

Shyam Sunder Gupta

# Creative Puzzles to Ignite Your Mind



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# Creative Puzzles to Ignite Your Mind

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*This book is dedicated with great respect to the memory of my mother late Smt. Shanti Devi, with the hope that it will keep alive her contribution in solving problems of all her near and dear ones.*

# Preface

The author takes great pleasure in presenting the book, *Creative Puzzles to Ignite Your Mind*, which is a great treasure for everybody who enjoys the beauty of the fascinating world of recreational mathematics. The book has been written keeping in view a large number of people who can be benefitted by reading the book. Apart from puzzle enthusiasts and math lovers, the book is considered of immense value for aspirants of Mathematics Olympiad, CAT/MBA and placement interviews of big companies like Google, Microsoft, Amazon, Apple, Facebook, Yahoo, NVidia, Oracle, Adobe, Morgan Stanley, Bloomberg and so on.

The book covers a large variety of intriguing puzzles with detailed ingenious solutions generally not found elsewhere. The puzzles can be browsed at random as these are not grouped in any orderly manner. The book is a result of collection and framing of puzzles to make them entertaining over a large period of thirty-five years, so references/sources of many puzzles are not available.

The book contains 25 short riddles and brainteasers in Chap. 1, which vary from simple but tricky to challenging ones. Chapter 2 provides solutions to all these short riddles and brainteasers given in Chap. 1.

Chapter 3 contains 125 creative puzzles of varying difficulty covering arithmetic and algebraic like clock, calendar, weight, age and digital puzzles, geometric puzzles, logical reasoning puzzles, combinatorial puzzles, match puzzles and game puzzles like who'll become a decamillionaire (kaun banega crorepati)?, new year winner, winning numbers, etc. Some famous and old puzzles like Cheryl's birthday, Bachet's weight, liquid decanting, crossing bridge/river/desert, etc., have been included so that readers can find all types of puzzles at one place.

Only basic mathematics is required to solve these puzzles. But most of these puzzles are tricky and can be simplified by ingenious ideas. Chapter 4 provides detailed ingenious solutions to all 125 creative puzzles in a lucid manner along with special comments section which covers generalization of solutions, different techniques of attacking the same puzzle wherever possible. This will create interest in readers for further exploring the puzzle.

The title of puzzles has been suitably framed. Repetition of similar type of puzzles has been avoided to keep the book in concise form. However, important aspects of similar puzzles if any have been covered in comments section.

Like physical exercise is essential for a healthy body, mental exercise is equally essential for a healthy brain/mind. Puzzle solving is one of the brain exercises which can also train the mind to solve the real-world problems. So let us not waste time and start brain exercise as puzzles are eagerly waiting to ignite your mind.

Jaipur, India

Shyam Sunder Gupta



# Acknowledgements

I sincerely acknowledge and thank Dr. Akhilendra Bhusan Gupta and Mukesh Singhal for their comments after going through some of the puzzles in the book. I thank my sons Tarun Kumar and Amit Gupta for going through the manuscript and helping in making all the illustrations in the book.

I thank my wife Sushil Gupta for her encouragement and support without which it would not have been possible to start writing and complete this book.

I got interested in puzzles after getting inspired by the puzzles of world's greatest puzzle makers like Sam Loyd, Henry Dudeney, Boris Kordemsky, Martin Gardner, Raymond Smullyan and others. I am grateful and thank them all.

Since the book has been prepared based on material prepared and collected over a long period of time, it is practically not possible to make available the references. However, I am thankful to everybody associated directly or indirectly with the puzzles in this book.

Every effort has been made to make the book error-free; however, some errors and mistakes may always remain. Therefore, I shall be grateful for any suggestions and comments not only for rectifying the errors and mistakes but for improving the book also.

Shyam Sunder Gupta

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## About the Author

**Shyam Sunder Gupta** is former Principal Chief Engineer, Indian Railways, Government of India. He is an Indian Railway Service of Engineers (IRSE) Officer of batch 1981. He has experience of more than 35 years in various managerial, administrative and technical positions such as Principal Chief Engineer, Executive Director, Divisional Railway Manager and Director/RDSO on Indian Railways. A recreational mathematician, who is actively involved in popularizing mathematics at the national and international levels, his major discoveries are equal product of reversible numbers (EPORNS), rare numbers, unique numbers, palindromic pseudoprimes, fifth-order prime polynomial, 17,350-digit memorable prime, etc.

His interest in number recreations dates back to 1978, when his first paper “Miracles of last digit” was published. Since then, his contributions have been published in *Science Reporter*, *Science Today*, *Math Education*, *The American Mathematical Monthly*, *The Mathematical Gazette*, *Mathematical Spectrum*, *Scientia Magna* and several other international books like *Unsolved Problems in Number Theory* (by R. K. Guy), *The Universal book of Mathematics* (by David J. Darling), *The Penguin Dictionary of Curious and Interesting Numbers* (by David Wells), *Prime Numbers: The Most Mysterious Figures in Math* (by David Wells), *Prime Curios!: The Dictionary of Prime Number Trivia* (by Chris K. Caldwell and G. L. Honaker) and *Those Fascinating Numbers* (by Jean-Marie De Koninck). He is co-author of the book, *Civil Engineering Through Objective Questions*.

# List of Short Riddles and Brain Teasers

1. Health Monitoring
2. The Surface Area and Volume of a Cube
3. Missing Numbers in the Sequence
4. Weight of Rice Packets
5. Solving Equations
6. Pair of Balls
7. Coin Denominations
8. Buildings in the Colony
9. Partially Completed Grid
10. Finding Birthday
11. Allowance for Casting Vote
12. Counterfeit Cheque
13. Speed of an Old Car
14. Rate of Interest
15. Clock Digits
16. Unique Number
17. Largest Value and Average
18. Playing the Card Game
19. Candle Light Study
20. Apparent Miscalculation
21. Colliding Cars
22. Four Digit Squares
23. Vanishing Squares
24. Two Different Date Formats
25. Product of Three Consecutive Even Numbers

# List of Creative Puzzles

1. The Economist and a Mathematician
2. Mobile Phones and Pen Drives
3. Inter-hostel Athletics Competition
4. Ages and Inequalities
5. Consecutive Double-Digit Numbers
6. Interchangeable Hands of a Clock
7. Largest Product of Two Numbers
8. Three Balls and Four Boxes
9. Worm on a Rubber Rope
10. Winning Numbers for 101
11. Keys to Open the Locker Room
12. Fastest Three Horses
13. Climbing the Stairs
14. Shopping During Partial Lockdown
15. Shaking Hands
16. Equal Distribution by Doubling
17. Identify the Apple Juice Bottle
18. Lockers Finally Remain Opened
19. Weights in Increasing Order
20. Grant Distribution Among Districts
21. Trucks to Transfer Payload
22. Inverting an Equilateral Triangle
23. Largest Product from Distinct Numbers
24. Gold Chain for Daily Payment
25. Age of Two Liars
26. Three Sundays on Prime Numbered Dates
27. Squares from Adjacent Numbers
28. Crossing the Bridge at Night
29. Distinct Digit Milometer Reading

30. Three Hands of a Clock
31. Review Meeting Days
32. Curious Olympic Rings
33. Maximum Area of Plot
34. Building Location for a Senior Citizen
35. Roll Number Dilemma
36. Relative Motion on Circular Track
37. Race Competition
38. A Gem from Bhaskaracharya II's Work
39. Five Children and 517 Gold Coins
40. Sum = Product
41. Investment and Returns
42. The Grazing Cow's
43. Labour on a Construction Site
44. The Biggest Number Using Three Identical Digits
45. Five Jealous Husbands and Their Wives
46. The Look and Say Sequence
47. Thirty-Six Inch Scale with Minimum Markings
48. Number of Triangles
49. The Ants on a Stick
50. Winner of the Year
51. Careless Bank Cashier
52. Five Working Days a Week
53. Defective Coin Among 24 Coins
54. Two Trains and a Bird
55. Basket and Eggs
56. Ranking Large Numbers
57. A Unique Polydivisible Number
58. Handless Clock Chimer
59. Mango Sharing
60. Five Sundays in February
61. Employment During Covid-19 Crisis
62. Camel and Banana Transportation
63. Distance Between Two Colonies
64. Bachet's Weights
65. Match Stick and Squares
66. Insufficient Pounds
67. Mixing Water and Milk
68. The Three Jug-Decanting Liquid
69. Crack the 3-Digit Lock Code
70. Gold and Silver Bricks
71. Three Men and Their Wives
72. Hundred Balloons in Hundred Rupees

73. Counterfeit Coin
74. Effect of Paper Folding
75. Seven Security Posts
76. Rotating Balls
77. Holidays During Covid-19 Crisis
78. Making the Chain from Cut Pieces
79. Four Operations on Two Numbers
80. Who'll Become a Decamillionaire (Kaun Banega Crorepati)?
81. India's Independence Day
82. Palindromic Mileage
83. Time Measurement with Hourglass
84. Smallest Product of Two Numbers
85. Squares and Rectangles on a Chessboard
86. New Year Party and the Poisoned Drink
87. Black and White Balls
88. Missing Page Numbers
89. How Many Byes
90. Hourly Consumption of Lemon Juice
91. Unique Four Digit Square
92. The Age of Three Children
93. Pairs of Friendly Rectangles
94. When RIGHT Becomes LEFT
95. Seventh Root
96. Motion on a Straight Road
97. Unlucky Thirteen
98. Doubly True Alphametic
99. Tickets for the New Railway Stations
100. Egg Dropping
101. How Many Squares
102. Identify Gold Coin Box
103. Taxi Charges from Jaipur to Delhi
104. Cheryl's Birthday
105. Twelve Dots and Connecting Lines
106. Equalize Liquid Concentration
107. Two Boats and Width of a River
108. First Day of a New Century
109. Largest Product from Given Sum
110. Ten Digit Self-descriptive Number
111. Upward Journey of a Ball
112. Mathematician on the Escalator
113. Incorrectly Labeled Boxes
114. How Long Professor Walked
115. Ratio of a Number to its Digit Sum

116. Financial Assistance to Villagers
117. Gold Coins and Culprit Jeweller
118. Pricing of a Fruit Set
119. Perfect Powerful Number
120. Minimum Number of Houses
121. Locker and Coins
122. Sum of Digits of Numbers
123. Number of Diagonals in a Polygon
124. Peculiar Pages in a Book
125. Coin Distribution



# Chapter 1

## Short Riddles and Brain Teasers



### 1. Health Monitoring

A survey was conducted in a town during the Covid-19 epidemic. It was found that 55% of the population is suffering from diabetes, 70% from heart disease and 80% from depression. Find the minimum possible percentage of the population suffering from all three diseases i.e. diabetes, heart disease and depression.

### 2. The Surface Area and Volume of a Cube

The surface area and volume of a cube are both five-digit integers. The volume of the cube is an integer multiple of the surface area. Find the side of the cube. Assume the units of side, surface area and volume of the cube as mm, mm<sup>2</sup> and mm<sup>3</sup> respectively.

### 3. Missing Numbers in the Sequence

Find the missing numbers X and Y in the following sequence:  
1100100, 10201, 1210, 400, 244, 202, X, Y, 100

### 4. Weight of Rice Packets

There are five packets containing rice. Instead of weighing these five packets individually, they were weighed in all possible combinations of two packets i.e., packet 1 and 2, packet 1 and 3, packet 2 and 3 etc. The weights in kilograms of all these combinations in ascending order are 6.7, 7.2, 7.3, 8.1, 8.3, 8.4, 8.9, 9.2, 9.7 and 9.8. It is not known which weight pertains to which pair of packets. Find the weight of each packet.

### 5. Solving Equations

Solve  $(x^2 - 9x + 19)^{(x^2 - 15x + 56)} = 1$  and find all possible integer values of x.

### 6. Pair of Balls

A box containing 5 red, 11 green and 17 white balls are kept in a room. At least two balls of the same colour are to be taken out of the box, without looking at it. Find the minimum number of balls required to be taken out of the box in order to be sure of getting at least two balls of the same colour.

### 7. Coin Denominations

In a certain Kingdom, three gold coins of different denominations in tolas were in vogue. Anupama had four gold coins worth 20 tolas. Akshara had five gold coins worth 15 tolas. If both Anupama and Akshara had at least one gold coin of each denomination, find the value of the denomination (an integer number) of each of the three different gold coins.

### 8. Buildings in the Colony

The Buildings in a small colony are numbered using different positive integers. The sum of the building numbers is 101. If the maximum possible number of buildings exists in the colony, find the building numbers.

### 9. Partially Completed Grid

There are 16 squares in the grid shown below. Ten squares are filled with the letters A to J and six squares are filled with whole numbers. Replace the letters A to J in ten squares with numbers from 1 to 10, using each number only once, such that the six squares containing numbers become the product of numbers in their adjacent squares filled with letters.

|   |     |     |     |    |    |   |
|---|-----|-----|-----|----|----|---|
|   |     |     | A   |    |    |   |
|   |     | B   | 378 | C  |    |   |
|   | D   | 144 | E   | 90 | F  |   |
| G | 160 | H   | 40  | I  | 60 | J |

### 10. Finding Birthday

In 1940, a man stated that he was  $2n$  years old in the year  $n^2$ . He also said that if his age in the year  $n^2$  is added to the month number of his birth, the result obtained gives the square of the day of the month of his birth. Assume that  $n$  is a positive integer. Find the day, month and year of his birth.

**11. Allowance for Casting Vote**

During elections, it was decided by the administration to pay an allowance of Rs. 250 to every male and Rs. 200 to every female senior citizen who cast their votes. As per the census of the area, there were a total of 10000 senior citizens including both males and females. After the end of the voting day, it was noted that 60% of the male and 75% of the female senior citizens cast their votes. Find the total amount paid to senior citizens on the voting day.

**12. Counterfeit Cheque**

A person X bought an Antique Clock at a cost of \$500 and sold it on the same day to person Y for \$870. Person Y not having the change gave a \$1000 cheque to person X. Person X not having cash at hand, requested another person Z, who was his friend for help. So, person Z paid in cash \$130 to person Y in lieu of the \$1000 cheque. Before paying the balance amount of \$870 to person X, he (person Z) went to the bank to encash the \$1000 cheque. However, to his surprise, the \$1000 cheque was bounced and found to be counterfeit. So, person Z informed person X about the counterfeit cheque. Person X tried to contact Y but he was not traceable. So, person X repaid in cash \$130 to person Z. Find the amount actually lost by person X in the above transactions?

**13. Speed of an Old Car**

My son used to go to the school by cycle rickshaw. One day he left home at 7 AM but forgot his homework notebook. When I came to know about it, I started by my old car at 7:20 AM and after handing over the homework notebook to my son on the way, I returned home at 7:40 AM. Find the speed of my old car, if the speed of the cycle rickshaw is 20 km/h. Assume uniform speeds of cycle rickshaw and car in both directions. Ignore any time lost in handing over the notebook and turning back by my old car.

**14. Rate of Interest**

On a certain amount of money, the compound interest earned during the 6th and 7th year is 1000 rupees and 1060 rupees respectively. Find the annual rate of interest if compounding is done annually.

**15. Clock Digits**

A regular 12-hour digital clock displays hours, minutes and seconds like **08:37:56**

At what time in each of the 12-hour periods, do all six digits of the clock change simultaneously.

**16. Unique Number**

Find the number  $N$  such that  $N^3$  and  $N^4$  together contain each of the ten digits i.e., 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 exactly once only.

**17. Largest Value and Average**

If the average of 20 different positive integers is 20, find the largest possible value that any one of the integers can have.

**18. Playing the Card Game**

Three persons namely A, B and C before starting to play the card game among themselves had balances as under:

A and B combined had five times as much money as C had, while B and C combined had four times as much money as A had. At the end of the play, their balances become as under:

A and B combined had four times as much money as C had, while B and C combined had three times as much money as A had.

If one person lost Rs. 100, find the amount each person had before starting the card game.

**19. Candle Light Study**

A student was preparing for his examinations. The light went off. The student lights two candles of equal length, one of which was thicker than the other candle. The thick candle was designed to last for five hours while the thin candle was designed to last for three hours. After completing his study, when the student went to sleep, the thick candle was three times as long as the thin candle. How long did the student study in the candlelight?

**20. Apparent Miscalculation**

This is an interesting ancient puzzle, where two fruit sellers used to sell apples every day in the market. One day, one fruit seller sold all his 30 apples at the rate of 3 apples per dollar, whereas, another fruit seller sold all his 30 apples at the rate of 2 apples per dollar. Thus, the total amount received by two fruit sellers is 25 dollars. It may be assumed that the apples of both fruit sellers are not distinguishable visibly, though the apples of the second fruit seller are of superior quality.

The next day, one fruit seller falls sick, so he requested the other fruit seller to sell his 30 apples also at yesterday's rate. Accordingly, the fruit seller went to the market to sell his 30 apples along with 30 apples from the other fruit seller at yesterday's rate. On the way, all apples got mixed up, so he decided to sell all the apples at the rate of 5 apples for 2 dollars. This appeared logical to him as three apples for one dollar plus two apples for one dollar are the same as five apples for two dollars. Thus, the total amount received is 24 dollars, one dollar less than yesterday.

How do you explain the difference of one dollar?

**21. Colliding Cars**

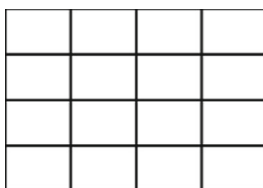
Two cars that are 60 km apart are travelling towards each other. The speed of cars is 108 km/h and 144 km/h. Find the distance between two cars just 1 second before they collide.

**22. Four Digit Squares**

If each digit of a four-digit perfect square is increased by 1, another perfect square is obtained, find all such four-digit perfect squares.

**23. Vanishing Squares**

Forty match sticks each 1 unit in length are placed in square form as given below:



A total of 30 squares (1 of  $4 \times 4$ , 4 of  $3 \times 3$ , 9 of  $2 \times 2$  and 16 of  $1 \times 1$ ) can be seen in this arrangement. Find the minimum number of match sticks which on removing, vanishes all 30 squares.

**24. Two Different Date Formats**

Two different date formats i.e., DD/MM/YY and MM/DD/YY are prevalent in most of the countries. For example, 6th September 1960 is written as 6/9/60 in DD/MM/YY format and as 9/6/60 in MM/DD/YY format. Many such dates create confusion unless we know, which date format is used.

How many dates in a year can be written as two different valid dates in two different date formats which can create confusion?

**25. Product of Three Consecutive Even Numbers**

The product of three consecutive even numbers consists of seven digits. If the first and last digit of this product is 8 and 2 respectively, find the remaining five digits of this product and three consecutive even numbers.