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The Story of Spiro Math

For the past three years, one of my son's summertime activities has been to work in his office every weekday morning. His office consists of a desk, our home computer and a bookcase full of reference materials, art supplies and junk. During office hours he makes copies of famous drawings and comic book heroes; learns typing from Mario and Mavis Beacon; reads his current book; builds things out of Legos and takes apart old bits and pieces of computer hardware. Although he does not view his office hours as particularly fun, they are at least interesting and varied and have taught him a number of useful skills and worthwhile traits.

Part of the point of Pete's office is to maintain skills he learns during the school year, and math facts are one of the things we concentrate on. Over the years he has used many commercial basic math programs, some shareware and not a few programs which I have written for him myself. Last summer, I wrote a shareware program called Mouse Math for him. This is a whimsical drill and practice program that emphasizes basic math facts. I published Mouse Math as shareware and you can now find it in some shareware catalogs and on the internet at my home page - point your browser at <http://warren.penn.com/~hank> Pete is now 12 and another summer approaches, so here is the little math drill program with which he will spend time this summer.

The idea for Spiro Math came from two sources ---- the 24 Game and from a relic of my youth. The 24 Game is fun, exercises your basic math ability and is a real instrument of torture. The game consists of a deck of cards, each of which has four digits printed on each face. The object of the game is to use addition, subtraction, multiplication and division to manipulate the digits to yield a result of 24. The game is played against opponent, and the first to solve each card scores points toward eventual victory. As I said above, this is fun and exercises your math skills, but, when you get stuck, you are really stuck and frustration soon sets in.

At the library, I found an old book called More Number Games which describes many games like the 24 Game. As a class, these are called MADS games (Multiply Add Divide Subtract) and such games seem to have been around for a long time. What I set out to write was a kinder, friendlier, computer oriented MADS game. A computer allows hints to be given if you are stuck, can beep and chortle in response to your answers, and can reward a correct result without the necessity of having a loser. But what kind of reward?

Long ago, I read a *Mathematical Games* column in *Scientific American* titled *Fantastic patterns traced by programmed worms*. This told of the work of a number of people who were interested in generating complex graphical patterns from simple instructions. I photostated the article back then and stuck in my files where, 30 years on, it provided the rewards for my MADS game. In response to a correct answer, Spiro Math draws a spiro-lateral. This type of graphical figure was proposed by Frank C. Odds, a British biochemist. Spiro-laterals are further described elsewhere in this help file, and a little menu for making spiro-laterals can be reached from the Menu in Spiro Math.

So, enjoy Spiro Math and pity poor Pete who will spend 30 minutes a day for the next three months playing this little game.

Hank Hufnagel
Clarion May 12, 1996

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Acknowledgments

The original idea for Spiro Math came from the *24 Game*, copyright 1993 by Suntex International. This company can be reached at 118 North Third Street, Easton, PA 18042 USA (610) 253-5255. I like the 24 Game and, once you have practiced with Spiro Math for a while, you should be a red-hot player.

Additional ideas for Spiro Math features came from the book *More Number Games - Mathematics Made Easy through Play* by Abraham B. Hurwitz, Arthur Goddard and David T. Epstein. Published in 1976 by Funk & Wagnalls, New York.

The rules for creating Spirolaterals were first proposed by Frank C. Odds, a British biochemist. I know nothing more of the man, but I am nonetheless indebted to him, and to Martin Gardner, in whose *Mathematical Games* column I so often found intriguing ideas such as this.

The Spiro Math program was written using Microsoft Visual Basic 3, Copyright Microsoft Corporation 1993-1995.

The sounds produced by Spiro Math were created using Creative WaveStudio, Copyright Creative Technology Ltd 1992-94. This small program came bundled with my sound board.

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Using the Setup Menu

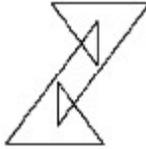
From the problem screen, click on Menu and then Setup to get to the Setup menu. The Setup menu controls various aspects of game play within Spiro Math. Using this menu you can control the sought after result of the math problems, and which mathematical operators are to be used in solutions. You can also control the amount of sound and the display of spirolaterals using this menu. Finally, your record of success for the current session of Spiro Math is displayed here.

-
- **Answer Will Be** - One box in this grid of nine will have a black number in it. The rest will be gray. The black number is the result to shoot for in solving Spiro Math problems. Click on any of the gray numbers to change the sought after result.
 - **Operators** - Some boxes of operators will be black, and others may be gray. The black boxes show the operators that may be required to solve any particular Spiro Math problem. You can use any operators you like in solving the problems, but if, for instance, only the **+** - box is black, then a solution is guaranteed to exist using only addition and subtraction. Click on any boxes you like to set the possible operators.
 - **Sound** - These boxes control the amount of sound generated by the program as you play Spiro Math. **Lots** is good for people who need lots of reinforcement on their math fact, **Some** is good for most players, and **None** is good in low noise environments. Click the desired choice.
 - **Spiro** - This Yes/No choice controls the display of spirolaterals. Usually you would want to select **Yes**, but for a speedier game without rewards, **No** is the correct choice.
 - **record of success** - This is a summary of your performance so far during this run of the game. These numbers are zeroed each time you start Spiro Math.

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Making Spirolaterals

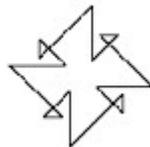
Spirolaterals are complex graphical images that are made by following very simple programming rules. Refer to the illustration as you read the items below:



Order -- Each Spirolateral is constructed by drawing a line of length 1, making a turn, drawing a line of length 2, making a turn, drawing a line of length 3, making a turn, and so on until the Order of the Spirolateral is reached. When this happens, another turn is made and the process starts over with a line of length 1. Drawing continues until a line returns to the starting point. In the example above, the order of the spirolateral is 4 and so lines of length 1, 2, 3 and 4 are drawn. Since the drawing is not yet complete, the line drawing process is repeated a second time. At that point, we have returned to the starting point and the spirolateral is complete.

Angle -- The angle is simply the angle of the turn that is made between drawing successive lines in the spirolateral. In the example above, the angle is 45 degrees.

Left T - Usually, all of the turns used in constructing a spirolateral are right turns, as in the example above. Many additional spirolaterals can be created if left turns are also allowed. In Spiro Math you can specify a number for left turns and any line whose length is evenly divisible by that number will turn left rather than right. The spirolateral below has an order of 4 and an angle of 45 degrees just as the one above, but the Left T value has now been set to 3. This means that after line lengths evenly divisible by 3, a left rather than a right turn was made. You can see that this made a big difference in the generated spirolateral. Four repeats, rather than two, were required to complete the figure.



Changing the numbers -- To change the values for order, angle and left turns, first click on the desired item with your mouse. When you do this, a gray mouse box appears. As you move your mouse around in this box, the value of the selected item will change. When you get to the desired value, click your mouse to select it. This IS a strange way to set values, but it has the advantage of requiring no keyboard input, and you should find it a pretty quick method, once you get used to the idea.

Line -- Spirolaterals can be drawn using three different line styles in Spiro Math. Click on the Line command to select the one the program is to use.

Draw -- Click on Draw to begin drawing a spirolateral using the currently selected parameters. Not all spirolaterals return to their starting point, and so the program does not always produce symmetrical results. Note that the programs spirolateral drawings are elongated to better fill the computer screen.

When you are done viewing a particular spirolateral, click on the screen to return to the Making Spirolaterals menu. You DO NOT have to wait for the drawing of the spirolateral to complete before doing this.

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Help with Problems

Spiro Math is very simple and you should not have many problems in using it, but...

If you hear no sound it is because you do not have a sound system/driver installed correctly on your system. If you have this problem, refer to the documentation that came with your sound card.

If the screen background is of poor quality, you probably have a black-and-white monitor, or are in a 16 color video mode. Refer to the documentation for your video card and see if you can't select a higher color resolution.

If you have another problem with a **registered** copy of Spiro Math, get in touch with us:

Hufnagel Software
PO Box 747
Clarion PA 16214
USA
Phone: 814-226-5600 Fax: 814-226-5551
Internet: hank@penn.com

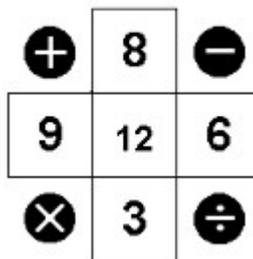
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How to Use Spiro Math



Spiro Math is very easy to use, figuring out the correct answer can be more of a puzzle.

Lets work out the problem above as a way of understanding how to use the program. The number 12 is in the center of the figure. This means that our goal is to use addition, subtraction, multiplication and division on the four surrounding numbers so as to give a result of 12. If we click on the 9, the add button (+) and then the 3, this causes the two numbers to be added. The first number we clicked will then dissappear and the second will be replaced by 12 (9+3=12.) So we now have 12, but we still have three numbers left on the screen - 8, 6 and 12. We might next click on 8, minus (-) and 6, which would then leave us with 12 and 2 on the screen. If we now clicked on 12 x 2 we would be left with the single number 24 on the screen. This is an incorrect answer since it is not 12. The program would note the wrong answer, and then reset to the original problem so that we could take a second crack at it.

Well, obviously we are stuck, so maybe we should try a hint. If you click on the word Hint in the lower left corner of the screen, the program will respond by giving you a hint such as this: **2 x 6** This is the final operation needed to complete the problem correctly. Now, if we can just figure out how to get to the numbers 2 and 6, we could solve the problem. Suppose we were still stuck. Clicking Hint again gives a second hint. This one might be: **9 - 8** This second hint tells us the first thing to do to solve the problem. Clicking Hint again gives a third hint. This might look like this: **9 - 8 then 3 - 1** This hint tells us the first two steps to use in solving the problem, and from there any problem becomes very easy to solve. The answer is: $(3-(9-8))\times 6=12$

If we solve the problem correctly, Spiro Math responds by drawing a facinating spiroilateral on the screen. As the game progresses, Spiro Math will only draw spirolaterals if you use fewer and fewer hints. Finally, after 10 problems, you must get each problem correct with no hints if you want to see a spiroilateral.

Time and Score: If you double-click the center number on the problem screen, 12 in the example above, your time and score will be displayed at the top of the screen. These numbers let you keep track of how long you have been playing the game, and how well you are doing. You get 10 points for a correct no hint answer, and fewer points for each additional hint you require to solve a problem. Double-click the center number again to hide the time/score information. Double-clicking once again zeroes the time and score.

Recommended System: To get the most out of Spiro Math, you should have a video card running in at least 256 color mode and a Windows sound driver which supports .WAV files.

Minimum System: At a minimum you need a color monitor and Windows to run Spiro Math.

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