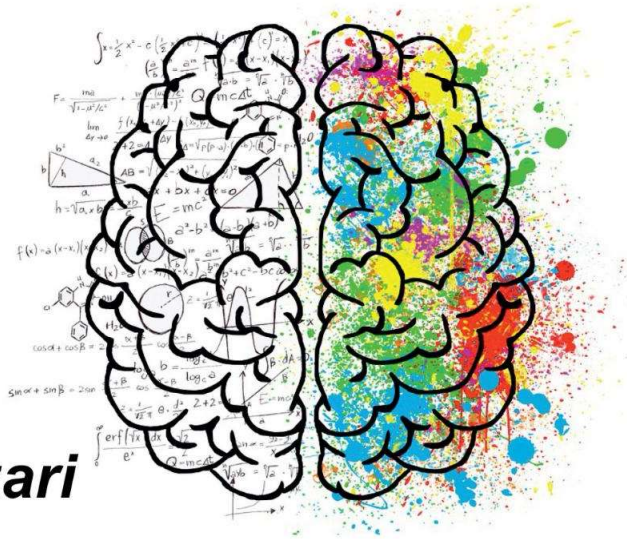
Math
and
Critical Thinking
Challenges

For the Middle and High School Student



By

Reza Nazari

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Math and Critical Thinking Challenges

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Introduction

This book is for all teachers and parents who wish to make their students and children intelligent and smart. It is very possible for all students to excel in Math!

A super collection of more than 120 problems challenge your students in all areas of math–from basic arithmetic to algebra – while emphasizing problem-solving and critical thinking. It's the perfect refresher course on all math subjects we all encounter in our daily lives.

The problems and the critical thinking questions in this book are prepared to challenge even the best students in the nation. This is also a problem-solving textbook for students in grades 5 - 12 who are preparing for advanced Math contests like the Harvard-MIT Mathematics Tournament.

Written for the gifted math students, the new math coach, the teacher in search of problems and materials to challenge exceptional students, or anyone else interested in advanced mathematical problems.

I recommend it to any students who aspire to be "great problem solvers."

A strong foundation in pre-algebra is necessary before approaching most of the problems in this book. You or

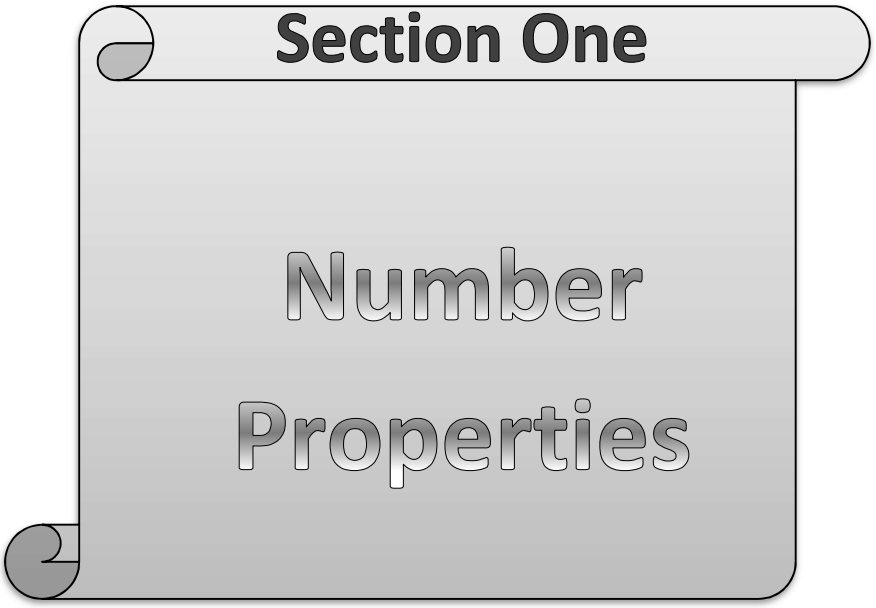
your student should not get discouraged if you cannot solve most of the problems. The challenging problems are supposed to be very difficult even for super smart students!

If your students could solve most of the problems in this book, they are definitely as smart as the world's smartest students.

Reza Nazari

January 2017

Section One: Number Properties



Challenge 1

What is the average (arithmetic mean) of all the multiples of ten from 110 to 990 inclusive?

A. 480
B. 500
C. 550
D. 590
E. 600

1. Critical Thinking

How many squares are there in a chess board?

64? 65? No! Consider squares of 2 × 2, 3 × 3, etc.

Challenge 2

1- $(1+\frac{1}{2}) \times (1+\frac{1}{3}) \times (1+\frac{1}{4}) \times (1+\frac{1}{5}) \times \dots \times (1+\frac{1}{2015}) =$

A. $\frac{2015}{2014}$

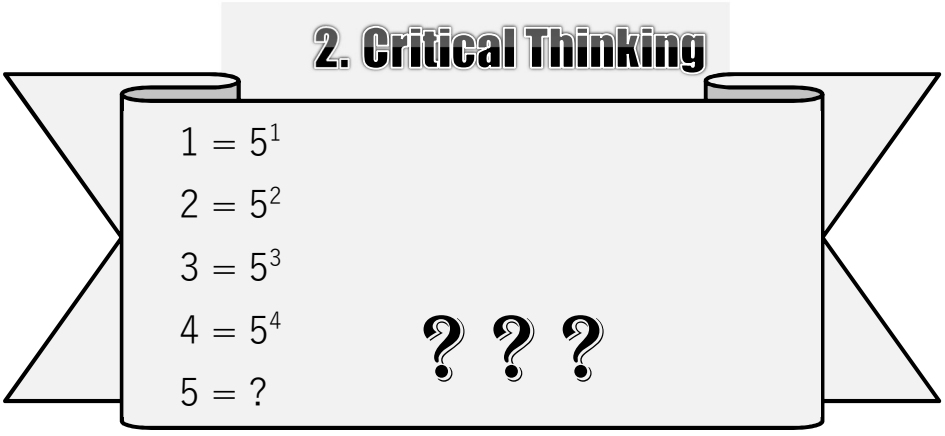
B. $\frac{2016}{1001}$

C. 1008

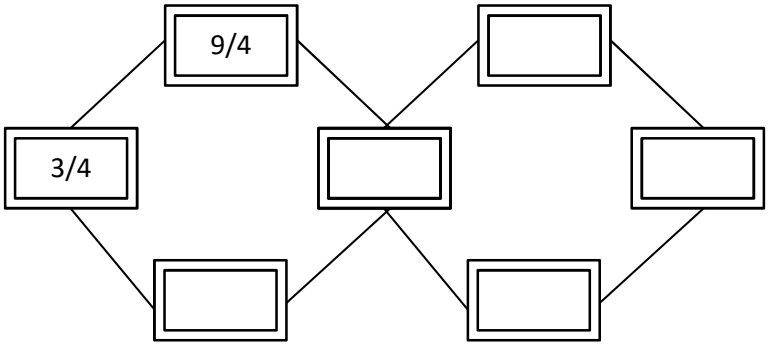
D. 2015

E. 2016

2. Critical Thinking



Challenge 3



2- In the figure above, the sum of the values of the numbers inside two rectangular that connected with a line equals to three (For example 3/4 + 9/4 = 3), what is the sum of numbers inside all rectangular?

A. $9\frac{1}{4}$

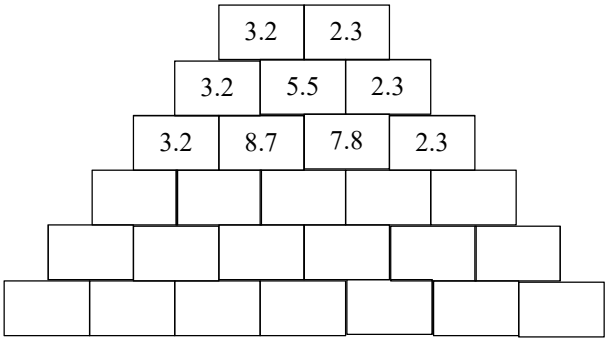
B. $9\frac{3}{4}$

C. $11\frac{1}{4}$

D. $11\frac{3}{4}$

E. 12

Challenge 4



In the figure above, if the pattern continues, what is the sum of the values in all of the rectangles on the base? (Sum of 7 rectangles)

A. 121

B. 137

C. 157.7

D. 170.5

E. 176

Challenge 5

Number 4 is a perfect square number (2 × 2 = 4) and number 8 is a perfect cube number (2 × 2 × 2 = 8). How many positive perfect square numbers less than 2016 are also perfect cubes?

A.2

B.3

C. 4

D. 5

E.10

Challenge 6

In a children's game, students count from 1 to 100 and applaud every time that they find either a multiple of 3 or a number ending with 3. How many times are they supposed to applaud?

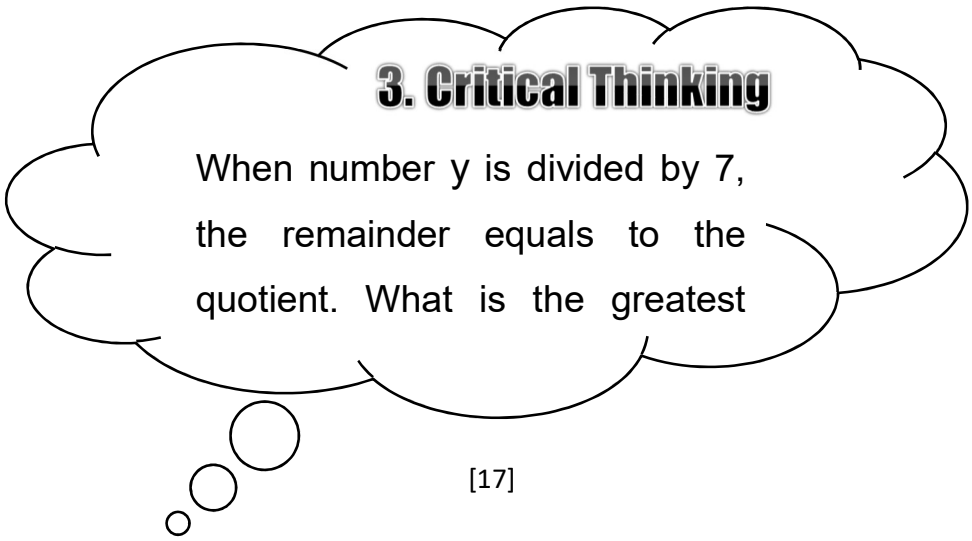
A. 30

B. 33

C. 36

D. 39

E. 40



Challenge 7

If $a = (5^{11})^2$ and $b = 4^{11}$, how many digits long is ab?

A. 22

B. 23

C. 33

D. 44

E. 121

Challenge 8

The number 10 has four different factors: 1, 2, 5, 10. What is the smallest 2 digits number that has exactly three positive factors?

Challenge 9

How many positive integers less than 10,000 are there in which the sum of the digits equals 5?

(A) 31
(B) 51
(C) 56
(D) 62
(E) 93

Challenge 10

If $a=2^{6000}$, $b=3^{4000}$ and $c=7^{2000}$, which of the following is true?

A. $a < b < c$
B. $c < b < a$
C. $a < c < b$
D. $c < a < b$
E. $b < a < c$