CREST Olympiads

# MATHEMATICS WORKBOOK

5

For the preparation of National & International Olympiads


- Chapter-wise practice exercises
- Previous year paper

CREST Mathematics Olympiad (CMO)

# Mathematics Olympiad

## Exams Preparation Book

CMO | IMO | UMO | iOM | UIMO | HMO

**Grade 5**

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# CREST Mathematics Olympiad Workbook for Grade 5

Fourth Edition



**Disclaimer:** The information in the Workbook is to give you the path to success but it does not guarantee 100% success as the strategy is completely dependent on its execution. And it is based on previous year papers of CMO exam.

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# Preface

We are pleased to launch a thoroughly revised edition of this workbook. We welcome feedback from students, teachers, educators and parents. For improvements in the next edition, please send your suggestions at info@crestolympiads.com. Our team will make an effort to work on those suggestions. The status of the improvements can be checked at https://www.crestolympiads.com/corrections-class5-587

CREST Olympiads is one of the largest Olympiad Exams with students from more than 60 countries. The objective of these exams is to build a competitive spirit while evaluating students on conceptual understanding of the concepts.

We strive to provide a superior learning experience, and this workbook is designed to complement the school studies and prepare the students for various competitive exams including the CREST Olympiads. This workbook provides a crisp summary of the topics followed by the practice questions. These questions encourage the students to think analytically, to be creative and to come up with solutions of their own. There is a previous year's paper given at the end of this workbook for the students to attempt after completing the syllabus. This paper should be attempted in 1 hour to get an assessment of the student's preparation for the final exam.

*Publishers*

Chapter 1

# Number Sense

## Number

Numbers are a core part of mathematics. In this workbook, the students will be introduced to the seven-digit and eight-digit numbers and their operations.

## Natural Numbers

Counting numbers from 1 to infinity form the set of Natural numbers.
For example, 74 is a natural number.

## Whole Number

Counting numbers including 0 form the set of Whole numbers.
All natural numbers are also whole numbers.
For example: 0, 5,14, 854, etc. are whole numbers.

## Integers

Set of all counting numbers, zero and negatives of counting numbers form the set of integers.
For example, 21, 4, 0, and –2048 are integers.

## Odd Number

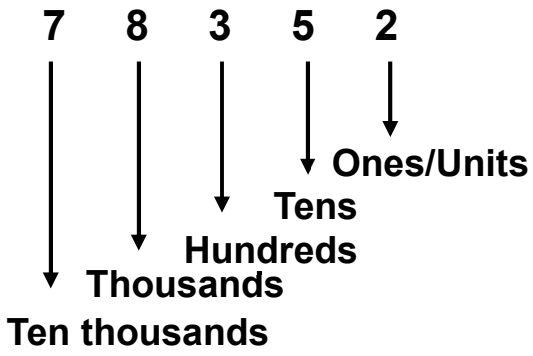
The numbers which are not completely divisible by 2 are called odd numbers. They always leave a remainder, 1.
For example: 1, 3, 5, 7, 9, 11, 13, etc are odd numbers.

## Even Number

The numbers which are completely divisible by 2 are called even numbers. When we divide even numbers by 2, the remainder is always zero.
For example: 2, 4, 6, 8, 10, etc are even numbers.

## Place Value

Place Value of a digit in a number is the digit multiplied by thousand, ten or whatever the place it lies.




For example, the place value of 4 in 541 is 4 × 10 = 40.

## Face Value

The face value of a digit in a number is the digit itself.
For example, the face value of 4 in 541 is 4.

## Roman Numbers

It is a numeral system that originated in Rome. We use this method to represent the numbers.

| | | | | | |
|---|---|---|---|---|---|
| 1 | I | 11 | XI | 50 | L |
| 2 | II | 12 | XII | 100 | C |
| 3 | III | 13 | XIII | 500 | D |
| 4 | IV | 14 | XIV | 1000 | M |
| 5 | V | 15 | XV | | |
| 6 | VI | 16 | XVI | | |
| 7 | VII | 17 | XVII | | |
| 8 | VIII | 18 | XVIII | | |
| 9 | IX | 19 | XIX | | |
| 10 | X | 20 | XX | | |

We will discuss some commonly used numerals.
For example, 72 is written as LXXII
Where L = 50, XX = 20 and II = 2

## Successor and Predecessor

In Math, the terms successor and predecessor refer to the numbers directly after or directly before a given number, respectively.

To find the successor of a given whole number, add one to the given number.
To find the predecessor of a given whole number, subtract one from the given number.

## Indian System of Numeration

- In Indian numeral system, we start grouping the digits into periods from the right most digit. Three rightmost digits are called ones period and they consist of ones, tens, and hundreds place, respectively.
- We group the digits in sets of two to the left of ones period. They are called thousands period, lakhs period and crores period, respectively.
- The place values of digits go in the sequence of Ones, Tens, Hundreds, Thousands, Ten Thousand, Lakhs, Ten Lakhs, Crores, Ten Crores and so on.
- Place value of a place is 10 times the place value to the immediately right of it. Similarly, place value of a place is obtained by dividing the place value to its immediate left by 10. So, the relationship between them is:

  i. 1 hundred = 10 tens
  ii. 1 thousand = 10 hundreds = 100 tens
  iii. 1 lakh = 100 thousands = 1000 hundreds
  iv. 1 crore = 100 lakhs = 10,000 thousands

In the number 18, 20, 65, 479 the place values of each digit are:

- 9 – Ones
- 7 – Tens
- 4 – Hundreds
- 5 – Thousands
- 6 – Ten Thousand
- 0 – Lakhs
- 2 – Ten Lakhs
- 8 – Crores
- 1 – Ten Crores

## International System of Numeration

- In International system of numeration, we start grouping the digits into periods in sets of 3 starting from extreme right. Periods from the right are ones period, thousands period, millions period.
- The place values of digits go in the sequence of Ones, Tens, Hundreds, Thousands, Ten thousand, Hundred thousand, Millions, Ten million and so on, in the international numeral system.
- Place value of a place is 10 times the place value to the immediately right of it. Similarly, place value of a place is obtained by dividing the place value to its immediate left by 10. So, the relations between them are:
  i. 1 hundred = 10 tens
  ii. 1 thousand = 10 hundreds = 100 tens
  iii. 1 million = 1000 thousands
  iv. 1 billion = 1000 millions

In the number 16,543,279 the place values of each digit are:

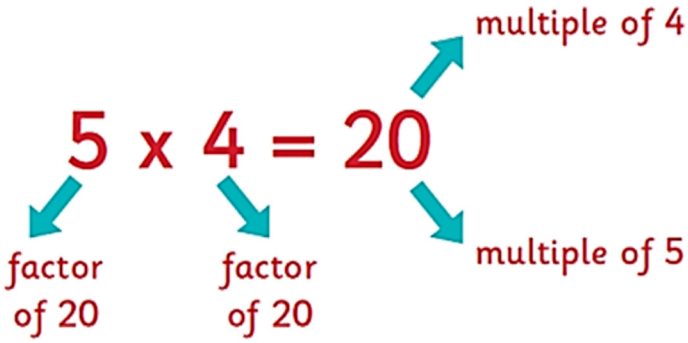
- 9 – Ones
- 7 – Tens
- 2 – Hundreds
- 3 – Thousands
- 4 – Ten thousand
- 5 – Hundred thousand
- 6 – Millions
- 1 – Ten million

## Factors

A factor divides a number completely without leaving any remainder.
For example:
1 is a factor of 6
2 is a factor of 6
3 is a factor of 6
6 is a factor of 6
This means 6 has 4 factors- 1, 2, 3 and 6.

## Multiples

A multiple of a number is a number that is the product of a given number and a natural number.
For example:
6 is a multiple of 6
12 is a multiple of 6
18 is a multiple of 6
24 is a multiple of 6
Multiples of 6 are: 6, 12, 18, 24, ...




## Prime Factorization

- Prime factorization is a process of writing a number as the product of its prime factors.
- The first few prime numbers are 2, 3, 5, 7, 11, 13, 17, 19 and so on.
- These prime numbers when multiplied with any natural numbers result in composite numbers.

# Common Multiples and Common Factors

Numbers which are multiples of all the given numbers are called as common multiples.
Consider 4 and 6.
Multiples of 4 are: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, ...
Multiples of 6 are: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, ...
Common multiples of 4 and 6 are: 12, 24, 36, 48, 60, ...

Numbers which are factors of all the given numbers are called as common factors.
Consider 12 and 18.
Factors of 12 are: 1, 2, 3, 4, 6, 12
Factors of 18 are: 1, 2, 3, 6, 9, 18
Common factors of 12 and 18 are: 1, 2, 3, 6

**HCF** stands for **Highest Common Factor**. HCF is also known as GCF (Greatest Common Factor) or GCD (Greatest Common Divisor).
The greatest common factor (GCF or GCD or HCF) of a set of whole numbers is the largest positive integer that divides all the given numbers evenly.
**LCM** stands for **Lowest or Least Common Multiple**. The LCM of two or more numbers is the smallest positive integer that is divisible by all the given numbers.

# Rounding up of Numbers

Rounding is a process to estimate a particular number in a context. To round a number, consider the digit immediately to the right of the place to which rounding is supposed to be done. If the digit is less than 5, round down i.e., leave the digit as it is and make the digits to the right of the place as 0 and if the digit is 5 or more than 5, round up i.e., add 1 to the digit and make the digits to the right of the place as 0.
For example:
Round 1245 to the nearest 100.
Since 4 is less than 5, we will round down and the answer will be 1200.
Let us solve some examples to understand the topic better.

**Example 1:** DXL ÷ LX = _____

a. IX
b. XI
c. VIII
d. XIX

Solution 1: a

DXL = 500 + 50 – 10 = 540
LX = 50 + 10 = 60
So, 540/60 = 9
9 can be represented as IX.

**Example 2:** Rosy had 16 red fruits and 24 yellow fruits. She wants to make fruit baskets with the same number of each colour fruits in each basket. What is the greatest number of baskets that she can make?

a. 2 b. 3
c. 5 d. 8

Solution 2: c

She needs to find the greatest number which exactly divides 16 and 24. This means she should go for HCF of 16 and 24.
HCF = 8.
So, she can make 2 fruit baskets with 8 red fruits and 3 fruit baskets 8 yellow fruits in them.

## Practice Questions

1. What is the sum of the factors of 24?

   a. 28 b. 27
   c. 60 d. 51

2. Which is the correct roman number representation of the 14th multiple of twelve?

   a. CLXVIII b. CXVIII
   c. LXVIII d. MLXVIII

3. Two clocks are turned on at the same time. One clock chimes every 16 minutes. The other clock chimes every 20 minutes. In how many minutes will they chime together?

   a. 60 b. 40
   c. 80 d. 120

4. What will you get on rounding 988247 to the nearest 10000?

   a. 990000 b. 980000
   c. 988000 d. 998000

5. What is the sum of the place value and face value of 9 in 2179100?

   a. 9000 b. 900
   c. 909 d. 9009

6. What is the product of the successor of 1579 and the predecessor of 16?

   a. 27300 b. 25700
   c. 23700 d. 26300

**7.** Sara is making some baskets to donate to charity. She has 36 pencils and 48 erasers. What is the greatest number of baskets she can make if each type of stationery is equally distributed among the baskets such that the number of baskets of pencils and erasers is same?

a. 24
b. 36
c. 48
d. 12

**8.** Forty-nine thousand four hundred nine rounded to nearest 10000, gives _____.

a. 49000
b. 50000
c. 49400
d. 50400

**9.** What is the predecessor of the 19th multiple of 48?

a. 912
b. 910
c. 911
d. 913

**10.** Count the number of even factors of 77.

a. 0
b. 1
c. 2
d. 3

**11.** 192 less than CCCLXIX, gives _____.

a. 170
b. 177
c. 169
d. 167

**12.** The hotel staff baked 96 cakes and 144 cookies. The staff had to prepare platters for dinner. If each platter will have the same number of cakes and cookies, what is the greatest number of platters they can make?

a. 24
b. 48
c. 36
d. 96

**13.** When the largest 4-digit number is subtracted from the smallest six-digit number, we obtain:

a. 9001
b. 90000
c. 9000
d. 90001

**14.** DCCXXIV - _____ = CXXIV

a. D
b. DC
c. CC
d. XX

**15.** The sum of 8376 and 87132 when rounded off to the nearest 10000 gives _____.

a. 95000
b. 96000
c. 100000
d. 90000

**16.** Fruit merchant Alex has to export 14 jackfruits, 12 watermelons, and 8 muskmelons. He must load the same number of fruits in each box and is only permitted to pack one variety of fruit per box. What is the greatest number of fruits Alex can pack in each box?

a. 4
b. 3
c. 2
d. 1

**17.** Which multiple of 34 is closest to 5874?

a. 171
b. 172
c. 173
d. 174

**18.** Seven million five hundred fifty-four thousand twenty-nine can be represented as:

a. 7,554,029
b. 75,50,429
c. 7,454,029
d. 7,545,029

**19.** 1200 thousand's successor when added to the predecessor of 120645 gives _____.

a. 1320644
b. 1320645
c. 1320654
d. 1320455

**20.** In the beginning stages of Lucy's fashion design business, she makes less money. She has 16 red beads and 24 yellow beads, and she has received one small order of ribbons to be stitched. She wishes to create ribbons with an equal number of beads from each colour in each ribbon. What is the maximum quantity of ribbons she can make?

a. 3
b. 4
c. 5
d. 6