

Pre Number Theory

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Preface

Yes. Number Theory is hard. Thus, to help those middle school students without any tuition, this book is created. In this book, I'm going to cover basics of number theory so that you will have a basic understanding on Number Theory and you can read **Modern Olympiad Number Theory by Aditya Khurmi** afterward easier.

Since this is a pretty basic book, you don't need any advanced knowledge to complete this book. However, basic knowledges like: **AP, GP, set theory, binomial coefficients** are highly recommended.

By the way, I really apologize if my English is bad since I'm not native English speaker. And - you **should** do the exercises yourself so you will convince yourself why the method works. You are highly recommended to solve everything yourself without any help.

I hope you would have a great time while reading this book. Thank you!

Chapter 1

Divisibility

Mostly, in every book, they introduce divisibility first. This is because number theory are based on divisibility e.g. see if 9 is divisible by 3 or not. This chapter can be very complicated to understand.

1.1 Divisors and Multiples

Let's introduce new symbol.

$$m \mid n$$

implies m is a divisor of n **or** n is divisible by m .

But what is a *divisor*? To understand this, let's see an example. Suppose two number -9 and 3 . How if $-9 \div 3$? The answer is -3 . Thus, we know that:

-9 is divisible by 3 .

Thus, 3 is a divisor of -9 . This means:

Definition 1.1.0.1. *Divisors(also known as factors) are numbers that evenly divide a larger number.*

You can also express it as $3 \mid -9$. We will see another example. Let's say: how if $7 \div 2$? It will give out remainder of 1 . Thus, 2 is not a divisor of 7 . You can also express it as $2 \nmid 7$.

We can do some problems first.

Problem 1.1.0.1. *Determine whether:*

(a) 6 is a divisor of 42

(c) 9 is a divisor of 36

(b) 8 is a divisor of -52

(d) 1 is a divisor of 91

Problem 1.1.0.2. Determine whether:

(a) $9 \mid 21$

(c) $3 \nmid -33$

(b) $2 \mid 14$

(d) $7 \nmid 63$