



MATH & SPORTS

Math Scores!

Get all the Angles!!

Khayyam: Poet and Mathematician

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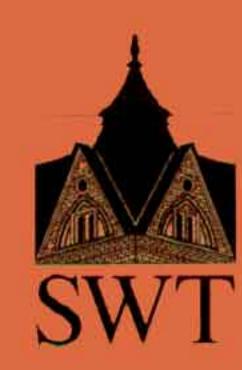
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Math Explorer and Math Reader are published

by Southwest Texas State University

Math Institute for Talented Youth (MITY).

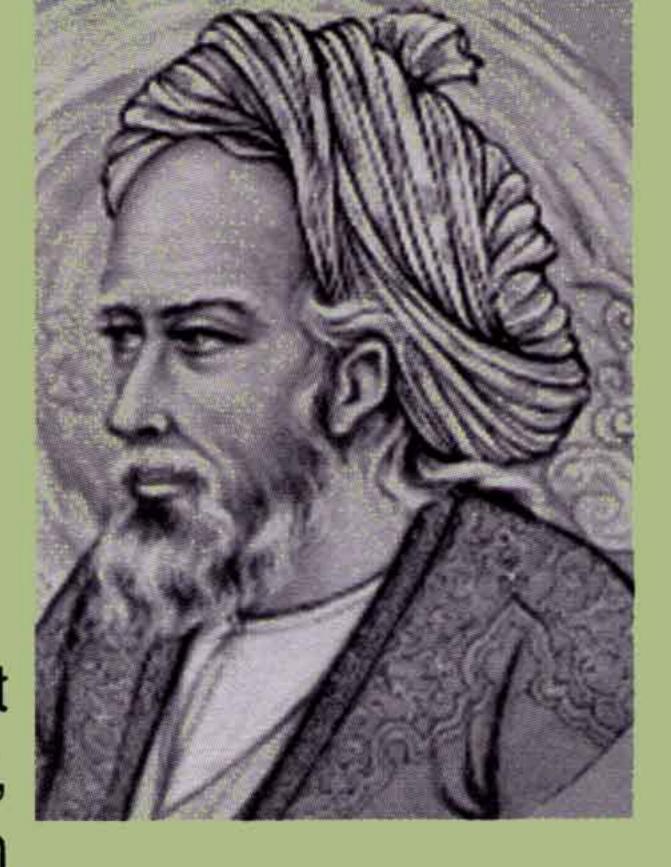


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Omar Khayyam

by Ahmad Fatehi

Omar Khayyam, a prominent Persian mathematician, astronomer, philosopher and poet was born in



Khorassan (the northeastern state of Iran) in 1048, and died there in 1131. The majority of his scientific works and essays were written in Arabic, according to the tradition of that era. His sublime poetry, known as Rubaiyat (quatrains), as well as some of his philosophical essays were written in Farsi (Persian), his native tongue.

Khayyam's scientific contributions were well known in the East for many centuries prior to being introduced to the West. His book on algebra was translated into French by F. Woepcke and published in Paris in 1851. Khayyam's scientific fame was eclipsed, to some extent, by the popularity of the translations of his Rubaiyat into several western languages. Edward Fitzgerald's masterful translation of Rubaiyat, which first appeared in 1859, is now considered a classic work of English literature.

Historically, the first relatively complete solution of the third degree equation has been attributed to Omar Khayyam. In an ingenious manner, he first transformed the cubic equation into an apparently more complex framework, that is a fourth degree algebraic equation. He then devised a geometric theory for reducing the fourth degree problem in the search for the intersections of two conic sections, namely a circle and a hyperbola.

Khayyam also noted that a geometric solution for a cubic equation cannot be generally obtained with a compass and ruler. This supposition was conjectured independently more than 500 years later by the French mathematician/philosopher, Rene Descartes, in 1637 and was finally proven by P. Wantzelin in 1837.

Omar Khayyam also examined, in some depth, the postulates and axioms of Euclidean geometry and the study of the binomial

(continued on page 7)

PROBLEMS OF THE MONTH

- 1. In five years, Sam will be half as old as his dad. Five years ago, he was one third his father's age. How old is Sam now?
- 2. Find the last two digits of the number 41 1034.
- 3. Suppose that numbers are blue if they are even or if the last digit is 5. All of the other numbers are red. How many blue numbers are there between 1 and 1000?
- 4. Draw a circle of radius 3 with its center at the origin on graph paper and count the number of grid points inside the circle. Guess how many grid points are inside a circle of radius 4. What about a circle of radius 5? What is the pattern? Do you see how this pattern is related to the areas of the circles?
- 5. "We are selling items on this rack for 15% off the marked price. This will save you \$3.60 on these jeans," said the sales clerk to Maria. What was the marked price on the jeans?
- 6. There are 16 teams in a tournament. If the tournament is single elimination, how many games will be played? If the tournament is double elimination, what is the greatest possible number of games that could be played?
- 7. What is the greatest number not possible as a score for a football team? What is the greatest score not possible if you cannot have any safeties, which are worth 2 points each? (We only allow scoring with field goals of 3 points, or touchdowns of 7 points.)
- 8. How many ways can a football team score 30 points?

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 Explorer pens!

THE GEOMETRY

by Terry McCabe

You cannot watch or play the sport of pool without noticing many geometric problems and questions. In the various games of pool, a player strikes the white cue ball in such a way as to try to cause the target ball (we will use a blue ball) to go into a hole or pocket in the side or corner of the pool table. We will look at some problems that arise in playing this game. We will ignore the effect of putting spin on the cue ball, which could effect how the other ball reacts when struck.

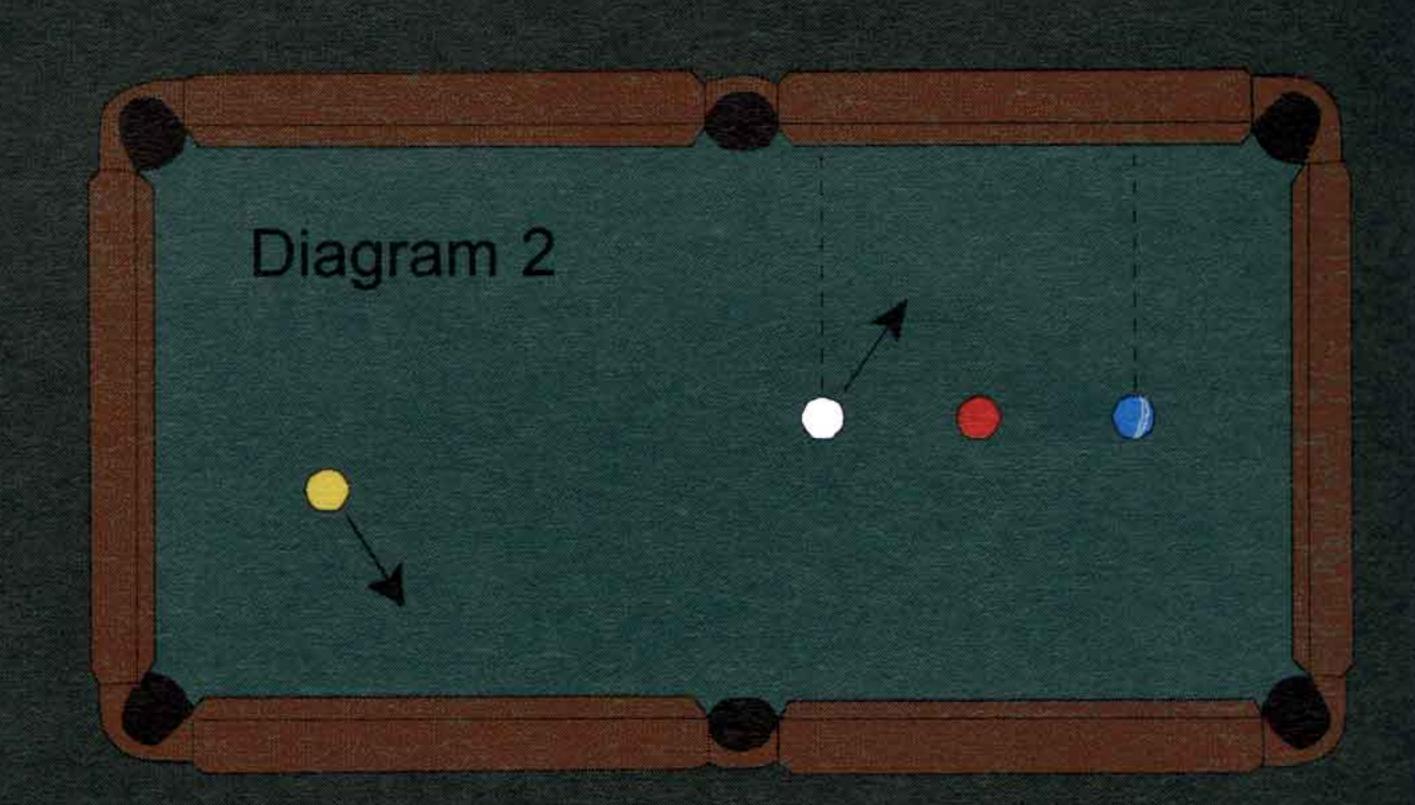
Suppose the blue ball and the cue ball are located on a pool table as in Diagram 1. In what direction should the player strike the cue ball 1 in order to

knock the blue ball in? Which pocket

should the player target as the place to

"sink" the blue ball? You will need to draw

some imaginary lines representing the path of the balls to solve this problem. (Use a ruler and pencil because you may need to erase!) If you successfully sink the blue ball, in what direction will the cue ball travel after hitting the blue ball? Experiment to see if you can find other directions to hit the cue in order to sink the blue ball in other pockets. Do the same for cue ball 2 and the red ball.



Another interesting problem occurs when there is no direct path for the cue ball to his the blue ball because another ball is in the way (see Diagram 2). How can we hit the target ball in this situation? We use what is called a bank shot.

But first, let's discuss the path a ball will take after striking a side. In diagram 2, the path of the yellow ball approaching a side is drawn. Draw the path of how the ball will travel after rebounding off the side.

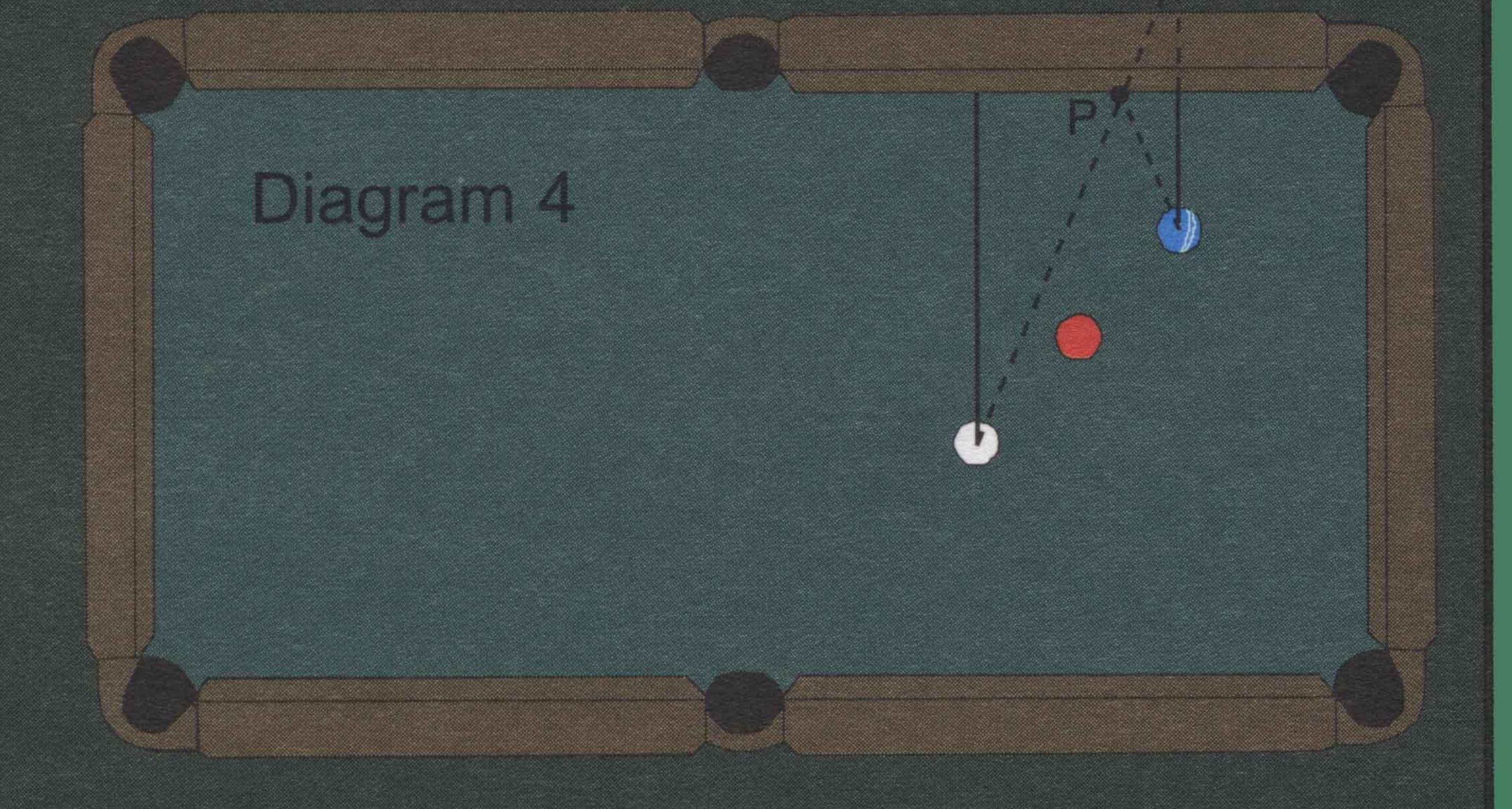
FPLAYING POOL

The angle between the approach path and the side should be the same as the angle between the rebound path and the side. On the other side of Diagram 2, draw the path you would make the cue ball travel in order for it to strike the blue ball. Which wall did you choose to use? In Diagram 2, draw a line from the cue ball to the near side to make a right angle. Call this point P. Do the same for the blue ball and call the point on the side nearest it Q. You probably discovered that in order for the cue ball to hit the blue ball, the point where the cue ball hits the side should the midpoint between P and Q.

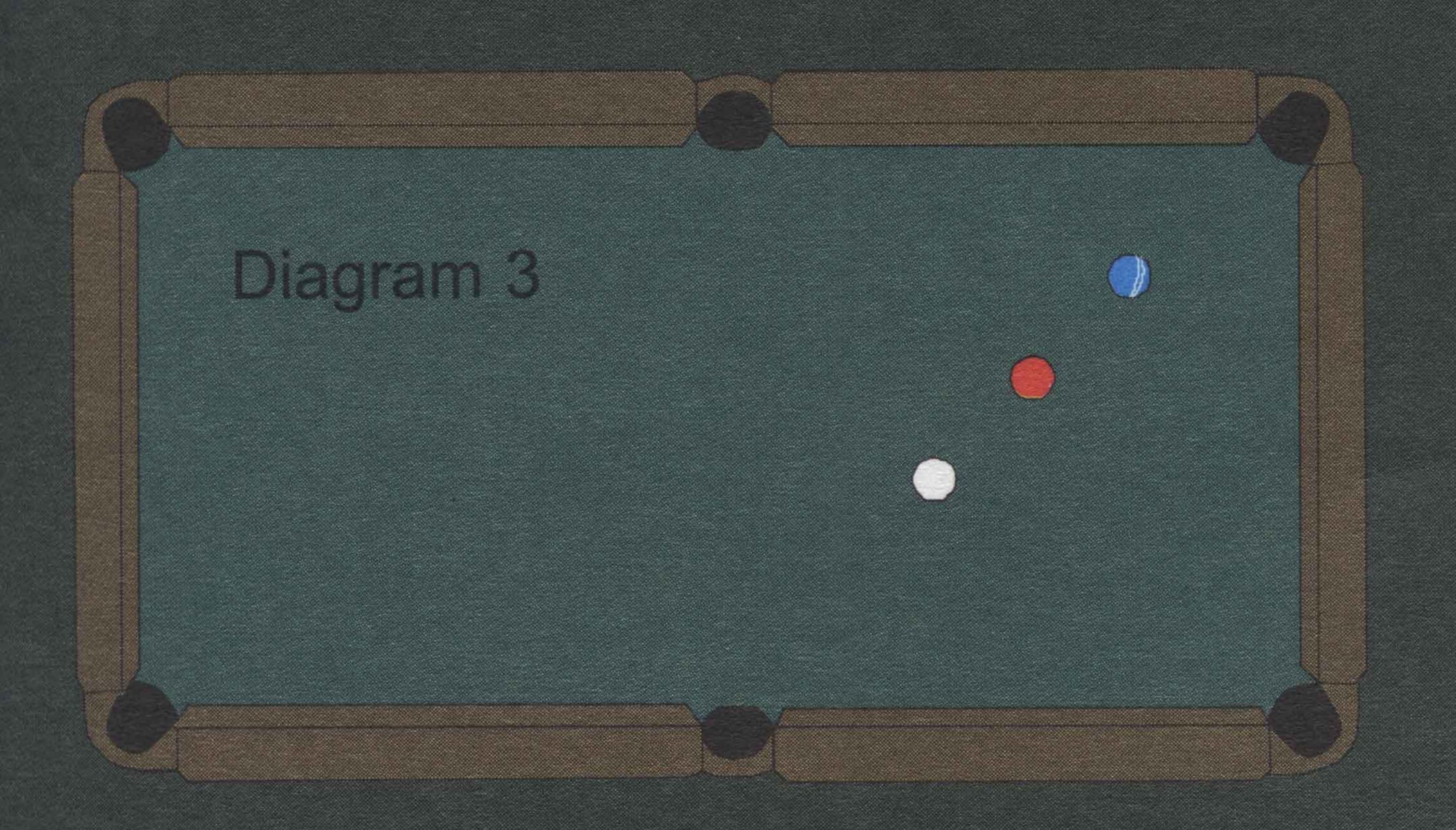
On the right side in Diagram 3, we see a similar problem, except that the cue ball and the blue ball are not the same distance from the side. What path should the cue ball travel in this case? Experiment with this for a while and then come back to this section.

think about this problem. One way to look at this problem is to extend the line from the blue ball to the side off the table to an imaginary ball equal distance from the side as the blue ball (Look at Diagram 4). Draw an imaginary line from the cue ball to this imaginary ball. The point P at which this imaginary line crosses the side of the table is the point the cue ball must hit in order to rebound and hit the real blue ball. This is a surprisingly simple solution. Can you explain why this method works?

Are you back? There are several ways to



Another way to look at this problem involves geometry and algebra. See if you can come up with other ways to solve this problem. As an extension, what if the problem is that the cue ball must hit two sides of the table before hitting the blue ball? Where would you hit the sides?



Puzzle Page

Math Explorers:

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 Explorer pens.

Picky Picky Picky! Using

Using 1, 2, 3, 4, 5, 6, 7 (all of them), place a number in each circle so that the sum of the numbers in each segment and on each circle is 12.

24 toothpicks, we made a big square containing 9 little squares. Remove 8 toothpicks so that only 2 squares of different size are on the picture.

Connect Those Points Draw 6 points and connect some of

them with segments of a straight line in such a way that every point is connected to 3 other points and the connecting segments do not intersect each other.

Bulletin Board

World Math Contest

The Po Leung Kuk 4th Primary Mathematics World Contest (PMWC) organized by Hong Kong Po Leung Kuk will be held July 15-20, 2000 in Hong Kong.

For more info e-mail: eadmaths@poleungkuk.org.hk

Did you know that?

Etymology is the study of the history of words. Using an unabridged dictionary, find the etymology of these words: fraction, numerator, denominator.

Words of Wisdom

"Mathematics seems to endow one with something like a new sense." -- Charles Darwin

"The mathematical sciences particularly exhibit order, symmetry, and limitation; and these are the greatest forms of the beautiful." -- Aristotle

Math Opportunities

Interested in a Math Camp for Girls? In addition to SWT's co-ed program, you could try Mount Holyoke Math Camp: http://www.mtholyoke.edu/proj/summermath/

Mathcamp 2000 will be held at the University of British Columbia in Vancouver, Canada, from July 9th to August 13th, 2000. More details will appear on this website as they become available: http://www.mathcamp.org/

Omar Khayyam (continued)

expression (x+y) raised to the nth power, for n=1, 2,12. The binomial coefficients are generally exhibited in a triangular form known as "Pascal's Triangle". Khayyam has also been credited with stating what would become Fermat's Theorem in the 17th century. He claimed it is impossible to solve the equation x to the third power plus y to the third power equal to z to the third power with positive integers x, y and z.

Omar Khayyam was a mathematician/philosopher absorbed in the problems of physics and the natural sciences, with a penchant for aesthetics and poetry. In spite of his epicurean image, he was not Sufi, a mystic or a fundamentalist. He is perhaps best remembered in the West as a romantic.

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How are mathematics and sports related you might ask? Mathematics can reveal records of teams or indicate athletic performance. Batting averages, rushing yardage, running times all involve working with numbers. Billiard players must study angles, and track athletes study speed. We'd like to know how you combine math and sports!

Good luck on this month's puzzles and problems. We'd like to encourage you to share your solutions with our readers.

Sincerely,

Hiroko K. Warshamer

Hiroko K. Warshauer

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Next year's magazines will be quarterly -- an issue each season -- bringing you biographies, puzzles, problems and articles that connect mathematics to the world around us. Be sure to subscribe now so you don't miss the fall issue!