PFS 23-4 11/5/09 _____

In Honor of Martin Gardner

Hip, Sim, and Hex!

Martin Gardner was born in Tulsa, Oklahoma, on October 21, 1914. For three decades, beginning in 1956, he wrote the *Mathematical Games* column in the monthly magazine *Scientific American.* He has also published over 70 books. His writings have had an enormous influence, and many young people have become interested in math because of his columns and books. He has a knack for making math ideas understandable, exciting and fun! Many of the topics we've worked on in Problem of the Week at our school were popularized by Martin Gardner: Penrose Tiles, Pentominoes, Color Squares, Fault-Free Rectangles, etc. In his honor, here are three games he wrote about. Happy 95th birthday, Martin!

Hip!

Usually Martin Gardner reported on other people's discoveries and inventions, but this is a game he made up himself. Two players take turns placing counters (one color for each player) on the squares of a 6 x 6 checkerboard. The first player whose counters form a square loses. The squares can be of any size, and rotated at different angles.

1) Play Hip! Can you develop a strategy to help you win? Do you think the first or second player has an advantage?

2) How many squares of all sizes and orientations are possible on a six by six board? Can you find a formula that will give that answer for different size boards?

3) Is a tie possible? If so, show a completed game with no squares.

4) By the way, if you're searching for that tie, how many different completed games can there be?

5) Invent a variation.

6) (For algebra students.) What do you notice about the slopes of the sides of the squares when the lines are neither vertical or horizontal?

7) Have fun!

Sim!

Draw the vertices of a regular hexagon, and number them 1 through 6. Now, two players take turns connecting the points with segments of their own color (say, red or blue). If you complete a triangle of your own color, you lose. (Only triangles connecting the six numbered points count for winning and losing.)

8) How many total segments can there be, sides and diagonals?

9) A tie is *not* possible in this game. Can you find a way to prove it's impossible to end in a tie?

10) Can you discover a winning strategy?

11) Try playing this game on a pentagon. In this case, the game can end in a tie. Can you find a tie ending?

12) Do some research on Ramsay Theory.

13) Have fun!

Hex!

This game was invented (at least) twice: by the Danish mathematician Piet Hein in 1942, and by the American mathematician John Nash in the late 1940's (while he was a graduate student at Princeton). It's played on a hexagonal board in the shape of a rhombus. The board can be different sizes. We'll start on a 6 x 6 board. Two players take turns placing counters (one color for each, say red and blue) on the hexagons. The object of the game is to make a path or bridge connecting your two sides of the board, and the first player to do so wins. Corner hexagons count for both players.

14) Play Hex, and see if you can find some winning strategies.

15) Is a tie possible in this game? Explain!

16) If you think the first player has an advantage, learn about the "Pie Rule."

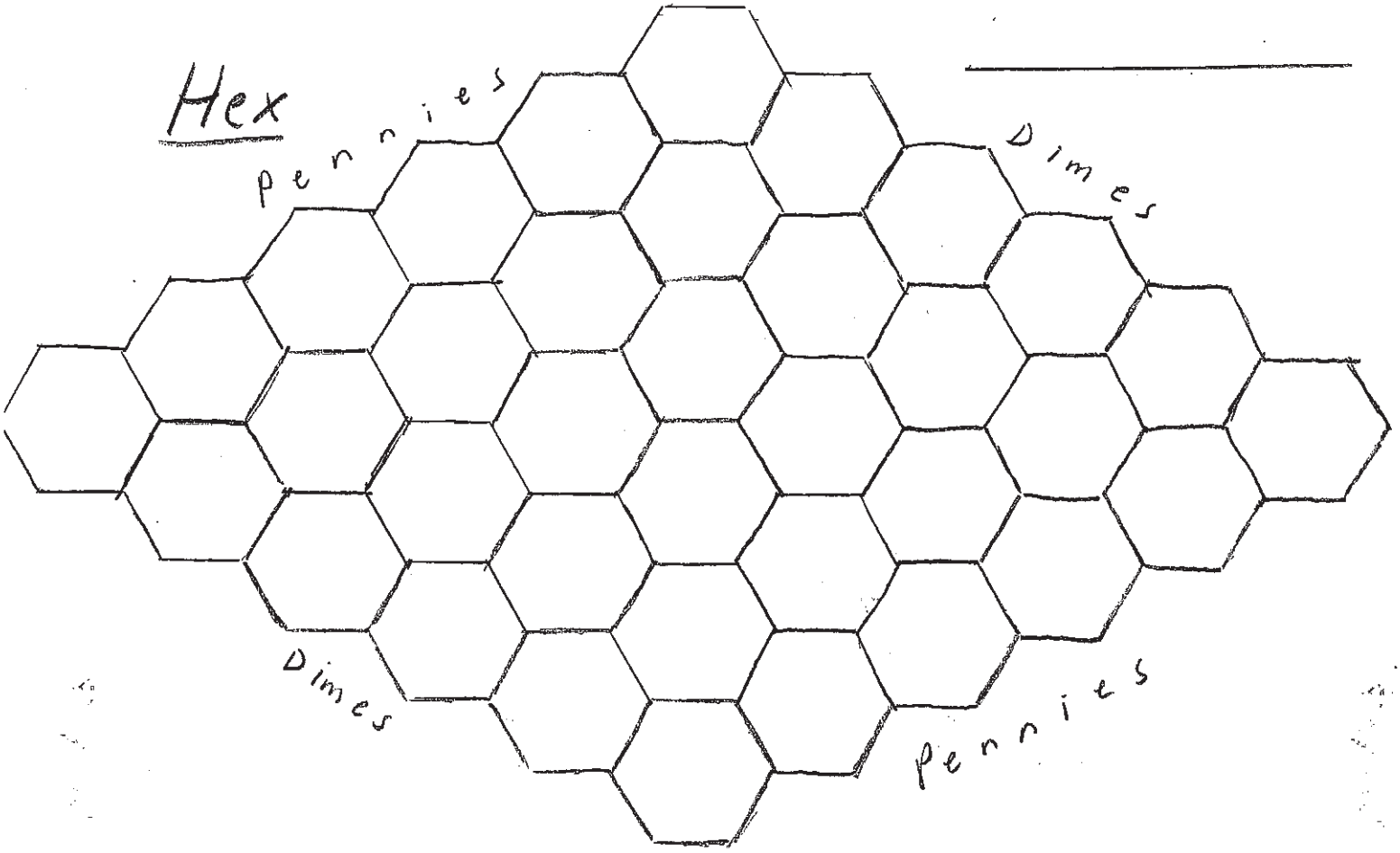
17) Can you make a board so three players can play this game? Report on it.

18) Make up another variation.

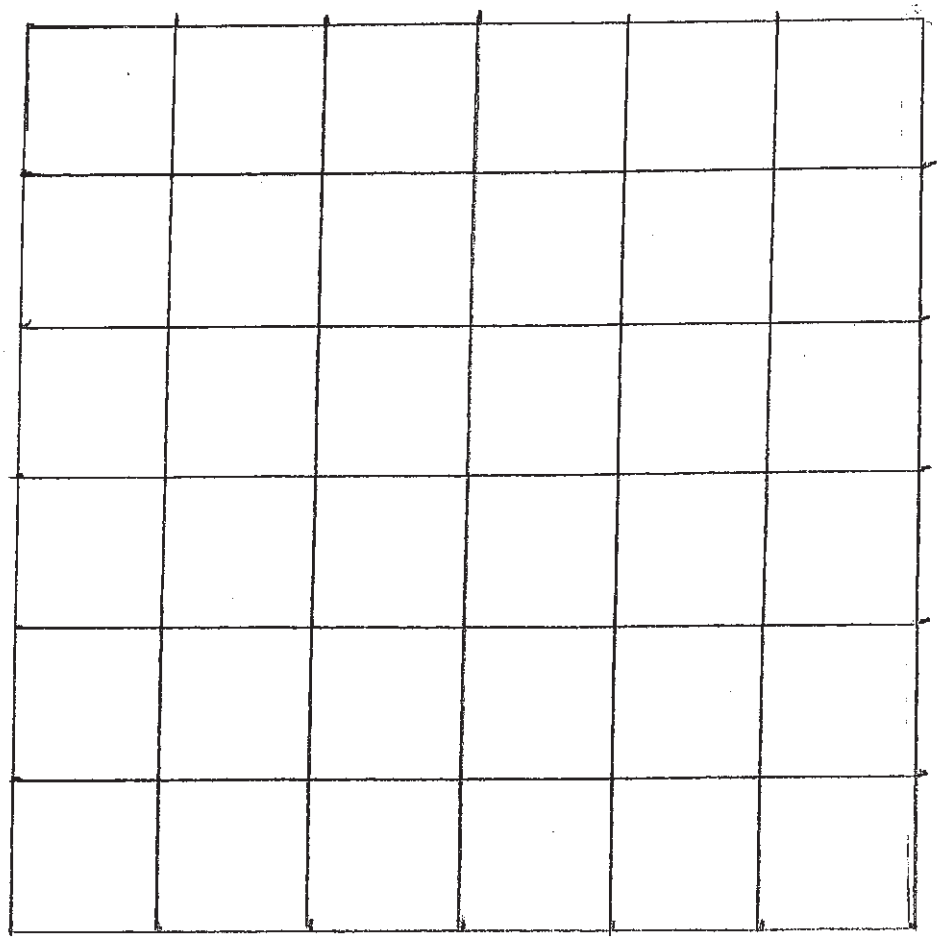
19) Learn more about Piet Hein, John Nash--or Martin Gardner!

20) Have fun!

Hex



Hip



Sim

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