

Problem Set 1: Number Theory

Dakahlia Math Club

Week 1

Problems

1. The first two numbers that are both squares and triangles are 1 and 36. Find the next one and, if possible, the one after that. Can you figure out an efficient way to find triangular-square numbers? Do you think that there are infinitely many?
2. Try adding up the first few odd numbers and see if the numbers you get satisfy some sort of pattern. Once you find the pattern, express it as a formula. Give a geometric verification that your formula is correct.
3. The consecutive odd numbers 3, 5, and 7 are all primes. Are there infinitely many such "prime triplets"? That is, are there infinitely many prime numbers p such that $p + 2$ and $p + 4$ are also primes?
4. It is generally believed that infinitely many primes have the form $N^2 + 1$, although no one knows for sure.
 - (a) Do you think that there are infinitely many primes of the form $N^2 - 1$?
 - (b) Do you think that there are infinitely many primes of the form $N^2 - 2$?
 - (c) How about of the form $N^2 - 3$? How about $N^2 - 4$?
 - (d) Which values of a do you think give infinitely many primes of the form $N^2 - a$?
5. The following two lines indicate another way to derive the formula for the sum of the first n integers by rearranging the terms in the sum. Fill in the details.

$$\begin{aligned} 1 + 2 + 3 + \cdots + n &= (1 + n) + (2 + (n - 1)) + (3 + (n - 2)) + \cdots \\ &= (1 + n) + (1 + n) + (1 + n) + \cdots \end{aligned}$$

How many copies of $n + 1$ are in the second line? You may need to consider the cases of odd n and even n separately. If that's not clear, first try writing it out explicitly for $n = 6$ and $n = 7$.

Problems In Elementary Number Theory Problem Solving

Huangqi Zhang



Problems In Elementary Number Theory Problem Solving:

The Top Books of the Year Problems In Elementary Number Theory Problem Solving The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of bestselling books, exploring the engaging narratives that have enthralled audiences this year.

Problems In Elementary Number Theory Problem Solving : Colleen Hoover's "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed.

Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This intriguing historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery.

Discover the Magic : Delia Owens "Where the Crawdads Sing" This mesmerizing coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting.

These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered.

The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts.

The Secret History is a masterful and gripping novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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Table of Contents Problems In Elementary Number Theory Problem Solving

1. Understanding the eBook Problems In Elementary Number Theory Problem Solving
 - The Rise of Digital Reading Problems In Elementary Number Theory Problem Solving
 - Advantages of eBooks Over Traditional Books
2. Identifying Problems In Elementary Number Theory Problem Solving
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Problems In Elementary Number Theory Problem Solving
 - User-Friendly Interface
4. Exploring eBook Recommendations from Problems In Elementary Number Theory Problem Solving
 - Personalized Recommendations
 - Problems In Elementary Number Theory Problem Solving User Reviews and Ratings
 - Problems In Elementary Number Theory Problem Solving and Bestseller Lists
5. Accessing Problems In Elementary Number Theory Problem Solving Free and Paid eBooks
 - Problems In Elementary Number Theory Problem Solving Public Domain eBooks
 - Problems In Elementary Number Theory Problem Solving eBook Subscription Services
 - Problems In Elementary Number Theory Problem Solving Budget-Friendly Options
6. Navigating Problems In Elementary Number Theory Problem Solving eBook Formats
 - ePub, PDF, MOBI, and More
 - Problems In Elementary Number Theory Problem Solving Compatibility with Devices
 - Problems In Elementary Number Theory Problem Solving Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Problems In Elementary Number Theory Problem Solving
 - Highlighting and Note-Taking Problems In Elementary Number Theory Problem Solving
 - Interactive Elements Problems In Elementary Number Theory Problem Solving

8. Staying Engaged with Problems In Elementary Number Theory Problem Solving
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Problems In Elementary Number Theory Problem Solving
9. Balancing eBooks and Physical Books Problems In Elementary Number Theory Problem Solving
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Problems In Elementary Number Theory Problem Solving
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Problems In Elementary Number Theory Problem Solving
 - Setting Reading Goals Problems In Elementary Number Theory Problem Solving
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Problems In Elementary Number Theory Problem Solving
 - Fact-Checking eBook Content of Problems In Elementary Number Theory Problem Solving
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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