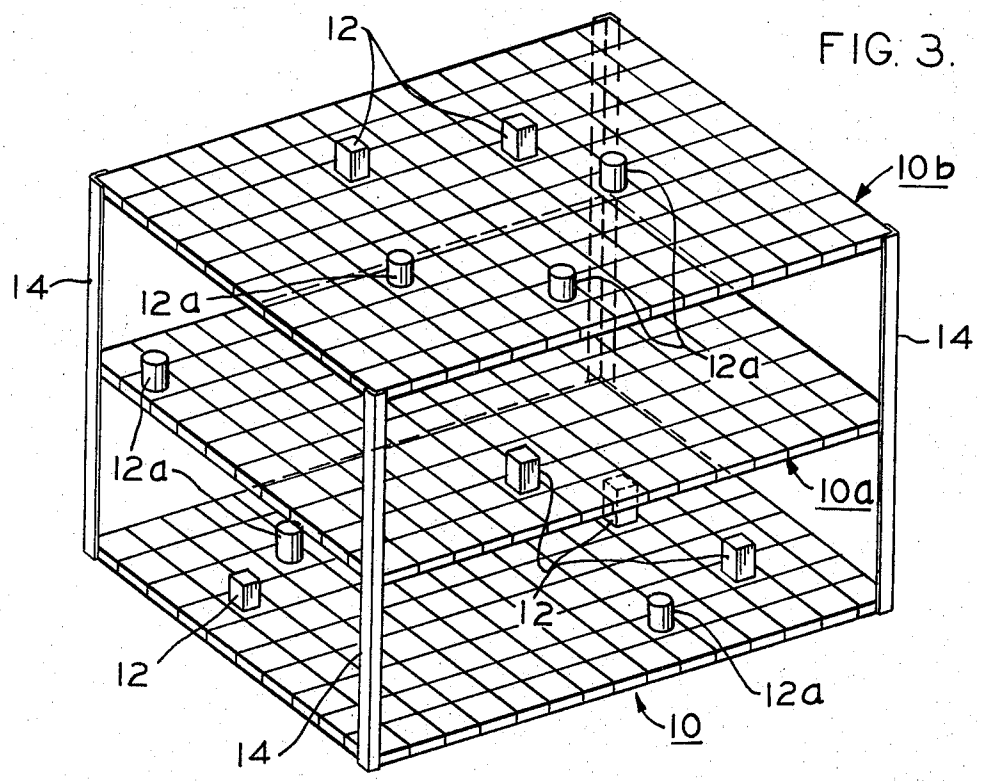

12
3,2
3,2
5,4
5,4
7,6
7,6
10, 9, 8
10, 9, 8
10, 9, 8
X
X

FIG. 2.

FIG. 3.


12
10b
14
12a
14
12a
12a
10a
12
12
12a
14
10

MATHEMATICAL BOARD GAME APPARATUS

The present invention concerns a novel educational mathematical game played on a game board containing a plurality of numbered areas. More particularly, the present invention concerns a novel educational game comprising a playing board divided into a series of demarcated areas, and at least two sets of playing pieces which are marked with one or more numbers, and/or one or more non-numeric symbols.

It is an object of the present invention to provide an educational game which teaches the principles of multiplication, division, and prime numbers as well as promoting memorization of multiplication tables, all in the context of a competitive game.

In accordance with the present invention there is provided a game apparatus comprising a game board divided into demarcated areas, each area bearing a number or numbers thereon, and two or more sets of playing pieces, each piece in a set bearing indicia thereon, the indicia consisting of one or more numbers or non-numeric symbols.

Generally speaking, the indicia bear a discernible mathematical relationship to at least some of the numbers marked on the demarcated playing areas. The term "number" used in reference to the numbers on the demarcated areas and the indicia on the playing pieces includes integers, fractions, decimal numbers and mixed numbers as those terms are conventionally used in mathematics and may include also mathematical symbols with or without specific numbers associated therewith. The term "indicia" used with reference to the playing pieces includes numbers as defined above and non-numeric symbols such as letters or unmarked playing pieces, the unmarked pieces being considered to bear non-numeric indicia by virtue of their lack of a number marking. By the term "a discernible mathematical relationship" as used in the specification and claims is meant that according to the rules of the game indicia on the playing pieces may be related by a correct mathematical statement to numbers contained on the demarcated areas.

In accordance with one aspect of the invention, each player is provided with a set of playing pieces which is identical to every other set with respect to the number of pieces in the set and the markings thereon. Preferably, the several sets are distinguishable one from the other so that one player's pieces on the board can be distinguished from the pieces of the other players. This may conveniently be accomplished by having the pieces of the several sets made in distinctive colors and/or shapes.

In accordance with another aspect of the invention, each playing piece of a set contains either two or three integers marked thereon, except for one piece of a set which contains no integers marked thereon and is either left blank or has a non-numeric symbol marked thereon. In a preferred aspect, the numbers on the pieces are integers selected from the numbers betwen 2 and 10.

In accordance with another aspect of the invention, the numbered, demarcated areas are non-numerically coded to indicate which of the numbers contained on the pieces are integer multiples of the number in the demarcated area. A preferred form of such non-numeric coding is a color code wherein a different color is assigned to each number represented on a playing piece, and each demarcated area contains all colors

which correspond to numbers on the pieces which satisfy the relationship to be discerned. The term "code" used in the specification and claims, unless specified to be a color or other particular code, is intended to embrace any and all forms of coding.

In accordance with another aspect of the invention, the demarcated areas are arranged in a regular pattern, preferably in horizontal rows and vertical columns.

The object of the game is to capture opposing pieces by moving a piece to a demarcated area occupied by an opposing piece, which is captured thereby. A piece can take possession of a demarcated area only if the area bears at least one number which bears a discernible mathematical relationship to at least one of the indicia on the moving piece, in accordance with the rules of the game.

In a preferred embodiment, the mathematical relationship to be discerned by the player and which is prerequisite to moving a numbered piece to a particular demarcated area is that a number on the demarcated area be an integer multiple of at least one of the numbers on the moving piece. Otherwise stated, the moved piece must contain an integer which is a factor of the number on the demarcated area to which the piece is moved. Another preferred aspect is that if a non-numbered piece is to be moved to a demarcated area containing a prime number, the fact that the number on the demarcated area is a prime number must be discerned by the player, who states this fact as a prerequisite to making the move.

Obviously, in other embodiments of the game any other mathematical relationship may be required to be discerned such as, e.g., numbers which are squares or square roots of the indicia number, numbers which when multiplied by an indicia number yield a fixed value, etc. Fractions or decimal numbers may be employed in lieu of or in addition to integers to provide variations of the game and to expand the subject matter taught by the game.

The game may be further varied by providing open demarcated areas on the playing board, such open areas being freely accessible by any piece, by providing demarcated areas containing two or more numbers thereon, or the like.

In one aspect of the invention, non-numeric coding, such as color coding, is used to indicate demarcated areas which are numbered with integer multiples of specific numbers on the playing pieces.

In another aspect of the invention, a plurality of game boards are employed and pieces may be moved from one board to another, the boards preferably being positioned one above the other to form a multilevel game.

In a preferred aspect of the game, pieces with no numbers marked thereon, or with a non-numeric symbol marked thereon, have a greater freedom of movement and may come to rest on a number of demarcated areas, preferably on any demarcated area.

Any style of demarcated areas arranged in any desired pattern and any distribution of numbers and symbols on the demarcated areas and playing pieces which are compatible with the prescribed mathematical relationship to be discerned may be employed.

The objects and advantages of the invention may best be understood by considering the following description of a preferred embodiment thereof including the attached drawings wherein

FIG. 1 represents a rectangular game board in accordance with the invention,

FIG 2 represents a set of playing pieces for use on the playing board of FIG. 1; and

FIG. 3 represents a multi-level game board with three boards positioned one above the other.

A game board in accordance with the invention is generally indicated at **10** and may be made of any suitable material such as a stiff cardboard over which a suitably printed paper has been glued. As is usual with such game boards, game board **10** may be designed to fold in half to facilitate storage thereof.

The playing surface of board **10** has printed thereon a series of demarcated areas comprising in this case squares which are consecutively numbered from 1 to 150 and are arranged in 10 vertical columns and 15 horizontal rows.

Each numbered square is color coded by one or more color patches printed within the square. While in an actual embodiment each of the patches would be suitable color, in FIG. 1 each color contained within each color pathch is indicated by a letter keyed to the legend forming part of FIG. 1. Naturally, the color coding could be applied to each square in any desired pattern, for example, a border stripe of the appropriate color could be provided for each square or the entire area of the square could be printed in the appropriate color codes with the designating numerals being over-printed thereon. For example, those squares which have only one color code would be entirely of that color, those with two color codes would have half the square of one color and the other half of the other color, etc.

The game is played by the movement of pieces thereon and a typical set of pieces is designated by the numeral **12** in FIG. 2. The set comprises six pieces: one piece designated **3, 2**; one piece designated **5, 4**; one piece designated **7, 6**; two pieces designated **10, 9, 8**; and one piece designated X. The sets of opposing players would be identical to the set of FIG. 2 in respect of the number of pieces and the designating numerals and non-numeric indicator (X) applied thereto. However, the opposing players' sets would be of a different color and/or of a different shape, e.g., cylindrical, so that each player's pieces on the board could be distinguished from those of the other players. If there are more than two sets of playing pieces, and preferably the game will be designed for up to six players so that six sets of playing pieces would be provided, it is most convenient to have the sets of the same shape but with different colors for each set. The different colors of the playing pieces are, as above stated, for the purpose of distinguishing one player's pieces from those of another player and such colors are not related to the color code on the playing board shown in FIG. 1, the significance of the color code being described in detail hereinbelow.

The object of the game, as aforesaid, is to capture the pieces of opposing players, thereby eliminating such captured pieces from the board.

The players seat themselves around the board so that play, once begun, proceeds in order from one player to the player next to him, for example from each player to the player seated on his immediate left. A beginning player is selected by lot by any convenient means. For example, the playing pieces may be employed to select a beginning player by having each player select a numbered piece from his set of playing pieces and hold it in his hand in a manner so that it is not visible to the other players. After each player has selected a piece, the pieces selected are simultaneously displayed; all players holding identical pieces are eliminated and the player holding the highest number piece after such elimination goes first.

Play begins with all pieces off the board. The player chosen to play first selects openly any piece from his set and places it on a selected square on the playing board. He must place the piece on a square whose number is a multiple of at least one of the numbers on the playing piece selected, unless the playing piece he selects is the X piece, which may be placed on any square including those squares marked with a prime number. A part of the move is the announcement by the moving player of a correct mathematical equation or statement on which the move is based. For example, if the player selects the **5, 4** piece and places it on square **25,** he must state a correct mathematical equation justifying the move of the selected piece to the selected square. The justifying equation must include one of the numbers on the moved piece and the result must be **25,** e.g., "five times five equals **25.**" If the player elects to place the X piece on a prime numbered square, for example, on square **19,** he must state "19 is a prime number." If the X piece is placed on a square which is not a prime numbered square any correct mathematical equation which has as its result the number of the square will suffice. For example, if the X piece is placed on square **27,** the statement "9 times 3 equals 27" suffices.

If the player selects, for example, the **10, 9, 8** piece, he can place this piece upon the board only on those squares having numbers which are multiples of either **10** or **9** or **8** and as part of the move he must state a correct, justifying mathematical equation therefor. So, for example, if the player selects the **10, 9, 8** piece, and places it on square number **144** he must state an equation such as "16 times 9 equals 144" or "8 times 18 equals 144."

If a player makes a wrong mathematical statement with respect to the move and if he is challenged as to the correctness of the statement before the next move is made, the moved piece is removed from the board and considered captured, i.e., eliminated from the game.

After placing one piece on the board, or having it eliminated by virtue of a challenge to an incorrect statement accompanying the move, the next player proceeds in the same manner to place his first piece on the playing board. Play proceeds in this manner with each player taking a turn to place one piece on the playing board until either all pieces are on the playing board, have been eliminated by virtue of challenged incorrect mathematical statements accompanying the attempted move, or are impossible of placement upon the board. Pieces which cannot be placed upon the board either because there are not open squares remaining on which the piece can properly be placed or because the player cannot ascertain any such proper remaining open squares are considered eliminated from the game. During the placement of pieces on the board, no piece can be placed on a square occupied by another piece of the same set.

After all pieces have been placed upon the board or eliminated from the game in accordance with the foregoing, the player whose turn it is must move one of his pieces from one point on the playing board to another. Any piece may be moved to any otherwise permitted

square on the board which is not more than three horizontal rows away from the row in which the piece is located at the beginnning of its move. For example, a piece on square **76** (or on any other square in the **71 – 80** row of FIG. **1**) could move to any otherwise permitted square from square **41** to and including square **110.** A piece on square **132** (or on any other square in the **131 –140** row) could move to any otherwise permitted square from and including **101** up to and including **150,** its upward range of movement being limited in this case by the limits of the playing board. Except for this restriction on the magnitude of movement, the piece may move from the square it occupies to any unoccupied square having a number which is a multiple of at least one of the numbers on the moved piece, always excepting the X piece which is free to move to any numbered square. Each and every move of each piece must be accompanied by a correct justifying mathematical statement. For example, a **7, 6** piece on square **42** may be moved to, for example, square **56,** by the player stating "7 times 8 equals 56."

Opposing pieces are captured by properly moving the capturing piece onto a square occupied by the captured piece. However, movement to an occupied square with resultant capture of the piece occupying it may be done only when the capturing piece is either in the same horizontal row or in the same vertical column as the captured piece at the beginning of the move in which the capture is made. All moves, including capturing moves, are subject to the magnitude limitation of horizontal rows to either side of the pre-move position, as discussed above.

Play continues in this manner with each player moving in turn and any and all players being free to challenge the mathematical statement made by moving plaayer at any time. Pieces which are captured are not captured by any particular player but are simply removed from the board and are out of play thereafter. Improper challenges to mathematical statements are not penalized. When a player has had all of his pieces captured he is eliminated from the game.

Play continues in this manner until either all opposing pieces are removed, in which case the player with the sole surviving piece or pieces is the winner, or until none of the remaining pieces can eliminate another piece from the board either as a mathematical impossibility or by concession of a majority of the original players. In such case, the player with the highest number of remaining pieces wins. If two or more players have the same number remaining pieces all the numbers on the remaining pieces are added up and the player having the highest total number wins, in this case the x symbol counting for **0.** If two or more players have the identical number of pieces and the identical sum total of all number symbols on the remaining pieces, the game is a tie between those two players.

The color coding on the game board is an optional feature and is not necessary for play. Referring to FIG. **1,** the numeral **1** square at the lowermost left hand corner of the board has the color code gold. In the embodiment shown, gold signifies that the numeral to which it is applied is a prime number. (Prime numbers are numbers which are not multiples of any integer other than 1 itself.) The gold color code square is signified in FIG. **1** by the letter G placed within the appropriate color patches. Prime number squares (**2, 3, 5** and **7**) in the lowermost horizontal row of the board are among the numbers represented by indicia on the playing pieces; therefore they bear, in addition to the gold color code, the appropriate color code to shown that they are integer multiples of themselves. All other prime numbers on the board bear only the gold code. Similarly, all numbers on the board which are divisible evenly by the number **2,** i.e., those which are integer multiples of the number **2,** contain a red color code. Color codes are similarly applied to the other numbers as follows: numbers which are integer multiples of the number **3** are color coded green (N), integer multiples of **4** are color coded blue (B), integer multiples of **5** are color coded aqua (A), integer multiples of **6** are color coded turquoise (T), integer multiples of **7** are color coded purple (P), integer multiples of **8** are color coded yellow (Y), integer multiples of **9** are color coded orange (O), and integer multiples of **10** are color coded brown (W). Thus, the square bearing the number **80** carries five color codes, red because ($40 \times 2 = 80$), blue because ($20 \times 4 = 80$), aqua because ($16 \times 5 = 80$), yellow because ($10 \times 8 = 80$) and brown because ($8 \times 10 = 80$). The color coding is a mnemonic device and is particularly useful for younger players to assist them determining which playing piece numbers are integer multiples of the number on the square to which they wish to move.

Another embodiment of the game may provide for a plurality of game boards being employed, with pieces able to move from one game board to a proper square on another game board. Although it is not necessary to do so, it is preferable, in a multi-board game, to superpose the boards one above the other in order to facilitate the player's ability to visualize the likely consequences of a given move. In such an embodiment, the boards are preferably made of a transparent material such as a clear plastic or glass to enhance the visibility of the pieces on the several boards. In a multi-level game, pieces which are moved from the surface of one game board to another have a vertical as well as a horizontal component of movement, which enhances the game.

An embodiment of a multi-level game is shown schematically in FIG. **3** wherein three game boards **10, 10***a* and **10***b* are supported vertically one above the other by four vertical supports **14.** The vertical distance between adjacent boards is sufficient to permit the players to place their hands between the boards to emplace pieces thereon and remove pieces therefrom. Each of the game boards is made of a transparent material and has the appropriate squares and numbers or other markings (not shown in FIG. **3**) printed or otherwise applied thereto. Preferably, the printed or otherwise applied markings on the playing board will be overlaid by a clear, thin plastic sheet to protect the markings.

In the embodiment shown, each of the three playing boards is divided into sqares and numbered and color coded identically to the board shown in FIG. **1.** (For clarity, the numbers and color codings are not shown in FIG. **3.**) The three level game embodiment shown is played according to rules identical to those described above with reference to the embodiment of FIG. **1,** except that the pieces have an added dimension in which to move, in that any permitted move may be made not only on the board on which the piece is located at the beginning of the move but onto any equivalent square on either of the other two boards. For example, a piece located on square **119** (referring to FIG. **1**) may move

to any otherwise permitted square from and including square **81** to and including square **150** on any one of game boards **10**, **10***a*, and **10***b*.

Naturally, as an alternative, the rules could be modified to permit movement of a piece only between adjacent board levels in one move. In such case, a piece initially on board **10***a* could move to either board **10** or **10***b* in a single move, but a piece on board **10** could move to board **10***a* but not **10***b*, and a piece on board **10***b* could move to board **10***a* but not **10**, in a single move.

Obviously, the bottom game board of a multi-level set may be made of an opaque material without adversely affecting visibility of the pieces, although it may be desired to make all the boards of transparent material for aesthetic reasons.

Preferably each of the superposed game boards are identically marked with respect to demarcated areas and the numbers included therein, although this is not necessary and the various boards could be marked differently, one from the others.

While the game has been described with reference to a particular embodiment thereof, it will be apparent upon a consideration of the foregoing description that many changes may be made in the specific embodiment of the game which changes are nonetheless within the spirit and scope of the claimed invention. For example, the numbers marked on the pieces obviously need not be selected from the numerals **2** through **10**, as shown in the preferred embodiment, but may be selected from any numbers. An adult version of the game might have, for example, double digit numbers marked on the pieces and double and triple digit numbers marked on the playing board. A time limit could be set for moves so that rapid recitation of justifying mathematical statements is required.

In addition to changing the numbers on the squares and on the playing pieces to set up any desired type of mathematical relationship to be discerned by the players, the geometry of the board may be varied. For example, the demarcated areas may of course have any shape desired, and may be arranged in other than vertical columns and horizontal rows **25** shown in the preferred embodiment. A diamond shape or Y-shape pattern board may be employed, for example, as well as any other suitable shape, and the movement of individual pieces may be unlimited in range or the range may be limited by any appropriate rule. All such variations may be made in either single board or multi-level ("three-dimensional") board games

Further, it is equally apparent that the game is not limited to integers but may be played with fractions, powers, exponents, mixed number values, etc., indicated on the various demarcated areas and playing pieces, with appropriate mathematical relations to be discerned. Different types of mathematical relationships may be employed in the same game. For example, one demarcated area may have the designation for square root ($\sqrt{\ }$) on it and a player having a piece marked with, for example, the number **64** may move to this demarcated area by stating that "the square root of 64 is 8." Another player with a piece marked with the number **2** could move to a demarcated area marked "exponent 4" by stating "2 to the fourth power is 32," etc. The game may therefore be modified to stress either multiplication as shown in the preferred embodiment, fractions, division, exponents, roots, or any other mathematical concept which it is desired to teach, although the game is particularly useful in helping the rote memorization of multiplication and division tables.

The game is thus seen to have a wide variety of modifications which make it suitable for, depending on the modification employed, an educational assistance toy for young children to learn basic division and multiplication tables up to an entertaining game for adults requiring rapid mental mathematical calculations.

It is intended to include all such modifications within the scope of the appended claims.

What is claimed is:

1. A numerical game comprising a game board having a series of demarcated areas arranged in horizontal rows and vertical columns, each of said demarcated areas having a separate, distinct number marked thereon, with said marked numbers each being different from the others and said numbers being organized in said rows and columns; at least two sets of a plurality of playing pieces each piece of a set having indicia marked thereon, each of said sets of pieces having means for distinguishing one set from all other sets; said indicia for a majority of said pieces being at least two identification numbers, which identification numbers each match a symbolically designated number on a selected demarcation area having a number which is a multiple of said identification number; and the other pieces having non-numerical indicia which may be said to match any symbolically designated number.

2. A numerical game as defined in claim **1** wherein said symbolically designated number is designated with a selected color for each integer below a selected integer which forms a multiple of said designated number.

3. A numerical game as defined in claim **2** wherein said selected integer is 10.

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