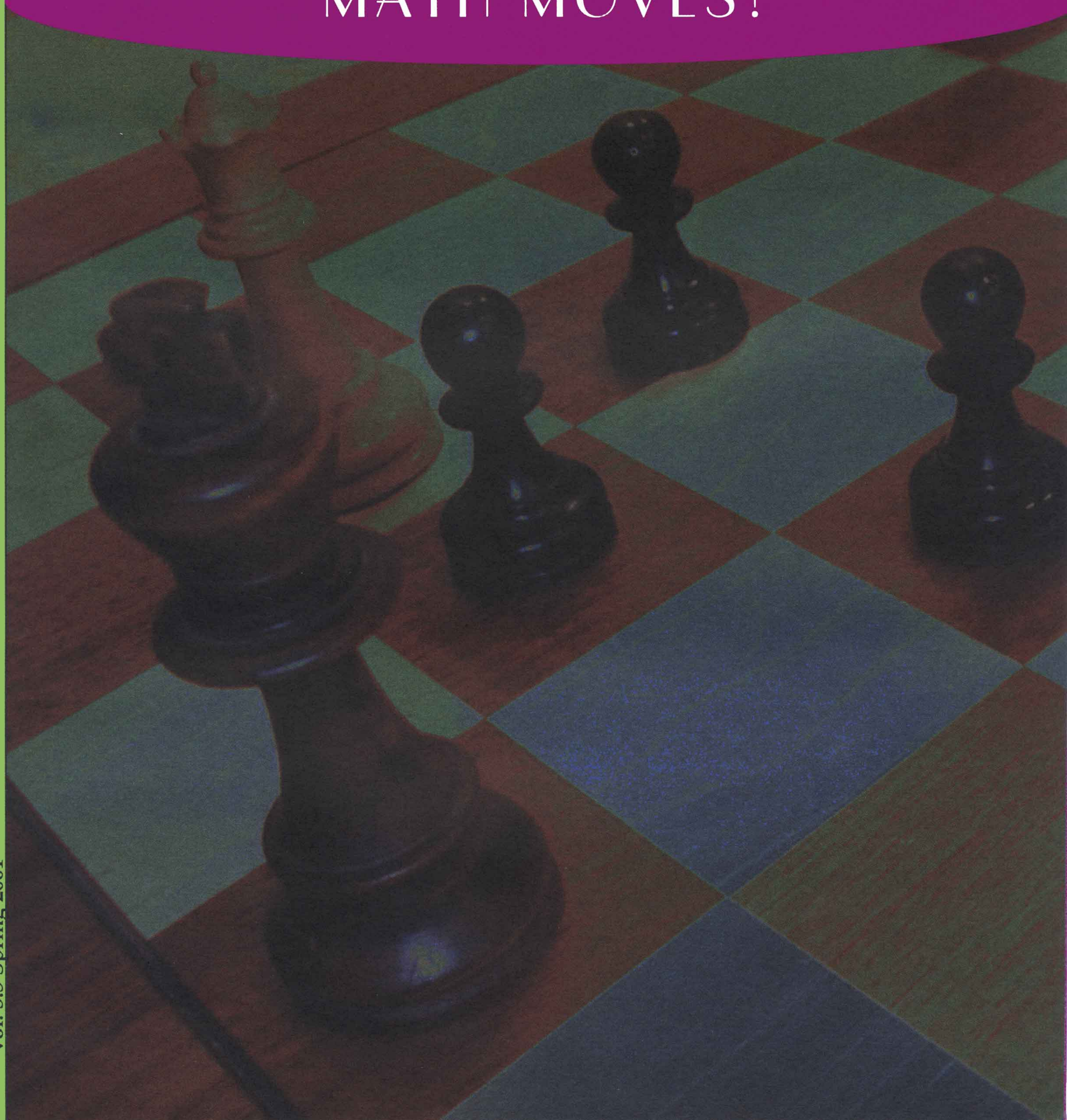
Math Reader

MATH MOVES!



Vol. 3.3 Spring 2001

Math Reader

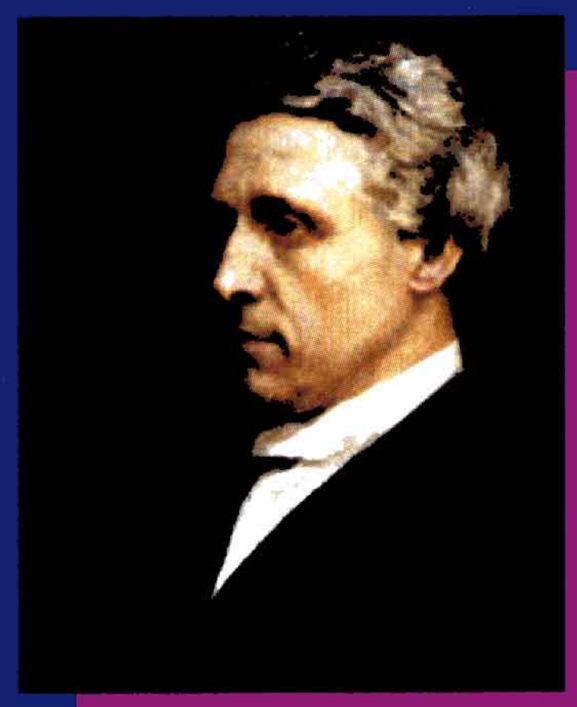
Contents

Math Reader
Southwest Texas State University
San Marcos, TX 78666
Phone: (512) 245-3439, Fax: (512) 245-1469
e-mail: mathexplorer@swt.edu.
Visit our website: www.mathexplorer.com
Math Explorer and **Math Reader** are published by Southwest Texas State University Math Institute for Talented Youth (MITY).

SWT

Lewis Carroll

by Joyce Fischer



Lewis Carroll was born Charles Lutwidge Dodgson on January 27, 1832, in Daresbury, England. He was the third child and first son of 11 children born to a clergyman and his wife during the reign of Queen Victoria. As a child, he wrote poetry and entertained his brothers and sisters by singing, doing magic tricks, and performing puppet shows.

He was home schooled until the age of 21, when he was sent to a small private school that he attended for about a year. After that, he was sent to Rugby School for 4 years. In 1851, he went to Christ Church, Oxford to attend college. He graduated a brilliant mathematician and was hired by the same college as a teacher. He taught there until his retirement in 1881.

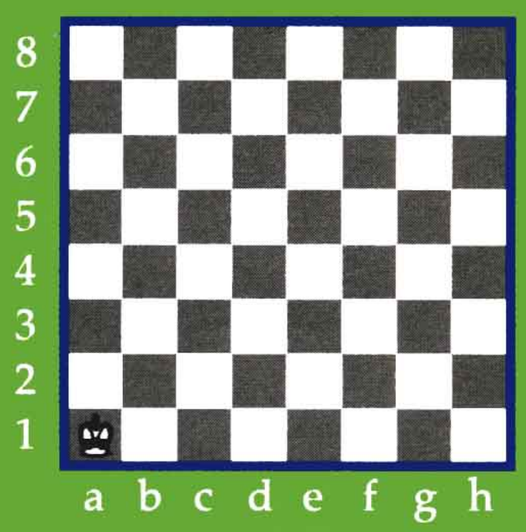
During his adult years, he seemed to behave like two different people. He used the name Charles Dodgson for his work as the distinguished mathematician who was also an accomplished logician and philosopher. He used the name Lewis Carroll for his work as the widely published and admired author of children's books, like *Alice's Adventures in Wonderland* . Lewis Carroll was funny and entertaining and loved by children and adults alike. This winning way of entertaining young people also helped to make him a very famous photographer.

As Lewis Carroll, he could interact with children using a fantasy world to change his entire life into a fairy tale. Throughout all of his children's books, he packed his talents for using logic, philosophy, and mathematics into fun and games for children.

Joyce Fischer teaches mathematics at Southwest Texas State University.

PROBLEMS OF THE MONTH

1. Josephine has 12 coins in her pocket, all dimes, nickels and quarters. She has 2 more nickels than quarters, and 2 more quarters than dimes. How much money does she have?



2. A chess player wants to move her king from a1 to b3 in exactly 3 moves. How many different routes are possible?

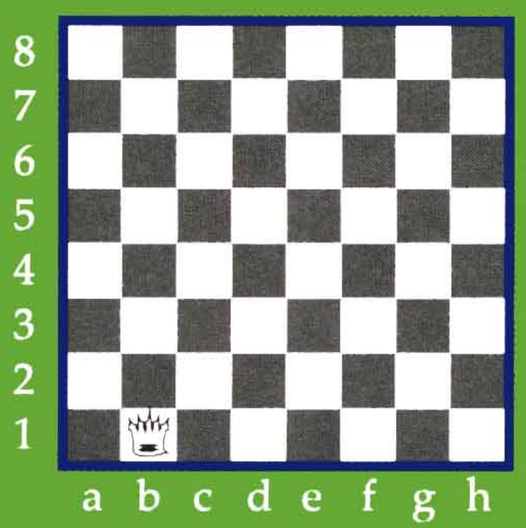
3. What day of the week will it be 100 days after Monday?

4. How many 3 digit numbers only use the digits 2, 3, and 4? How many use exactly one of each digit?

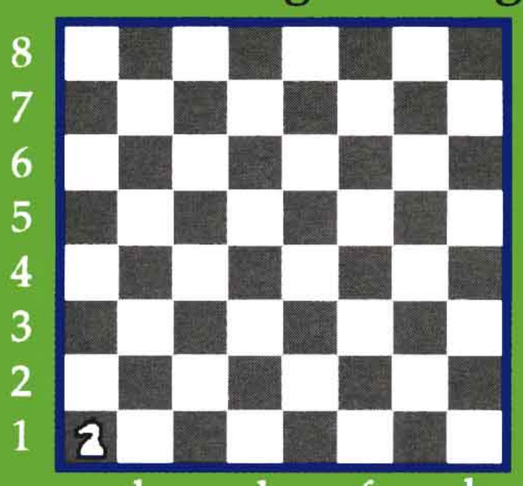
5. At the used book sale you can buy 9 books for $3.00 or 5 books for $2.00 or 1 book for $1.00. Isaac finds 31 books he wants to buy. What is the cheapest way to buy exactly these 31 books? Would it cost more to buy 32 books?

6. Carol is three times as old as her daughter. In 11 years she will be twice as old as her daughter. How old is Carol?

7. A queen placed on the square b1 on an empty board can move to 21 other squares. The queen moves to one of these squares, and on the next move has a choice of 27 other squares. Which square did the queen move to from b1?



8. A white knight is positioned on the square a1. A black queen is attacking the knight. No matter where the knight moves, the black queen can still capture it on the next move. On which squares could the queen be standing?



9. How many ways are there to make change for a quarter with an even number of coins?

10. Aaron saw some people walking their dogs in the park. Counting dogs and people, he got a total of 20, and counting legs he got a total of 66. How many dogs and how many people did Aaron see?

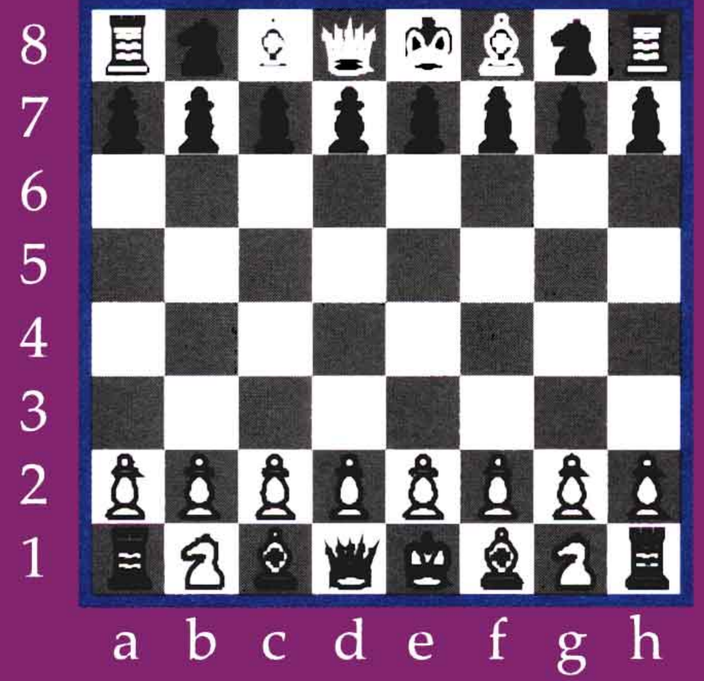
Send us your solutions! Every month, we will publish the best solutions on our website: **www.mathexplorer.com**. If we print your solutions, we will send you and your teacher free **Math Reader** pens!

QUEENING A PAWN

by Alexey Root

Alexey Root was the 1989 U.S. Women's Chess Champion. She has a doctorate in education and supervises student teachers. Alexey is assistant director of the Chess program at the University of Texas at Dallas. Clarissa Root is the daughter of Alexey and Doug Root. She attends Evers Park Elementary School in Denton, Texas. Clarissa is a second grader in Ms. Rebecca Foreman's class, and attends Ms. Clara Jackson's third grade class for math. Clarissa has played in one chess tournament. She helped Alexey make this article easy to understand for elementary school students.

Chess, math, and music are logical activities that do not require living a long time to understand. Many elementary school students become good at chess, math, or music. Chess rules take about one hour to learn. A chess game is played on an eight by eight square board. White and Black each have one king, one queen, two bishops, two knights, two rooks, and eight pawns.



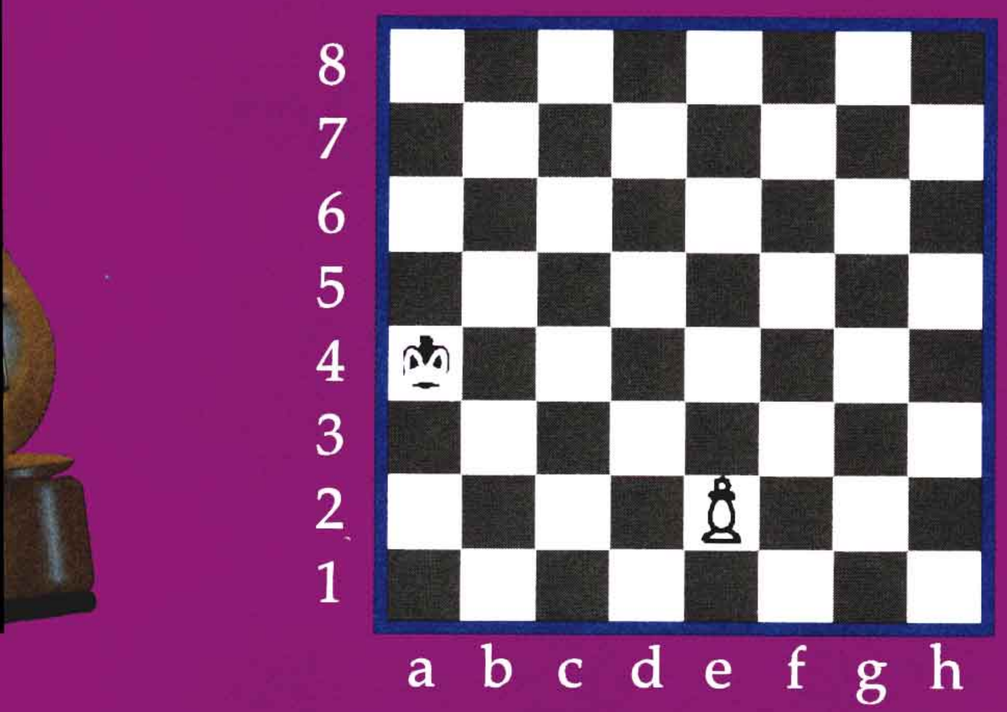
Each square on the chess board has its own name. That name is the square's file and rank. A **file** is a vertical (up and down) set of eight squares. Files have the letters a, b, c, d, e, f, g, and h. A **rank** is a horizontal (left and right) set of squares, labeled by the numbers 1, 2, 3, 4, 5, 6, 7, and 8. In the diagram above, the black king is on e8. Can you tell what piece is on a8? Which piece is on g1?

Checkmating the enemy king wins a chess game. Usually the easiest way to checkmate is to capture the enemy pieces that protect the enemy king. White tries to capture Black pieces, and Black tries to capture White pieces.

Queening one's own pawns is another way to have more pieces than the enemy. Queening a pawn means that your pawn moves to the other side of the board and becomes a queen. The pawn is the weakest piece on the chessboard and the queen is the most powerful. Mathematician Lewis Carroll based *Through the Looking Glass* (1871) on a chess lesson about queening that he gave to the real Alice, seven and a half year-old Alice Liddell. In Carroll's chess story, Alice the pawn begins on the second row and advances to the eighth row to become a queen. What she experiences is made memorable through Carroll's poetic and magical writing. Alice encounters Tweedle Dee and Tweedle Dum, Humpty Dumpty, and many other fantastic characters on her way to queening.

As she moves up the chessboard, Alice feels danger. She is scared of being captured. By looking at a pawn's journey in a chess endgame lesson, we can imagine Alice's quest to become queen. In this second chess diagram, we see that Alice, our lone pawn, is on the square e2. Remember that we can tell the square's name, e2, by checking first the file,

or vertical name, e, and then the rank, or horizontal name, 2. Alice is a white pawn. If she can make it to e8 without being captured, she will become a white queen.



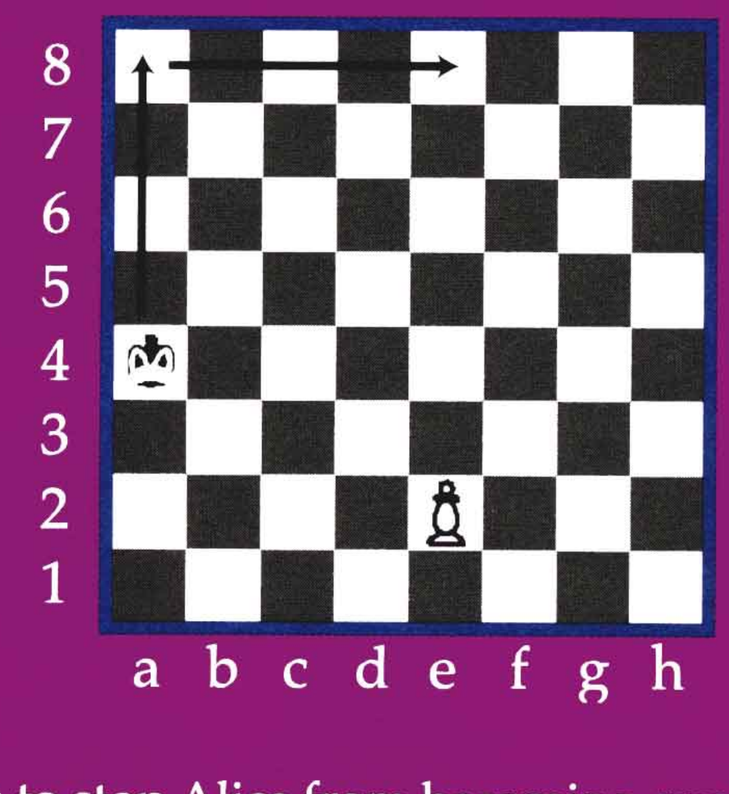
In our chess lesson, Alice will be chased by the enemy king. The enemy king is on the square a4. The enemy king has a head start because Black will move first from the diagrammed position.

Do you think the enemy king can catch Alice? That question is the subject of our chess lesson, and to answer it we need chess rules. Lewis Carroll did not follow real chess rules in *Through the Looking Glass*. For example, Carroll let the White side make thirteen moves and the Black side only three.

For our chess lesson, we will follow the real chess rules. After the Black king moves, it is Alice's turn to move. A pawn can jump one or two squares straight forward on her first move. After a pawn's first move, she moves one square forward at a time. The king can move one square at a time in any direction. The king captures by moving onto the same square as an enemy piece such as a pawn in our case and removing that enemy.

Now that we know the rules for Alice and the Black king, let's see what might happen for each of them during our chess lesson. We will count before we actually move the pieces.

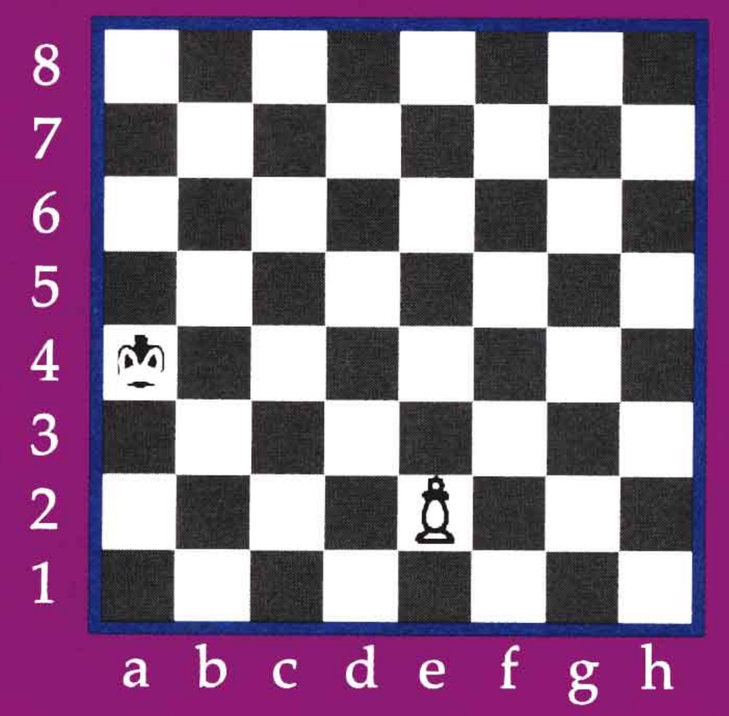
The Black king could go to a3, a5, b3, b4, or b5.



Black's goal is to stop Alice from becoming queen, so he will probably head for her queening square of e8. One path to e8 is along the a-file and then along the 8-rank. How many moves would that take?

The answer is 8: a5, a6, a7, a8, b8, c8, d8, and e8.

What happens if the king moves along a diagonal to e8?Black makes 4 moves in this case: b5, c6, d7, e8. Draw an arrow from a4 to e8 along the diagonal.



What square should Alice choose for her first move: e3 or e4? It seems like the best chance to queen is to run quickly toward the queening square. Alice's total moves to queening are 5: e4, e5, e6, e7, e8. Draw an arrow from e4 to e8. Do you think the enemy king can catch Alice? Yes! The Black king moving along the diagonal, will capture Alice in four moves, since Alice would take five moves to queen. To check this answer, set up a chessboard and play out the moves.

Visit the library, where you'll find chess books with more intriguing chess problems to read and enjoy.

Puzzle Page

Math Readers: We want to print your work! Send us original math games, puzzles, problems, and activities. If we print them, we'll send you and your math teacher free **Math Reader** pens.

Word Search

Forwards or backwards, up, slanted, or down.

Where can the words in this puzzle be found?

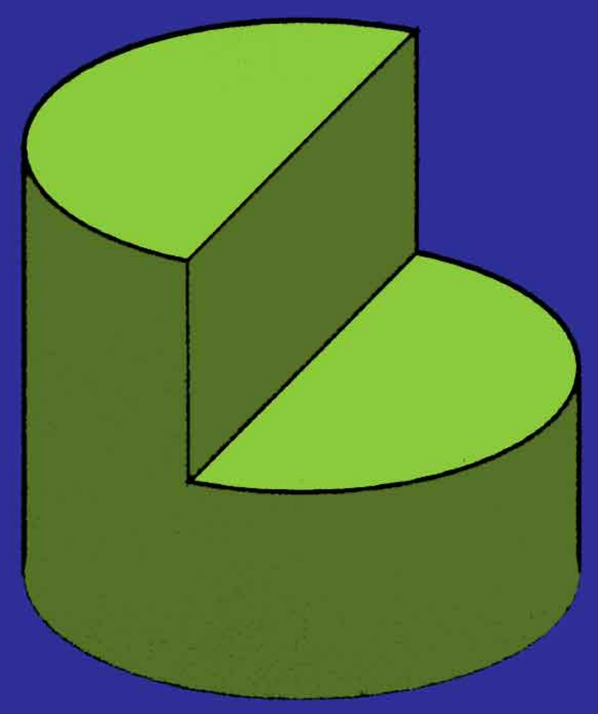
Pawn
Chess
Logician
File
Rank
Deduction
Checkmate
Queen
Diagonal

T	O	C	G	R	A	O	S	D	S	E	S	Y
W	F	H	R	A	D	Q	M	N	H	Y	D	E
C	I	E	Y	S	N	U	G	F	E	U	E	T
H	L	T	P	L	O	E	Q	N	P	N	E	A
E	L	R	H	A	N	E	I	O	E	R	N	M
C	G	A	O	I	W	N	C	N	K	P	K	K
K	L	N	N	N	L	I	L	O	M	D	W	B
M	O	K	C	O	O	E	L	I	F	U	N	M
A	T	L	S	R	G	C	R	T	H	G	E	W
T	O	K	C	I	I	A	L	C	H	E	S	S
E	D	G	D	I	C	D	I	U	D	S	I	N
T	O	U	N	Q	I	S	F	D	K	S	N	N
C	Q	U	E	E	A	Q	M	E	G	P	F	U
Q	X	P	A	W	N	O	G	D	L	H	D	K

If the following equation is true, what does the number ABC equal?

$$\begin{array}{r} AAAA \\ BBBB \\ +CCCC \\ \hline BAAAC \end{array}$$

The object to the right exactly fits through all three openings above. Can you create an object that will just fit through the openings below?



Bulletin Board

Check out the Chess Website

If you would like to learn how the other chess pieces move, you can visit the United States Chess Federation's website: *www.uschess.org*. It offers free materials about the rules of chess and how to organize a chess club at your school. If you continue playing chess through high school, the University of Texas at Dallas offers full scholarships to chess players who are also good students. For more information on scholarships, you can email Alexey Root at *aroot@utdallas.edu* or visit the website *http://www.utdallas.edu/orgs/chess/*.

Words of Wisdom

One learns by doing the thing; for though you think you know it, you have no certainty until you try.

-- Sophocles

GirlStart

Girlstart, an Austin based non-profit organization, offers summer camps for girls ages 11-18. Learn technology, math and science hands on at their Girls' Technology Center. For more information visit them on the web at ***http://www.girlstart.org/summer.htm*** or contact Amy at 1-877-768-4775

A Riddle

What is better than a dog that can count?

A spelling bee

Challenging Mathematics

The "Challenging Mathematics" program is based on extensive research and field-testing. It focuses on problem-solving as a strategy for developing an understanding of mathematical concepts. The game of chess is a perfect fit with a program that has these types of objectives. Chess is problem-solving from start to finish. It forces you to look ahead and anticipate -- skills we all need to succeed in life.

Source: Chess 'n Math Association, Canada's National Scholastic Chess Organization *http://www.chess-math.org/chess/math.htm*

MATH ODYSSEY

Tarts and Tea

by Joyce Fischer

Let's try some Lewis Carroll-type problems, supplied by *Raymond Smullyan in his book, "**Alice in Puzzleland**".

The Gryphon tells Alice a story about the Queen serving tarts (little pies) to 30 of her friends. She has 100 tarts to serve to her best friends and 3 to everyone else. How many best friends does she have?

Let's think about this one. Here is the way Professor Smullyan looks at the problem. First, we can give 3 tarts to each person. This will use 90 tarts and there will be 10 left over, so she has 10 best friends.

Here is another fun one. The Mad Hatter, the March Hare, and the Dormouse are having a tea party. The selfish Hatter serves himself all the tarts. When he goes inside to get the tea, the Hare takes 5/16 of the tarts and eats them. Then the Dormouse eats 7/11 of the remaining tarts. This leaves 8 tarts for the Hatter. How many did the other two eat?

Let's guess and check to solve this one. Since the Hare ate 5/16 of the tarts, the number was divisible by 16, so let's guess 16. If there were 16 tarts and the Hare ate 5 there would be 11 left. Of the 11, the Dormouse ate 7, so this would leave 4 for the Hatter. Since there were 8 left for the Hatter, we just need to double all our numbers. This means the Hare ate 10 and the Dormouse ate 14.

Now here is one for you to try by yourself. The Hare and the Hatter are having tea and tarts. The Hatter serves all of the tarts but gives himself 3 times as many as he gives the Hare. When the Hare complains the Hatter gives him another tart. "That isn't enough," said the Hare. "You still have twice as many tarts as me".

How many tarts must the Hatter give the Hare so that they have the same amount?

**Raymond Smullyan is an internationally known mathematician, logician and philosopher, as well as a magician and concert pianist. Author of more than a dozen books and countless articles on mathematical logic and other topics, he has been called the "Lewis Carroll" of our times.*

Games are great fun and give us a chance to tackle challenging problems creatively and make clear decisions understanding the consequences of our action. Chess is a game for young and old alike. We know you will enjoy the article on chess and mathematics in this issue of Math Reader and the challenging problems accompanying it. We hope you'll get hooked on chess and derive many hours of enjoyment playing with family and friends.

Sincerely,

Hiroko K. Warshauer

Hiroko K. Warshauer, editor