

Favorite Conjectures And Open Problems in Mathematics

NAME _____ DATE _____ PERIOD _____

2-1 Word Problem Practice Conjectures and Counterexamples

- 1. RAMPS** Rodney is rolling marbles down a ramp. Every second that passes, he measures how far the marbles travel. He records the information in the table shown below.

Second	1st	2nd	3rd	4th
Distance (cm)	20	60	100	140

Make a conjecture about how far the marble will roll in the fifth second.

- 2. PRIMES** A prime number is a number other than 1, that is divisible by only itself and 1. Lucille read that prime numbers are very important in cryptography, so she decided to find a systematic way of producing prime numbers. After some experimenting, she conjectured that $2^n - 1$ is a prime for all whole numbers $n > 1$. Find a counterexample to this conjecture.

- 3. GENEALOGY** Miranda is developing a chart that shows her ancestry. She makes the three sketches shown below. The first dot represents herself. The second sketch represents herself and her parents. The third sketch represents herself, her parents, and her grandparents.



Sketch what you think would be the next figure in the sequence.

- 4. MEDALS** Barbara is in charge of the award medals for a sporting event. She has 31 medals to give out to various individuals on 6 competing teams. She asserts that at least one team will end up with more than 5 medals. Do you believe her assertion? If you do, try to explain why you think her assertion is true, and if you do not, explain how she can be wrong.

- 5. PATTERNS** The figure shows a sequence of squares each made out of identical square tiles.



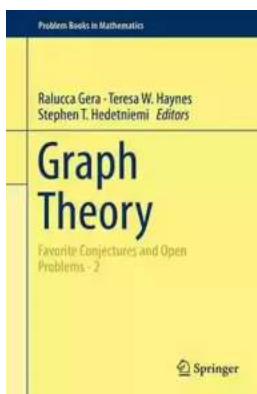
- Starting from zero tiles, how many tiles do you need to make the first square? How many tiles do you have to add to the first square to get the second square? How many tiles do you have to add to the second square to get the third square?
- Make a conjecture about the list of numbers you started writing in your answer to Exercise a.
- Make a conjecture about the sum of the first n odd numbers.

Mathematics is a fascinating field that encompasses a wide range of concepts and theories. It is constantly evolving as mathematicians work to solve complex problems and explore uncharted territories. Within this ever-growing landscape,

there are numerous conjectures and open problems that continue to capture the attention and curiosity of mathematicians around the world.

The Beauty of Conjectures

A conjecture, in mathematics, is a statement that is believed to be true but has not been proven. It serves as a starting point for further investigation and often paves the way for groundbreaking discoveries. Conjectures act as beacons, guiding mathematicians on their quest to unlock new mathematical truths.



Graph Theory: Favorite Conjectures and Open Problems - 1 (Problem Books in Mathematics)

by Jerrold Franklin (1st ed. 2016 Edition, Kindle Edition)

★★★★★ 5 out of 5

Language : English

File size : 8410 KB

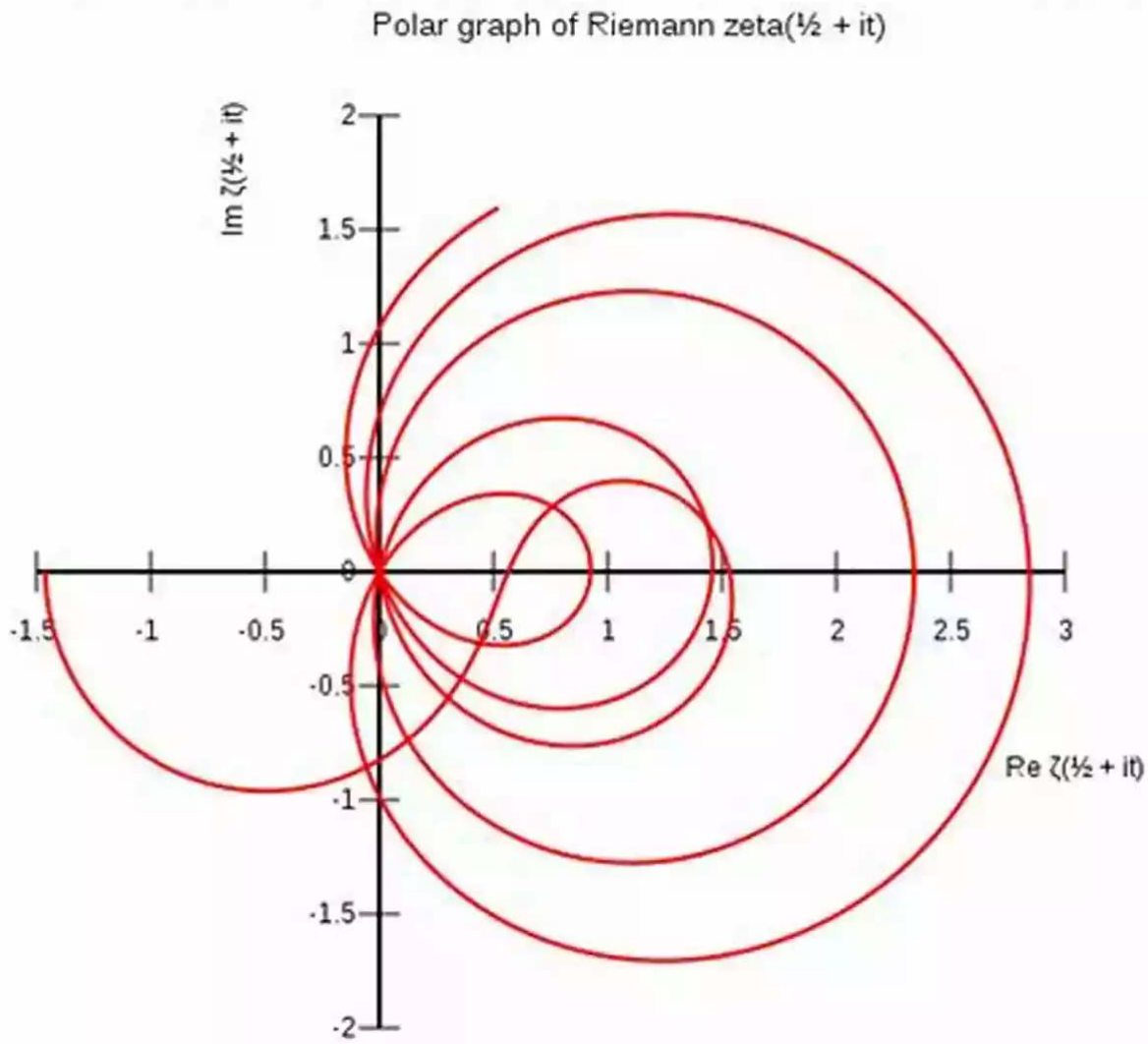
Screen Reader : Supported

Print length : 303 pages



Popular Conjectures

One of the most famous conjectures in mathematics is the **Riemann Hypothesis**. Proposed by Bernhard Riemann in 1859, it relates to the distribution of prime numbers and their connection to the Riemann zeta function. Despite numerous attempts, this conjecture remains unsolved, making it an intriguing challenge for mathematicians to this day.



Another notable conjecture is the **P versus NP problem**. It asks whether every problem whose solution can be verified quickly can also be solved quickly. In simpler terms, it explores the relationship between problems that are easy to verify and those that are easy to solve. This conjecture has significant implications in various fields, including computer science and optimization.

The Excitement of Open Problems

An open problem, on the other hand, refers to a question or challenge that has not been resolved yet. Unlike conjectures, open problems do not come with an

assumed answer. They offer an opportunity for mathematicians to delve into uncharted territories and make groundbreaking discoveries.

Popular Open Problems

One of the most well-known open problems is the **Birch and Swinnerton-Dyer conjecture**. It relates to the existence of rational points on elliptic curves and has direct implications on the study of number theory. Its significance lies in its potential to provide a better understanding of complex mathematical structures.

Birch and Swinnerton Dyer Conjecture



$$\zeta(s) = 1 + \frac{1}{2^s} + \frac{1}{3^s} \dots$$

Another captivating open problem is the **Navier-Stokes existence and smoothness problem**. It revolves around the behavior of fluid flow and aims to determine whether solutions to the Navier-Stokes equations exist and stay smooth for all time. This problem is not only of interest in mathematics but also plays a crucial role in engineering and physics.

The Quest for Solutions

Conjectures and open problems drive mathematicians to push the boundaries of knowledge and explore new avenues of research. They inspire collaboration, spark discussions, and fuel the desire to find elegant solutions. The pursuit of solving these problems often leads to the development of new mathematical techniques and insights.

Challenges Faced by Mathematicians

Mathematicians encounter numerous challenges when attempting to solve conjectures and open problems. The inherent complexity of these problems often requires interdisciplinary approaches, combining various branches of mathematics and even other fields. Additionally, the lack of available data or computational power can pose significant obstacles in the quest for solutions.

The Impact of Breakthroughs

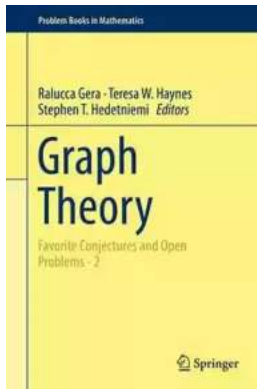
When a conjecture is proven or an open problem is solved, it can have profound implications for mathematics as a whole. It can lead to advancements in various subfields and shed light on previously unexplored connections. Furthermore, breakthroughs in mathematics often have real-world applications in fields such as cryptography, computer science, and physics.

The world of mathematics is filled with fascinating conjectures and open problems, waiting to be explored and solved. These challenges inspire mathematicians to push the boundaries of knowledge and unlock new mathematical truths. As the pursuit of these problems continues, the possibilities for discovery and advancement in the field of mathematics are truly limitless.

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This is the first in a series of volumes, which provide an extensive overview of conjectures and open problems in graph theory. The readership of each volume is geared toward graduate students who may be searching for research ideas. However, the well-established mathematician will find the overall exposition engaging and enlightening. Each chapter, presented in a story-telling style, includes more than a simple collection of results on a particular topic. Each contribution conveys the history, evolution, and techniques used to solve the authors' favorite conjectures and open problems, enhancing the reader's overall comprehension and enthusiasm.

The editors were inspired to create these volumes by the popular and well attended special sessions, entitled "My Favorite Graph Theory Conjectures," which were held at the winter AMS/MAA Joint Meeting in Boston (January, 2012), the SIAM Conference on Discrete Mathematics in Halifax (June, 2012) and the winter AMS/MAA Joint meeting in Baltimore (January, 2014). In an effort to aid in the creation and dissemination of open problems, which is crucial to the growth and development of a field, the editors requested the speakers, as well as notable experts in graph theory, to contribute to these volumes.



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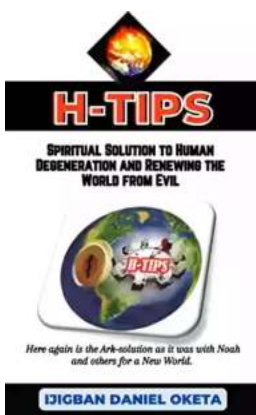
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