UNIT ONE

WHOLE NUMBERS AND THE FOUR OPERATIONS

Unit Outcomes: After completing this unit, you should be able to:

- understand and have deep knowledge about whole numbers.
- perform the four fundamental operations on whole numbers.
- apply your knowledge of whole numbers to solve problems in your environment.

Introduction

In earlier grades, you have learnt about whole numbers up to 1,000,000, their properties and basic mathematical operations upon them. After a review of your knowledge about whole numbers, you will continue studying whole numbers greater than 1,000,000, and the four operations in the present unit.

1.1 Whole Numbers Greater Than 1,000,000

1.1.1 Revision of Whole Numbers Up to 1,000,000

Activity 1.1

1. What is the name given to the numbers 0, 1, 2, 3, 4, 5,... ?
2. What is the least whole number? Is there any largest whole number?
3. Identify a possible pattern. Use the pattern to write the next four numbers.

a) 10,000, 20,000, 30,000, _____, _____, _____, _____

b) 100,000, 200,000, 300,000, ____, ____ , ____ , _____

Do you remember how to read and write whole numbers up to 1,000,000? In your previous study of Mathematics lessons on whole numbers, you have learnt about place value.

Place value chart

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones (units)
8	9	1	4	1	2

Figure 1.1

How do you read the whole number 891,412? Can you write the whole number 'three hundred seventeen thousand sixty' and show to your partner? In order to help you revise the lessons on whole numbers up to 1,000,000 you have studied earlier attempt each of the problems given in the following exercise.

Exercise 1A

1. Read these numbers.

a. 136,042	c. 390,071	e. 522,202	g. 800,304
b. 218,606	d. 467,319	f. 650,505	h. 430,713

2. Match a number with its word expression.

Column A	Column B
i. 100,003	a. five hundred forty thousand eight hundred nine
ii. 430,006	b. One hundred thousand three
iii. 896,750	c. Four hundred thirty thousand six
iv. 540,809	d. Three hundred eighteen thousand fourteen
v. 318,014	e. Eight hundred ninety six thousand seven hundred fifty
vi. 594,713	f. Three hundred seventeen thousand sixty five
vii. 405,028	g. Four hundred five thousand twenty eight
viii. 317,065	h. Five hundred ninety four thousand seven hundred thirteen
	i. One hundred thousand thirty
	j. Four hundred five thousand eighty two
	k. Three hundred eighteen thousand fourty

3. Write these numbers in words.

a. 100,350	c. 160,080	e. 485,675	g. 973,468
b. 206,570	d. 320,010	f. 860,003	h. 98,764

4. Write down the place value of 6 in each of these numbers.

a. 324,761 b. 406,117 c. 218,416 d. 163,514 e. 258,629

5. Write these numbers in figures (the first one is done for you)

a. One hundred forty thousand 140,000.
b. One hundred seventy thousand six hundred thirty.
c. Two hundred five thousand three hundred eighty.
d. Five hundred sixteen thousand four hundred nine.

e. Six hundred three thousand twenty seven.
f. Ninety thousand seventy four.
g. Seven hundred eighty five thousand two hundred twelve.

6. Comparing and ordering: Draw a line under the greatest number in each group.

a. 97,000	b. 388,000	c. 689,400
705,000	326,000	652,800
423,000	362,000	630,900

1.1.2 Whole Numbers Greater Than 1,000,000

What number comes after 999,999?

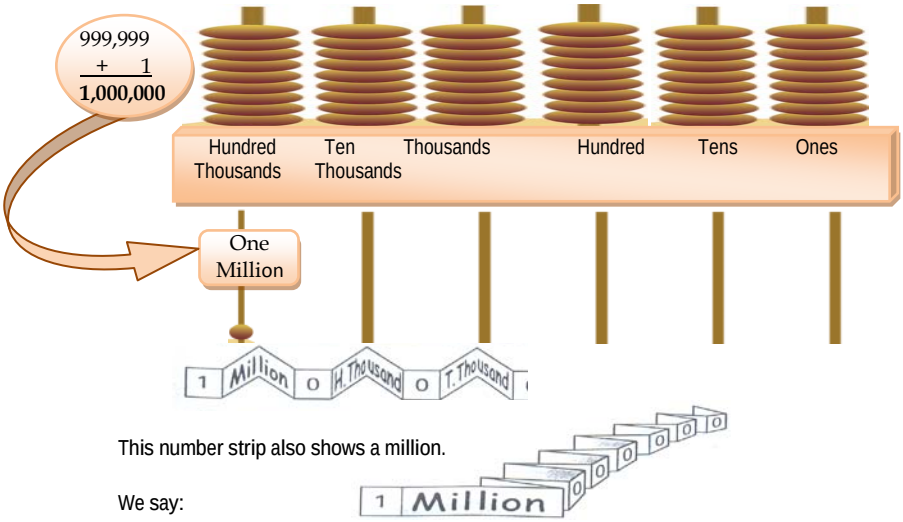


Figure 1.2

We need a new place value. Ten hundred thousand make a thousand thousands which is a **million**. You can see that one million is a 7 digit number. When do we count in millions?

Have you heard people talking about millions? What do you know about stars and planets?

Did you know that the sun is about 150,000,000 km away from Earth?

Find out the names of the other planets and how far they are from the sun, where 1 Mile ≈ 1.6km.

Figure 1.3

Planet	*Miles from the sun*	*Km from the sun*	*Planet*	*Miles from the sun*	*Km from the sun*
Mercury	**36 million**		**Saturn**	**886.1 million**	
Venus	**67.2 million**		**Uranus**	**1783 million**	
Earth	**92.9 million**		**Neptune**	**2793 million**	
Mars	**141.5 million**		**Pluto**	**3670 million**	
Jupiter	**483.3 million**				

Do you know (according to CSA, 2007) that the population of Ethiopia is about 74 million?

There are more people in India than in most countries. India alone has more than 900 Million people. How many times is India's population bigger than Ethiopia's population? What is the population of your region?

Activity 1.2

Write these numbers in words. The first one is done for you.

a. 3,500,820 three million five hundred thousand eight hundred twenty

b. 7,416,035 _____

c. 8,042,107 _____

d. 9,104,060 _____

e. 12,000,000_____

Study the following example

Example 1

Writing numbers in figures. Say this number: Three Million four hundred seventy thousand fifty.
How will you write this in figures?
Remember we break up the numbers and write them in groups, like this.

Three million		**3,000,000**
Four hundred seventy thousand	**+**	**470,000**
Fifty		**50**
		3,470,050

Group work 1.1

1. Convert 8000 kilometers in to meters.
2. Convert 900 kilometers in to centimeters.

In addition to reading and writing whole numbers, you can also find the predecessor (except zero) and successor of a whole number.

Example 2

a) What whole number comes before 3,465,287? The number that comes before 3,465,287 is less by 1. That is, 3,465,287-1. Therefore 3,465,286 is the Predecessor of 3,465,287.

b) What whole number comes after 2,746,352?
Remember that the number that comes after 2,746,352 is greater by 1. That is 2,746,352 + 1. Therefore, 2,746,353 is the successor of 2,746,352.

Note

1. **Any whole number n different from 0 has a predecessor "n-1" and a successor "n+1".**
2. **There is no largest whole number (why?)**
3. **Zero is the smallest whole number.**

Exercise 1B

1. Write these numbers in figures.
   a. Five million, eight hundred four thousand, twenty.
   b. Eight million, nine hundred six thousand, one hundred thirty two.
   c. Nine million thirty thousand, four hundred three.
2. Write the numbers in words. The first one is done for you.
   a. A heart beats about 37,000,000 times each year.

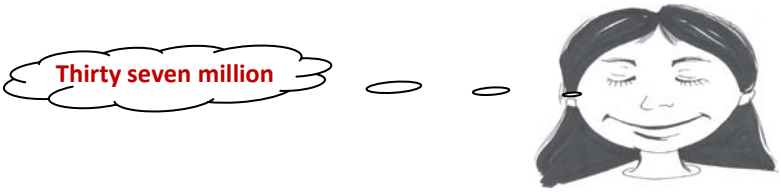


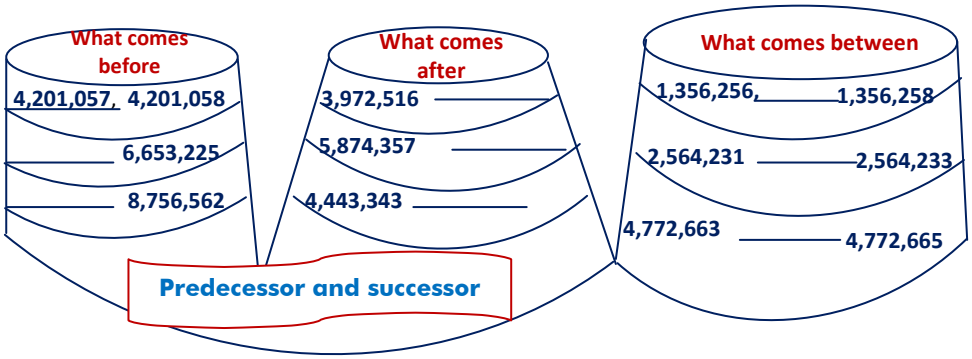
Figure 1.4

   b. Most people blink about 5,625,000 times each year _____
   c. One Megabyte is 1,048,576 bytes._____
   d. Africa has an area of 30,271,000km^2 _____

3. Determine the predecessor and successor of each the following numbers.

	Predecessor	Successor
a. 3,406,705	_____	_____
b. 5,167,428	_____	_____
c. 9,582,396	_____	_____
d. 8,005,104	_____	_____
e. 6,767,221	_____	_____

4. Write each missing number.



5. Compare the numbers using >, < or =. The first one is done for you.

a. 5,370,002 [>] 5,370,001

b. 3,820,013 [ ] 3,820,012

c. 6,540,000 [ ] 540,000 + 6,000,000

d. 7,630,009 [ ] 7,630,010

e. 8,999,026 [ ] 8,999,025

1.1.3 Place Value and Ordering of Whole Numbers

Activity 1.3

Arrange the digits of the number 214,587 to get the

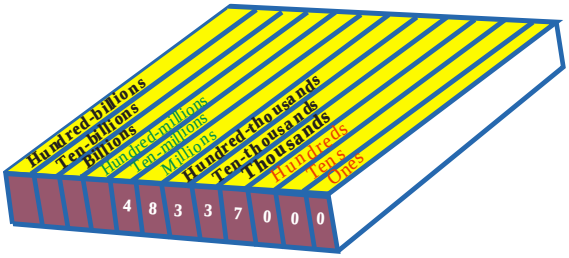
a) smallest six digit number possible

b) largest six digit number possible

Remember that you have learnt about place value and ordering of whole numbers upto 1,000,000. Here you will learn about place value and ordering of whole numbers in more detail.

a) Finding the place value of a digit in a whole number

The position of each digit in a number determines its **place value**. A place use the same chart is shown next for the whole number 48,337,000.



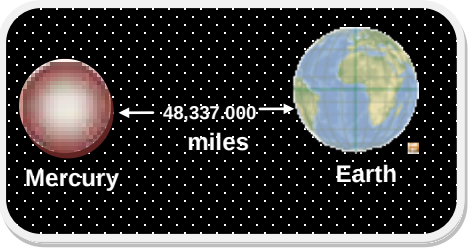


Figure 1.5

The two 3s in 48,337,000 represent different amounts because of their different placements. The place value of the 3 on the left is hundred-thousands. The place value of the 3 on the right is ten-thousands.

Study the following examples

Example 3

The place value of the digits of the number 4,695,783 is shown below.

6 Hundred-Thousands
600,000

9 Ten-thousands
90,000

5 Thousands
5,000

4 Millions
4,000,000

4,695,783

3 Ones
3

7 Hundreds
700

8 Tens
80

We write the expansion of the given number as

$$4{,}695{,}783 = 4{,}000{,}000 + 600{,}000 + 90{,}000 + 5{,}000 + 700 + 80 + 3$$
$$= (4\times1{,}000{,}000)+(6\times100{,}000)+(9\times10{,}000)+(5\times1{,}000)+(7\times100)+(8\times10)+3$$

Example 4

The palce value of the digits of the number 5,793,612 is shown below

Place Value chart

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
1,000,000	100,000	10,000	1,000	100	10	1
5	7	9	3	6	1	2

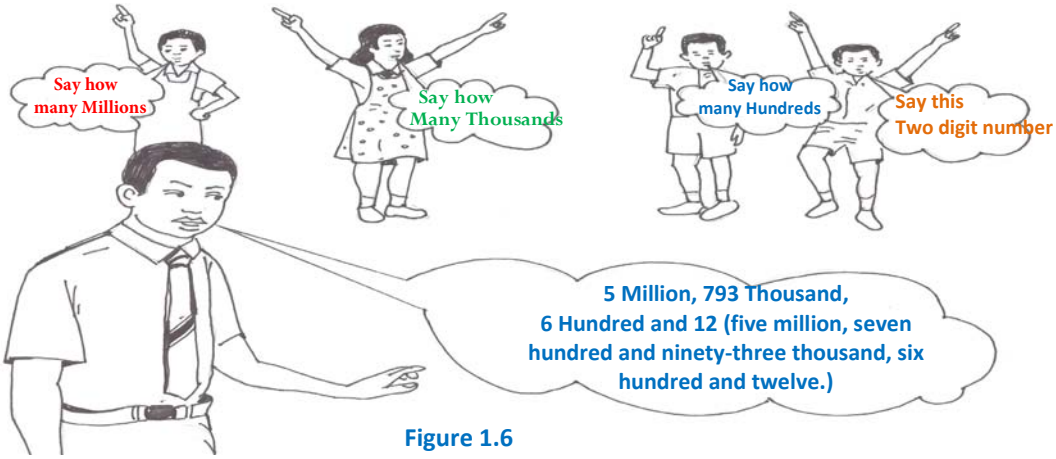


Figure 1.6

The expansion is as follows:

$$5{,}793{,}612 = (5\times1{,}000{,}000) + (7\times100{,}000) + (9\times10{,}000) + (3\times1{,}000) + (6\times100) + (1\times10) + 2$$

Group work 1.2

1. What is the place value of 7 in the whole number 27,431,568?
2. Write the expansion of the whole number 8,697,351.

b) Ordering of whole numbers

In addition to telling the place value of whole numbers you can also order and compare them.

Study the following examples

Example 5

We are going to compare large numbers and order them.

a. **Putting numbers in order:**
To put numbers in order, look at the digits with the same place value. Start at the left.
7546 > 7364

Thousands	Hundreds	Tens	Units
7	5	4	6
7	3	6	4

Look here first

Look here next

The thousands digits are the same.
The hundreds digits are 5 and 3.
5 > 3
So 7546 > 7364

b. Compare and order

712,340 529,798 645,938 1,306,493
6,790,104

645,349 5,438,654 2,009,870 917,503
4,877,428 689,740

First arrange them vertically with the ones in a line.

712,340
529,798
645,938
1,306,493
6,790,104
645,349
5,438,654
2,009,870
917,503
4,877,428
689,740

Step 1. List the numbers with the largest number of digits

Step 2. Compare the highest place value digits and order.

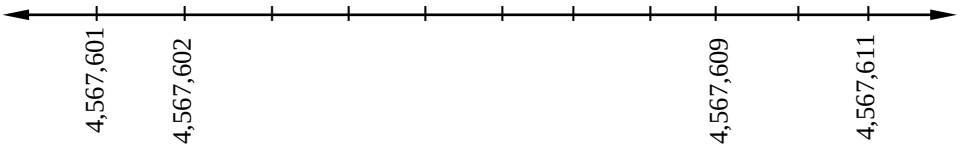
Step 3. When there are equal digits re-order using the next lower digit

Step 4. Order other groups of numbers with equal number of digits using steps 1,2 and 3

6,790,104
5,438,654
4,877,428
2,009,870
1,306,493
917,503
712,340
689,740
645,938
645,349
529,798

Exercise 1.C

1. Write the place value of the underlined number.
   a. 7,816,489 c. 4,976,096 e. 2,648,143
   b. 6,594,038 d. 3,800,667
2. Write the following numbers in expanded form.
   a. 2,536,879 c. 7,089,461 e. 9,988,472
   b. 1,546,308 d. 8,571,026
3. Write the number for the following.
   a. $(3 \times 1{,}000{,}000) + (6 \times 10{,}000) + (8 \times 100) + (4 \times 10) + 3$
   b. $(6 \times 1{,}000{,}000) + (8 \times 100{,}000) + (7 \times 1{,}000) + (3 \times 10) + 9$
   c. $(4 \times 1{,}000{,}000) + (5 \times 1{,}000) + (6 \times 100) + 7$
   d. $(8 \times 1{,}000{,}000) + (3 \times 100) + 8$
4. Which numbers are missing?



5. Write a number which has:
   a. 6 digits, with 8 in the Ten Thousands position.
   b. 7 digits, with 7 in the Hundred Thousands position.
   c. 7 digits, with 3 in the millions position.
6. Compare the following using >, < or =
   a. 4,325,270 ☐ 4,246,370
   b. 3,507,469 ☐ 3,206,986
   c. 5,651,845 ☐ 5,461,835
   d. 2,453,578 ☐ 2,453,587
   e. 9,678,450 ☐ 9,768,675

7. Count in hundred-thousands and list the numbers. The first one is done for you.
   a. From 124,000 to 524,000

      124,000, 224,000, 324,000, 424,000, 524,000
   b. From 230,000 to 930,000
   c. From 376,000 to 776,000
8. Count in millions and list the numbers.
   a. From 1,250,000 to 6,250,000
   b. From 4,600,000 to 9,600,000
9. Order these numbers

423,635	947,534	3,604,376	837,209	5,628,370
480,982	408,893	469,743	6,086,304	873,276

1.1.4 Even and Odd Whole Numbers

Remember that you have learnt about Even and Odd whole numbers in your previous mathematics lessons. **Even numbers** end in 0,2,4,6 and 8, and **odd numbers** end in 1,3,5,7 and 9.

Activity 1.4

1. List even numbers between 1,253,401 and 1,253,411
2. List odd numbers between 2,430,678 and 2,430,688
3. Complete
   a. 3,570,602 3,570,604 3,570,606 _____ _____ _____ _____ _____ 3,570,618
   b. 6,620,403 6,620,405 6,620,407 _____ _____ _____ _____ _____ 6,620,419

4. Find the number.
   a. I am an even number. I come between 2,438,670 and 2,438,674. What number am I?
   b. I am an odd number. I come between 3,156,257 and 3,156,261. What number am I?
5. Use seven small pieces of card (or paper) numbered 1 to 7

Figure 1.7

   a. Write 4 even numbers with three digits.
   b. Write 4 odd numbers with four digits.

Here you will learn about properties of even and odd numbers in more detail.

Study the following examples:

Example 6

a) Both 23 and 45 are odd numbers. But their sum:
23 + 45 = 68 is an even number.
b) Both 32 and 54 are even numbers. Also their sum:
32 + 54 = 86 is an even number.
c) Consider the sum of an even number and an odd number:
32 + 45 = 77 is an odd number.

Group work 1.3

What can you conclude about

Even + Even?

Odd + Odd?

Even + Odd?

Exercise 1.D

Determine whether each of the following statements is true or false.

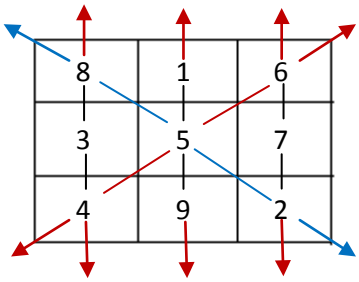
1. The sum of two even numbers is even.
2. The sum of two odd numbers is odd.
3. The sum of an odd number and an even number is an even number.
4. An even number is divisible by 2.
5. If a number ends in 7, then it is odd.
6. The sum of three odd numbers is odd.
7. The sum of any five whole numbers is odd.
8. The sum of any four consecutive whole numbers is even.

1.2 Operation on Whole Numbers

1.2.1 Addition and Subtraction of Whole numbers

Activity 1.5

In a magic square, the sums of the numbers in every row, column, and diagonal are equal.



a	71	b
99	c	155
113	183	85

Figure 1.8

What are the missing numbers?

You know that addition, subtraction, multiplication and division are four fundamental operations of mathematics. Here, you will learn about the properties of these operations on whole numbers.

Example 7

a. What is the missing number in

$4 + \square = 7$ and $\square + 4 = 7$?

Did you answer "3"? That's good. What do you notice then?

$4 + 3 = 3 + 4 = 7$

Do you remember the commutative property of addition?

$a + b = b + a$ for two whole numbers a and b.

b. Consider the sum $(3 + 4) + 5$ and $3 + (4 + 5)$. Is the sum equal? Do you remember the associative property of addition?

$(a + b) + c = a + (b + c)$ for three whole numbers a, b, and c

c. What is the missing number in both

$\square + 4 = 4$ and $4 + \square = 4$?

Do you remember the property of 0 on whole numbers?

$x + 0 = 0 + x = x$ for a whole number x.

Do the above three properties hold true for subtraction? Why?

When we add numbers we need to keep the digits in the correct columns, and take care with grouping and regrouping. Here are some examples. Study the examples carefully.

Example 8

$$\begin{array}{r} 6\ 2\ 4\ 2\ 3\ 6 \\ +\ \underline{1\ 3\ 3\ 4\ 9\ 5} \\ 7\ 5\ 7\ 7\ 3\ 1 \end{array}$$

Step 1. 6 and 5 ones are 11 ones. 11 ones make 1 Ten and 1 one. Write 1 carry ten.

Step 2. 1,3 and 9 Tens are 13 Tens. 13 Tens make 1 hundred and 3 Tens. Write 3 carry 1 Hundred.

Step 3. 1,2 and 4 Hundreds are 7 Hundreds. Write 7.

Step 4. 4 and 3 Thousands are 7 Thousands. Write 7.

Step 5. 2 and 3 Ten Thousands make 5 Ten Thousands. Write 5.

Step 6. 6 and 1 Hundred Thousands make 7 Hundred Thousands. Write 7.

Example 9

$$\begin{array}{r} 3\,3\,4\,2\,9\,7 \\ +\ \underline{4\,9\,5\,9\,6\,8} \\ 8\,3\,0\,2\,6\,5 \end{array}$$

Step 1. 7 and 8 ones are 15 ones. Write 5. Carry 1 Ten.

Step 2. 1, 9 and 6 Tens are 16 Tens. Write 6. Carry 1 Hundred.

Step 3. 1,2 and 9 Hundreds are 12 Hundreds. Write 2, carry 1 Thousand.

Step 4. 1,4 and 5 Thousands are 10 Thousands write 0. Carry 1 Ten Thousands.

Step 5. 1,3 and 9 Ten Thousands make 13 Ten Thousands. Write 3. Carry 1 Hundred Thousands.

Step 6. 1,3 and 4 Hundred Thousands make 8 Hundred Thousands. Write 8.

Group work 1.4

Add

a. $\begin{array}{r} 8\,2\,4\,6\,0\,8 \\ +\ 3\,4\,7\,7\,6\,5 \\ \hline \\ \hline \end{array}$

b. $\begin{array}{r} 9\,3\,3\,4\,8\,7 \\ +\ 6\,7\,8\,3\,2\,5 \\ \hline \\ \hline \end{array}$

Note that Subtraction is the reverse process of addition.

$$\begin{array}{r} 83\ 02\ 65 \\ -\ \underline{33\ 42\ 97} \\ 49\ 59\ 68 \end{array} \quad \text{and} \quad \begin{array}{r} 83\ 02\ 65 \\ -\ \underline{49\ 59\ 68} \\ 33\ 42\ 97 \end{array}$$

Example 10

$$\begin{array}{r} 56542 \\ -\ \underline{36886} \\ 19656 \end{array}$$

Step 1. 2 ones, take away 6, I can't. Take 1 Tens leaving 3. Change it to 10 ones, 12 ones, take away 6 is 6. Write 6.

Step 2. 3 Tens, take away 8, I can't. Take 1 hundred leaving 4. Change it to 10 Tens. 13 Tens, take away 8 is 5. Write 5.

Step 3. 4 Hundreds, take away 8, I can't. Take 1 Thousands leaving 5. Change it to 10 Hundreds. 14 Hundreds, take away 8 is 6. Write 6.

Step 4. 5 Thousands, take away 6, I can't, take 1 Ten Thousands leaving 4. Change it to 10 Thousands. 15 Thousands, take away 6 is 9, write 9.

Step 5. 4 Ten Thousands, take away 3, is 1, write 1.

Note that

$$\begin{array}{r} 56542 \\ -\underline{19656} \\ \mathbf{36886} \end{array} \quad \text{and} \quad \begin{array}{r} 36886 \\ +\underline{19656} \\ \mathbf{56542} \end{array}$$

Activity 1.6

1. Write the missing numbers.

a. 8 + ☐ = 8

b. ☐ + 9 = 9

c. 10 - ☐ = 10

d. (6 + 7) + ☐ = 6 + (7 + 8)

e. (300 + 500) + 600 = 300 + (500 + ☐)

f. 2,456 + 3,580 =3,580 + ☐

2. Complete. The first one is done for you.

a.
$$\begin{array}{r} 3\ 8 \\ +\ 5\ 4 \\ \hline \boxed{9}\boxed{2} \end{array} \qquad \begin{array}{r} \boxed{9}\boxed{2} \\ -\ 3\ 8 \\ \hline \boxed{5}\boxed{4} \end{array} \qquad \begin{array}{r} \boxed{9}\boxed{2} \\ -\ 5\ 4 \\ \hline 3\ 8 \end{array}$$

b.
$$\begin{array}{r} 4\ 3\ 2 \\ +\ 2\ 6\ 9 \\ \hline \boxed{}\boxed{}\boxed{} \end{array} \qquad \begin{array}{r} \boxed{}\boxed{}\boxed{} \\ -\ 2\ 6\ 9 \\ \hline \boxed{}\boxed{}\boxed{} \end{array} \qquad \begin{array}{r} \boxed{}\boxed{}\boxed{} \\ -\ 4\ 3\ 2 \\ \hline \boxed{}\boxed{}\boxed{} \end{array}$$

c.
$$\begin{array}{r} 5\ 4\ 4\ 5 \\ +\ 2\ 3\ 8\ 7 \\ \hline \boxed{}\boxed{}\boxed{}\boxed{} \end{array} \qquad \begin{array}{r} \boxed{}\boxed{}\boxed{}\boxed{} \\ -\ 5\ 4\ 4\ 5 \\ \hline \boxed{}\boxed{}\boxed{}\boxed{} \end{array} \qquad \begin{array}{r} \boxed{}\boxed{}\boxed{}\boxed{} \\ -\ 2\ 3\ 8\ 7 \\ \hline \boxed{}\boxed{}\boxed{}\boxed{} \end{array}$$

3. If we add any two whole numbers a and b, is it true that the new number is also a whole number?

4. Write > , < or = in the box in order to compare.

a. 232,567 + 687,758 $\boxed{}$ 354,743 + 467,869

b. 358,676 + 576,589 $\boxed{}$ 2,121,342 + 3,436,536

c. 6,234,238 – 4,867,786 $\boxed{}$ 7,158,349 - 3,283,898

Let us deal with solving word problems related to real life.

Example 11

A book has 1549 letters on the first page, 1672 on the second page and 1847 on the third page. What is the total number of letters on the first three pages?

Solution:

$$\begin{array}{r} 1549 \\ +\ 1672 \\ \underline{1847} \\ 5068 \end{array}$$

There are 5,068 letters on the first three page

Figure 1.9

Example 12

A woman has Birr twenty three thousand, eight hundred forty but had to pay Birr two thousand five hundred seventy five for some clothes. How much did she have left?

Solution:

$$\begin{array}{r} 23840 \\ -\ \underline{2575} \\ 21265 \end{array}$$

She was left with Birr 21,265.

Exercise 1. E

1. Add or subtract.

a) $\begin{array}{r} 43257 \\ +\ 15894 \\ \hline \\ \hline \end{array}$

b) $\begin{array}{r} 56674 \\ +\ 48486 \\ \hline \\ \hline \end{array}$

c) $\begin{array}{r} 727585 \\ +\ 575869 \\ \hline \\ \hline \end{array}$

d) 94328
- 56779
_____

e) 79024
- 68968
_____

f) 810731
- 799843
_____

2. A ship carries 8,754 bags of cocoa and 1,296 bags of coffee. How many bags are there altogether?
3. A large farm had seven thousand seven hundred cattle. They bought one thousand, five hundred seven more cattle. How many cattle did the farm have altogether?

Figure 1.10

4. The number of people in three towns are 12,542, 11,460 and 13,627. What is the total population of all the three towns?
5. In a factory where eight thousand, four hundred thirty two people worked, four thousand, nine hundred seventy one were men. How many women worked at the factory?
6. The male population of Ethiopia in the year 2007 (according to CSA) was 37,296,657 and the female population was 36,621,848.
   a. Which was the larger population- male or female?
   b. What was the total population of Ethiopia?
   c. Find the difference between female and male populations.

Figure 1.11

7. A man had Birr 1,052,747 in his bank account. If he withdrew Birr 905,002 and Birr 87,445 in two consecutive months, then how much money was left in his account?
8. In one year, 33,000,000 boxes of lemons and limes were produced. 1,200,900 boxes were limes. How many boxes of lemons were there?

1.2.2 Multiplication of Whole Numbers

Activity 1.7

One packet contains 6 pencils. How many pencils are in 3 packets?
What is 3 × 6?
Is 6 × 3 the same as 3 × 6?
3 + 3 + 3 + 3 + 3 + 3 =_____
and 6 + 6 + 6 = _____
What do you conclude?

Figure 1.12

Remember that multiplication is a repeated addition. You have learnt how to multiply two natural numbers. In this section you will study some properties of multiplication on whole numbers in more detail.

Do you remember?

1. **Multiplication of numbers is commutative. That is, if a and b are whole numbers, then $a \times b = b \times a$.**
   Does the associative property apply to multiplication?
   Multiply $2 \times 3 \times 5$.
   $2 \times 3 \times 5 = (2 \times 3) \times 5$ or $2 \times 3 \times 5 = 2 \times (3 \times 5)$
   $= 6 \times 5$ $\quad$ $= 2 \times 15$
   $= 30$ $\quad$ $= 30$
2. **The associative property also applies to multiplication. That is, if a, b and c are three whole numbers, then $(a \times b) \times c = a \times (b \times c)$.**
3. **Look at this multiplication.**
   $$25 \times (10 + 2) = 25 \times 12 = 300$$

Is it true that $25 \times (10 + 2) = (25 \times 10) + (25 \times 2)$?

$(25 \times 10) + (25 \times 2) = 250 + 50 = 300$

Cheek with 45×8

Is it true that $45 \times 8 = (40 + 5) \times 8$?

$$\begin{aligned}(40 + 5) \times 8 &= (40 \times 8) + (5 \times 8)\\ &= 320 + 40\\ &= 360\end{aligned}$$

This is called the **distributive property of multiplication over** addition. That is, if a, b and c are three whole numbers, then

$$a \times (b + c) = (a \times b) + (a \times c)$$

4. You have seen that $2 \times 1 = 1 \times 2$ and also $2 \times 1 = 2$ and $1 \times 2 = 2$. Observe that any whole number multiplied by 1 stays the same. That is, if a is a whole number, then $a \times 1 = 1 \times a = a$
5. **Multiplication property of 0** is given below:
   $4 \times 0 = 0 \times 4$ and also $4 \times 0 = 0$ and $0 \times 4 = 0$.
   Here we understand that any number multiplied by zero equals zero. That is, if a is a whole number, then $a \times 0 = 0 \times a = 0$

Group work 1.5

Tigist's heart rate is 78 beats per minute. Almaz's heart rate is 80 beats per minute. How many times do their heart beat altogether in 3 minutes?

The following example discusses the use of the distributive property. Study the example carefully

Example 13

$$\begin{aligned}3{,}457 \times 28 &= 3{,}457 \times (20 + 8)\\ &= (3{,}457 \times 20) + (3{,}457 \times 8)\\ &= (3{,}457 \times 2 \times 10) + (27{,}656) && \text{(Why?)}\\ &= (6{,}914 \times 10) + 27{,}656 && \text{(Why?)}\\ &= 69{,}140 + 27{,}656\\ &= 96{,}796\end{aligned}$$

Activity 1.8

Complete

a. $4{,}326 \times 15 = 4{,}326 \times (10 + 5)$

$= (4{,}326 \times 10) + (4{,}326 \times \square)$

$= (\square) + (\square)$

$= \square$

b. $3{,}674 \times 28 = 3{,}674 \times (\square + \square)$

$= (3{,}674 \times \square \times 10) + (3674 \times \square)$

$= (\square \times 10) + \square)$

$= (\square + \square)$

$= \square$

c. $4{,}318 \times 34 = 4{,}318 \times (\square + \square) = (4{,}318 \times \square \times 10) +$

$(4{,}318 \times \square)$

$= (\square \times 10) + \square = \square + \square = \square$

d. $7{,}508 \times 63 = 7{,}508 \times (\square + \square)$

$= (7{,}508 \times \square \times 10) + (7{,}508 \times \square)$

$= (\square \times 10) + \square$

$= \square + \square$

$= \square$

Study the steps when multiplying two whole numbers in the following example.

Example 14

Multiply

a. 287	**Step 1.**	3 × 7 ones = 21. Write 1 and carry 2 Tens.
× 3	**Step 2.**	3 × 8 Tens = 24.
861		24 + 2 = 26. Write 6 and carry 2 hundreds.
b. 457	**Step 3.**	3 × 2 Hundreds = 6
× 28		6 + 2 = 8
3656	**Step 1.**	8 × 7 = 56, write 6, carry 5 Tens.
9140	**Step 2.**	8 × 5 = 40, 40 + 5 = 45
12796	**Step 3.**	8 × 4 = 32 hundreds

Multiply by 10: write 0. Then multiply by 2.

Step 4. 2 × 7 = 14 Tens, write 4, carry 1 Hundred.

Step 5. 2 × 5 = 10 Hundreds. 10 + 1 = 11, write 1, carry 1 thousand.

Step 6. 2 × 4 = 8 Thousands. 8 + 1 = 9. write 9

3656 + 9,140 = 12,796

Example 15

A store rents space in a building at a cost of Birr 20 per square meter. If the store is 700 square meter, how much is the rent?

Solution

20 × 700

= 14,000

Therefore, the rent is Birr 14,000

Note that an **estimate** can indicate the size of a product. The following example discusses about working with approximate values for determining rough estimation when multiplying large numbers. Study the example carefully.

Example 16

6127 × 294 ≈ 6000 × 300 = 1,800,000 (rounding 6127 to thousands and rounding 294 to hundreds respectively)
6127 × 294 = 1,801,338 ≈ 1,800,000

Exercise 1.F

1. Multiply

a. $\begin{array}{r} 14 \\ \times\ 2 \\ \hline \end{array}$

b. $\begin{array}{r} 23 \\ \times\ 3 \\ \hline \end{array}$

c. $\begin{array}{r} 36 \\ \times\ 7 \\ \hline \end{array}$

d. $\begin{array}{r} 168 \\ \times\ 5 \\ \hline \end{array}$

e. $\begin{array}{r} 63 \\ \times\ 14 \\ \hline \end{array}$

f. $\begin{array}{r} 571 \\ \times\ 28 \\ \hline \end{array}$

g. $\begin{array}{r} 804 \\ \times\ 93 \\ \hline \end{array}$

h. 204 × 32 = ☐

i. 743 ×25 = ☐

j. 250 × 12 × 6 = ☐

k. 304 × 31 × 8 = ☐

2. Estimate the product
   a. 2112 × 198
   b. 3104 × 395

3. Fatuma bought 3 baskets of Mangoes. There were 25 Mangoes in each basket. How many Mangoes did she have altogether?

Figure 1.13

4. A school-week has 5 days. How many school-days are there in 42 weeks?
5. A Scientific dictionary has 1,236 pages. How many pages would 24 such dictionaries have?
6. Each day a man sells 3,762 copies of a news paper. How many copies can the man sell in two months?
7. A factory produced 483 motor bikes in a year. If the profit on one bike is Birr 5,830, how much profit did the factory make during the year?

1.2.3 Division of Whole Numbers

Look at the following divisions

(i) $6 \div 2 = 3$, remainder $= 0$

(ii) $8 \div 3 = 2$, remainder $= 2$

(iii) $9 \div 3 = 3$, remainder $= 0$

(iv) $6 \div 8 = ?$ here quotient is not a whole number.

In case of (i) and (iii), you can see that remainder is 0, i.e., one whole number completely divides another whole number and the result is a whole number.

In case of (ii) and (iv) when one whole number divides another whole number, the result is not a whole number.

Activity 1.9

Determine the quotient and remainder

a. $12 \div 3$

b. $13 \div 4$

c. $18 \div 2$

d. $16 \div 5$

Study the examples given below on division carefully.

Example 17

A box contains 56 shirt buttons. If a shirt needs 7 buttons, how many shirts can be made up from the box?

Solution: 56 ÷ 7 = 8 because 7 × 8 = 56

8 shirts can be made up from the box.

Example 18

a. 24 ÷ 8 = 3 because 8 × 3 = 24

b. 60 ÷ 5 = 12 because 5 × 12 = 60

c. 6000 ÷ 3 = 2000 because 3 × 2000 = 6000

you may also use the long division to divide numbers.

Example 19

```
      1 3 2
  7 |
      9 2 4
     -7
       2  2
       2  1
       1  4
       1  4
          0
      Reminder
```

9 hundreds ÷ 7=1 hundred, write 1 above the 9 in the hundreds column.

7 × 1 hundred= 7 hundreds, write 7 under the 9.9-7=2. Bring down the 2 Tens.

22 tens ÷ 7=3 tens. write 3 above the 2 in the tens column,

7 × 3 Tens = 21, write 21 under the 22. 22 – 21 = 1. Bring down the 4 units. 14 ÷ 7 = 2 units write 2 above the 4 in the units column 7 × 2 units = 14 units, write 14 under the 14. 14-14 = 0.

The answer or quotient is 132.

Do you remember?

- In any division

Dividend = (quotient) (divisor) + remainder

- $0 \div a = 0$ if a is a non-zero whole number.
- $a \div 1 = a$ for any whole number a.
- Division is not commutative as well as associative (Why?)

Example 20

```
      6 6
15 | 1000
     9 0
       1 0 0
         9 0
           1 0
```

Quotient = 66
Remainder = 10
Check that 1000
= 66 × 15 + 10

1 thousand ÷ 15? I can't.
10 hundreds ÷ 15? I can't.
100 tens ÷ 15 is 6 tens.
Write 6 in the quotient's Tens column. 15 × 6 = 90.
Write 90 under the 100.
100 - 90 = 10. Bring the 0 units down, 100 units ÷ 15 is 6.
Write 6 in the quotient's units column. 15 × 6 = 90. Write 90 under the 100.
100 - 90 = 10
The quotient is 66. The remainder is 10

Example 21

Divide 1,801,340 by 294

Check that

1,801,340 = 6127 × 294 + 2

```
        6127   ← quotient
294 | 1,801, 340
      1764
        373
        294
          794
          588
         2060
         2058
            2   ← remainder
```

Exercise 1.G

1. Divide and check by multiplying. Write the quotient and remainder in each case.

   a. 197 ÷ 6 d. 876 ÷ 9 g. 43,567 ÷ 372

   b. 216 ÷ 5 e. 908 ÷ 15 h. 67,890 ÷ 124

   c. 639 ÷ 7 f. 800 ÷ 27 i. 278,056 ÷ 6072

2. Complete

a ÷ b = 3	a	18	27	36		102		9000
	b	6			20		100	

3. How many weeks are there in 5887 days?
4. How many days are there in 360 hours?
5. There are 2400 eggs that are to be shared equally in to 96 groups. How many eggs must each group get?

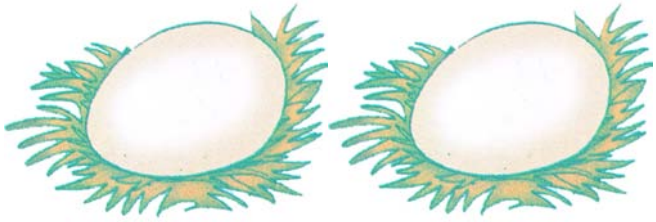


Figure 1.14

6. Three hundred eighty children share 8120 oranges. How many oranges will each child get? How many oranges are left over?
7. Find the number which when divided by 36 gives 352 as the quotient and 27 as the remainder.

1.2.4 Problems Containing Several Operations

A numerical expression is made up of numbers and operations. When simplifying a numerical expression, rules must be followed so that everyone gets the same answer.

Activity 1.10

Use two or more operations with these digits to make totals.

1	2	3	4	5	6	7	8	9

a. Total = 15

$15 = (2 + 3) \times 3$ using + and ×

$15 = 3 \times (7 - 4) + 6$ using +, - and ×

$15 = (6 \div 3) \times (5 + 3) - 1$ using +, - , × and ÷

$15 = (8 \div 4) \times (6 + 2) - 1$ using +, - , × and ÷

b. Use two or more operations and the numbers from 1 to 9 to make total = 25

Definition 1.1: A numerical expression is made up of numbers and operations. When simplifying a numerical expression, rules must be followed so that everyone gets the same answer.

From your previous mathematics lessons, observe that we use the four operations (+, -, ×, ÷) in this way:

Solve what is in the bracket first, followed by 'of', then division, multiplication, addition and subtraction (BODMAS).

Group work 1.6

A student simplified 8×(9 + 13) as follows:

$$8\times(9 + 13) = 8 \times 9 + 13$$
$$= 72 + 13$$
$$= 85$$

What is the student's error?

Example 22

Evaluate

a) $\dfrac{9+1\times 6}{(1+4)\times 3}+5$

b) $\dfrac{43\times 2\times 3-33}{25\times 3}$

c) $\dfrac{(6+100)-25}{3\times 3}$

d) $2\times 9\div 3-1$

Solution:

a) $\dfrac{9+1\times 6}{(1+4)\times 3}+5=\dfrac{9+6}{5\times 3}+5$

$=\dfrac{15}{15}+5=1+5=6$

b) $\dfrac{43\times 2\times 3-33}{25\times 3}=\dfrac{258-33}{75}$

$=\dfrac{225}{75}=3$

c) $\dfrac{(6+100)-25}{3\times 3}=\dfrac{106-25}{9}$

$=\dfrac{81}{9}=9$

d) $2\times 9\div 3-1=18\div 3-1$

$=6-1=5$

Exercise 1. H

1. Identify whether each of the following statements is true or false.
   a. $4\times(20-10)=(7\times 5)+5$
   b. $(27\div 9)+9>27\div(3+6)$
   c. $(20\div 2)\div 2<20-(18\div 3)$
   d. $(3\times 4)+(3\times 5)<(4\times 3)+(5\times 3)$
   e. $(32\div 4)+(36\div 4)=(4\times 2)+(3\times 3)$
   f. $(4\times 7)-(20-10)>(7\times 4)-(10-5)$
   g. $(25\div 5)+10>(30\div 6)+15$
   h. $(36\div 2)-15=(30\div 2)-12$
   i. $(5\times 4)+(6\times 4)<(6\times 3)+(7\times 3)$
   j. $(18\div 3)\times(30\div 5)=(6\times 6)\div(3\times 2)$

Figure 1.15

2. Calculate the value of the following. The first one is done for you

   a. $324 + (512 - 473) \div 3$

      $= 324 + 39 \div 3$ because $512 - 473 = 39$

      $= 324 + 13$ $\qquad$ $39 \div 3 = 13$

      $= 337$

   b. $285 + (483 - 387) \div 4$

   c. $(5000 - 800) \div 70 + 23$

   d. $16 \times (24 \div 4) + 10$

   e. $(5 \times 4 + 4) \div (4 \times 4 - 8)$

   f. $(15 \times 2) \div (14 + 1)$

   g. $100 - (12 \div 4 + 2)$

1.2.5 Multiples and Divisors of Whole Numbers

Activity 1.11

1. Write each number as a product of two whole numbers in as many ways as possible

   (a) 6 $\qquad$ (b) 16 $\qquad$ (c) 17 $\qquad$ (d) 36

2. Amare bikes every third day and walks every other day. On Meskerem 5, Amare biked and walked. When will he do both again?

The **divisors (factors)** of a number are all those numbers which will divide into that number with no remainder.

Example 23

a. 24 can be divided by 24,12,8,6,4,3,2,1. So the divisors (factors) of 24 are 24,12,8,6,4,3,2 and 1.
b. 1,2,3,5,6,10,15 and 30 are divisors of 30.

The multiples of a number are found by multiplying the number by 0,1,2,3,4,---

Example 24

Some of the multiples of 6 are:

$6 \times 0 = 0$, $6 \times 1 = 6$, $6 \times 2 = 12$, $6 \times 3 = 18$ $6 \times 4 = 24$

0,6,12,18 and 24 are multiples of 6.

What are some other multiples of 6?

Exercise 1.I

1. List all multiples of 5 less than 62.
2. List all multiples of 7 between 20 and 60.
3. What are multiples of 8?
4. Write down divisors of 32?
5. Write down common divisors of 18 and 32.

1.2.6 Power of Whole Numbers

Activity 1.12

Write as in the first example shown below

a) $2\times2\times2=2^3$

b) $3\times3\times3\times3=$

c) $4\times4\times4\times4\times4=$

When we write, $2\times2\times2\times2\times2$ as 2^5, read as **two raised to power five** or simply **two raised to five**. We know $2^5 = 32$ because $2\times2\times2\times2\times2 = 32$. Here 2 is called the **base** and 5 is called the **exponent.**

Example 25

a. $3^4 = 3\times3\times3\times3 = 81$

b. $5^3 = 5\times5\times5 = 125$

5^3 may be read as five cubed

c. $4^2 = 4 \times 4 = 16$

4^2 may be read as four squared

4^2 ← Exponent

← base

Study the following example:

Example 26

a. We may write $2^3 \times 2^4$ as 2^{3+4} or 2^7 because $2^3 \times 2^4$

$= 2\times2\times2\times2\times2\times2\times2 = 2^7$

b. $\frac{3^6}{3^4}$ may be written as 3^{6-4} or 3^2 because

$$\frac{3^6}{3^4} = \frac{3\times3\times3\times3\times3\times3}{3\times3\times3\times3}$$

$$= \frac{\cancel{3}\times\cancel{3}\times\cancel{3}\times\cancel{3}}{\cancel{3}\times\cancel{3}\times\cancel{3}\times\cancel{3}} \times 3 \times 3 = 3^2 = 9$$

Group work 1.7

Which numerical expression simplifies to 77?

(a) $3^2 \times (4 + 5)$
(b) $7 + 4^3 + 10$
(c) $3 \times 5^2 + 2$
(d) $10^2 - 4 \times 5 + 1$

Note: When you evaluate a numerical expression, which involves power of whole numbers, you need to follow the following rules:

Order of operations:

1. Do all operations within grouping symbols first; start with the inner most grouping symbols.
2. Do all powers before other operations.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

Example 27

Perform the indicated operations $(14 + 16) \div 5 \times 4 + (4^3 - 4)$

Solution:

$(14 + 16) \div 5 \times 4 + (4^3 - 4)$ here $14 + 16 = 30$, $64-4=60$ and $30 \div 5 = 6$

$= 30 \div 5 \times 4 + (64 - 4)$

$= 6 \times 4 + 60$

$= 24 + 60 = 84$

Exercise 1.J

1. Write the following numbers in power form. The first one is done for you.

a. $64 = 2\times2\times2\times2\times2\times2 = 2^6$

b. 27 = _____ = ____

c. 32 = _____ = ____

d. 125 = _____ = ____

e. 1000 = _____ = ____

2. Find the value of x, if

   a. $x^3 = 8$ (Example (a) if $x^3 = 8$, then $x^3 = 8 = 2\times2\times2 = 2^3$. Therefore $x = 2$).

   b. $x^3 = 27$

   c. $x^3 = 125$

   d. $x^3 = 1000$

3. Complete the table

Number	8	9	16	25	32	64	81
a^n	2^3						
Exponent	3		4	2		3	
Base	2	3			2		3

4. Compare using >, < or =

   a. 2^3 ——— 3^2

   b. 4^3 ——— 3^4

   c. 2^5 ——— 5^2

   d. 2^{10} ——— 10^2

5. Complete

Number	Product of Sevens	Number of Sevens	Number using exponents
7	7	1	7
49	7×7		
	7×7×7		
2,401			
			7^5
	7×7×7×7×7×7		
		7	
5,764,801			

6. Evaluate

   a) $\frac{36}{3^2 - 3}$

   b) $(5^2 + 3) \div 7$

   c) $(20 + 30) \div 5 \times 2 + (2^4 - 1)$

UNIT SUMMARY

Important facts you should know:

- **One Million (1,000,000) is a seven digit number.**
- **Any whole number n different from zero has a predecessor "n – 1" and a successor "n + 1".**
- **Place value chart**

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
1,000000	100,000	10,000	1,000	100	10	1

8,574,629= (8 × 1,000,000)+(5 × 100,000) + (7 × 10,000) + (4 × 1,000) + (6 × 100) + (2 × 10) + 9

- **Even numbers end in 0,2,4,6 and 8 and odd numbers end in 1,3,5,7 and 9.**
- **x + 0 = 0 + x = x for a whole number x.**
- **a × b = b × a for whole numbers a and b.**
- **(a × b) × c = a × (b × c) for whole numbers a, b and c.**
- **In any division Dividend = (quotient) (divisor) + remainder.**
- **We use the four operations (+, -, ×, ÷) in this way: BODMAS.**
- **The divisors (factors) of a number are all those numbers which will divide into the number with no remainder.**
- **When we write, 2 × 2 × 2 × 2 × 2 as 2^5 raised to five), 2^5 = 32. (2 is called the base and 5 is called the exponent).**
- **We may write $2^4 \times 2^5$ as 2^{4+5} or 2^9.**

REVIEW EXERCISE

1. Write these numbers in words.
   a. 4,350,672 _____
   b. 7,582,091 _____
   c. 10,093,385 _____
   d. 16,724,109 _____
   e. 20,000,000 _____
   f. 83,000,400 _____

2. Write these numbers in figures.
   a. Seven million, ten thousand eighty six.
   b. Twelve million, seven hundred thousand, one hundred three.
   c. Fourteen million, sixteen.
   d. Thirty seven million, six hundred twenty five thousand, forty nine.

3. a. What is the predecessor of 5,907,183?
   b. What is the successor of 7,068,439?
   c. What is the predecessor of 8,907,056?
   d. What is the successor of 12,000,400?

4. Compare the numbers using >, < or =
   a. 3, 5 8 6, 2 7 5 ☐ 3, 6 5 8, 7 5 2
   b. 10, 7 0 6, 0 0 9 ☐ 10, 0 9 9 , 9 9 1
   c. 13, 2 1 8, 7 8 0 ☐ 13, 9 0 0, 0 0 0
   d. 21, 0 0 7, 7 0 0 ☐ 21, 0 0 8, 0 0 0
   e. 38, 7 0 4, 1 0 0 ☐ 38, 4 0 7,1 0 0

5. Write the place value of 8 in the number 13,826,004.
6. Write the following numbers in expanded form.
   a. 21,706,489
   b. 34,069,705
   c. 91,360,072

7. Write the whole number which is represented by the following expanded form.
   a. $(4 \times 1{,}000{,}000) + (7 \times 10{,}000) + (5 \times 1{,}000) + (9 \times 10) + 1$
   b. $(7 \times 1{,}000{,}000) + (9 \times 100{,}000) + (6 \times 100) + (8 \times 10)$
   c. $(9 \times 1{,}000{,}000) + (8 \times 100) + (6 \times 10) + 3$
   d. $(6 \times 10{,}000{,}000) + (7 \times 1{,}000{,}000) + (7 \times 1000) + 9$

8. Count in millions and list the numbers.
   a. From 1,300,200 to 8,300,200
   b. From 13,407,500 to 20,407,500
   c. From 30,566,409 to 39,566,409

9. a. List even numbers between 30,708,969 and 30,708,983.
   b. List odd numbers between 42,561,842 and 42,561,852.

10. a. What is the sum of three even numbers? (Even, Odd)
    b. What is the sum of four odd numbers? (Even, Odd)
    c. What is the sum of five odd numbers? (Even, Odd)

11. Add

a.	b.	c)
8,346,271	13,097,805	24,681,967
+ 4,077,956	+ 7,903,769	+18,098,123

12. Subtract

a.	b.	c)
18,076,045	21,606,909	32,168,432
- 6,953,852	- 8,079,098	- 9,969,909

13. Multiply

a.	b.	c)
3468	7086	9431
× 94	× 29	× 573

14. Divide

a. $576{,}262 \div 73$

b. $3{,}945{,}305 \div 845$

c. $3{,}008{,}916 \div 6042$

d. $6{,}352{,}731 \div 927$

15. Perform the indicated operations

a. $4257 + (6028 - 5993) \div 5$

b. $250 \times (300 \div 6) + 150$

c. $(420 \times 6 + 4) \div (16 \times 2 - 28)$

d. $4^3 - 2 \times 5 + (8 \div 2)$

e. $[(4 + 12 \div 4) - 2]^3$

16. Write in power form.

a. 243

b. 128

c. 2401

d. 625

17. Zeberga bought two tickets for the instant lottery and still had Birr 85,234 in the bank. He dreamt that he had a winning ticket worth Birr 750,000 and another worth Birr 480,000. How much money would Zeberga have if his dream was **true?**

18. Ato Wondimu was the head master of a primary school in Holeta. He had Birr 854,550 in school fund. He paid his teachers' salaries and then had a total of Birr 45,680 left. How much did he have to pay the teachers?

19. In a school hall there are 1432 benches. Each bench can hold 16 children. How many children can sit on the benches in the hall?

20. Ato Dinkessa and Woizero Fatuma run a library. They have 32,448 books altogether. They ask a class of 52 students to carry the books to a new room. If each students carries the same number of books, how many will each of them carry?