Number Squares

List of Contents

A 100-square

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Square numbers are: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, . . .

Prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23,
29, 31, 37, 41, 43, 47, 53, 59,
61, 71,73, 79, 83, 89, 97, . . .

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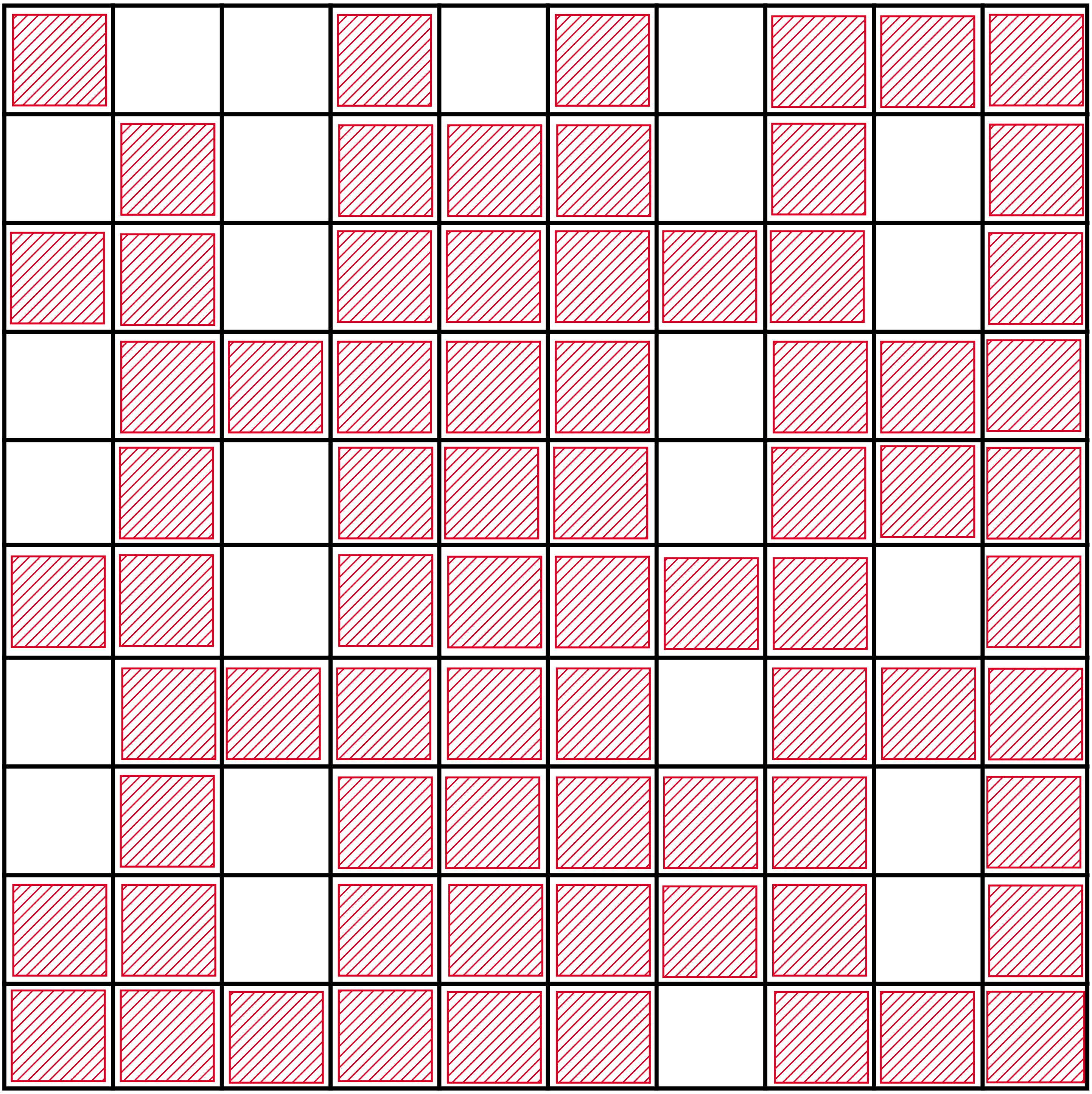
Eratosthenes' Mask



Take a 100 square . . .

Somebody once famously said that the best preparation a child could have for mathematics was "to be on friendly terms with the numbers from 1 to 100". Not many would disagree with the worthwhile nature of the well-expressed objective, so here are a few ideas that might help. These are written in note form, not only to save space, but mainly because the ideas are so flexible and can be used in such a variety of ways over a wide range of levels that it seemed a shame to pre-empt any applications by giving precise ready-to-use rules. All these ideas could be presented as a 5-minute 'filler' or a full-blown worksheet, and there could many different outcomes as well. A large 100-square is provided which can be photo-copied as necessary. The information lines on the bottom could be blanked out if it was thought desirable not to make it too easy. Additionally there is a sheet of smaller squares.

Games

First, there are those based Snakes and Ladders. Notice that the layout of the board is different to the board traditionally used for that game, and that here, players are expected to move from cell to cell in their numbered order regardless of the way they are placed. To overcome what might a difficulty for some, there is another (special) number square included, laid out in the traditional (games) way.

Squares and Primes. Normal race game using a single die to control moves and get past 100. Player landing on a square number must move back to previous square number. Landing on a prime number allows a move forward to the next prime number (or the other way around).

To and fro. Single die, normal style of race game to get past 100. If a player's counter is on an **odd** cell then the move is counted **on**. When the counter is on an **even** cell then the move is counted **back** - but there is no going below 1.

Clearly plenty of scope for variety in types of numbers used to control the game. Multiples of 3, 5 etc. Numbers ending in 1, 2, 3 etc. Numbers with the tens digit bigger/smaller than the units digit. If the number shown by the die has the same/different parity as the number of the cell move forwards/backwards. Note of caution on sets of numbers chosen - either make sure they are mutually exclusive or else provide a decision-making process. For example: multiples of 5 and 7 - what do you do on 35 (bonus? extra turn?)?

Second, there are games that use the 100-square merely as an array of numbered cells, and moves are not constrained by the order of numbering.

Fast or Slow. Start from one of the four cells in the middle of the board. Single die. Move is counted in a straight line up, down, across or diagonally. A move must be made - if it is possible. Number of cell landed on is added to player's own total. (Calculators?) Player can win by making total of 500 (or whatever). Player going over 500 is out, and winner is last player to be left in.

Parity Crossing. Two players with 5 counters each.One set on 2, 4, 6, 8 and 10 and the other set on 92, 94, 96, 98 and 100. Moves are made 1 cell at a time, but must always be to a cell of the opposite parity (from even to odd and vice versa). Also, from an even cell the move can only be sideways or forwards (diagonally); from an odd cell the move can only be sideways or backwards (diagonally). 'Forwards' and 'backwards' are defined by reference to the general direction of that player's counters in their move from the starting-edge to the finishing-edge. There is no capturing, and only one counter is allowed in a cell at a time. When it is a player's turn, a move must be made. Winner is the player who first gets all his/her counters to the opposite edge of the board. A 4-player version could start with six counters in a triangle formation at each corner.

Ingenuity. Two players and two dice. After rolling the dice a player combines the two numbers in some way to make a single number and then claims that cell on the board by putting a counter on it or marking it in some distinctive way. No cell can be claimed more than once. When neither player has been able to make a move for six successive rolls of the dice (that is 3 for each player) then the game stops. The winner is the player who has claimed the most cells, or who has the highest total. Plenty of scope for development here. What ways are there of 'combining' the two numbers? How much of the board can be claimed? Given two blank cubes, can you design two dice that will allow more of the board to be used? What about using three dice?

Activities

There are several other activities for which a 100-square is very suitable.

A. Invent a game to be played on a 100 square. This is probably best done before any 'official' games are seen.

B. Mark off a square array of cells of any size. What relationship exists between the numbers in the four corners? What do all the numbers in the array add up to? Given the two opposite corner-numbers of any size of square array, how can you find what all the numbers add up to - without actually constructing the array? Does any of the previous work apply to rectangles? Can you prove these results?

C. Starting with a clear board, place a counter on every 2nd cell. (This covers all the even numbers.) Next place a counter on every 3rd cell, then every 4th cell, and so on. When no more counters can be placed make some observations. What can you say about cells which have only 1 counter, or 2 counters, or an even number of counters, and so on. And what about that untouched “1”? It is all a variation on Eratosthenes’ Sieve of course. Unfortunately, it is not really a practical proposition - it takes too many counters and soon becomes very fragile in structure. However it is a good way of demonstrating the idea before moving over to making marks in the cells to show occupancy, and then counting up the marks at the end. Not only is this more robust, it is also quicker.

D. First define a CHANGE: If a cell is empty then a counter is put in it; if a cell already has a counter in it then that counter is removed. Starting with all cells empty, CHANGE every 2nd cell. (This puts a counter in every even cell.) Next CHANGE every 3rd cell. Then CHANGE every 4th cell and so on until no more can be done. Easy to recognise the sequence left in the empty cells. Just prove why it must be so. As a variation, start with every cell occupied.

E. For this activity the counting is done only on cells which are empty, which is different to C and D where all cells were counted whatever their state. Starting with all cells empty, place a counter in every 2nd cell. Next (counting only empty cells) place a counter in every 3rd cell. Then every 4th cell, and so on until no more can be done. The numbers remaining on show at the end can justifiably be called ‘Lucky Numbers’. What can you discover about that sequence?

F. Start with all cells empty. Cover 1 cell, miss 1; cover 2 cells, miss 1; cover 3 cells, miss 1; cover 4 cells, miss 1; cover 5 cells, miss 1; and so on until you run out at the end. The uncovered numbers show an unfamiliar sequence. Or is it a familiar one in disguise?

A *(special)* 100-square

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