Chapter 2

WHOLE NUMBERS AND OPERATIONS WITH WHOLE NUMBERS

Whole Number

In the previous lesson, we have learnt about counting of numbers and natural numbers.

1, 2, 3, 4, 5.....etc. are natural numbers. Can you say what will be the remainder when any natural number is subtracted from the same natural number? Yes, the remainder will always be zero.

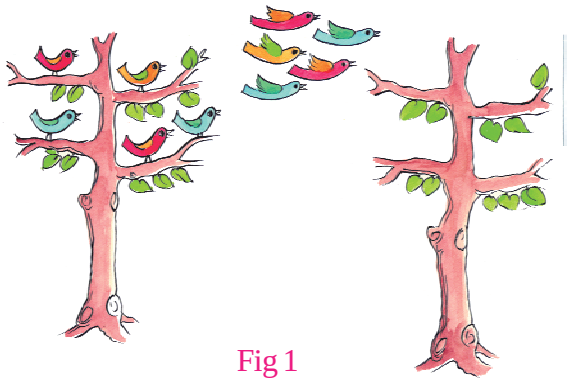


Fig 1

For example 2-2=0, 5-5=0. Is the zero (0) that is obtained here, a natural number?

No, zero is not a natural number. But we need this number. Suppose, 5 birds are sitting on a tree and all the five birds have flown away, then how many birds will remain sitting on the tree?

To answer this question, along with counting, we will need the number zero also. The group of numbers in which zero is included in the process of counting are known as WHOLE NUMBERS.

Whole numbers are denoted by "W".

i.e. whole numbers (W) = {0, 1, 2, 3, 4, 5, ...etc.}

Let us try to understand the concept of zero.

1. Sangeeta had Rs.10/- she brought a copy for Rs.7/- and a pen for Rs.3/-. How much money does she have now?

i.e. 10-7=3 (less the cost of a copy)

3-3=0 (less the cost of a pen)

Sangeeta has zero rupees left with her now, which means she has no money remaining. This state is denote by 0.

2. Ramu's mother gave 5 Laddus to Ramu. Ramu gave 2 Laddus to Mohan to eat and Ramu ate 3 Laddus himself. How many Laddus remain with Ramu?
3. Rahim has a note book of 100 pages. He has written Maths in 80 pages and Science in 20 pages. How many pages remain blank in his note book?

Representing Whole Numbers on A Number Line

To show whole numbers on a number line, we draw a straight line as in the example given below, on which many marks are put at equal distances.

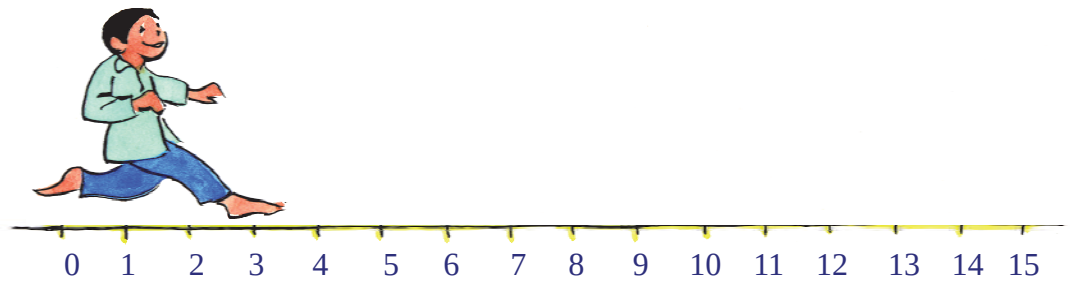


Fig 2

In this figure, the initial point is indicated by a "0". To the right of the zero (0), we write the numbers 1, 2, 3, 4 in order on the points marked at equal distances. Now, looking at this number line, can you tell, which number is greater? Think, whether the number on the left of any number would be greater than that number or smaller?

The Properties of Whole Number

You now know that 0, 1, 2, 3, 4, 5….etc. are whole numbers. Now, let us study its properties.

1. All the properties of natural numbers are applicable to Whole Numbers.
2. The smallest Whole Number is zero (0).
3. On a number line, the numbers to the right of zero (0) are in increasing (ascending) order.

i.e. 0+1=1, 1+1=2, …….. 101+1=102, 102+1=103, 103+1=104, etc.

4. On the number line if we move from the right towards left, we find that the numbers are in decreasing (descending) order, like 4, 3, 2, 1, 0.
5. No last or greatest whole number can be shown because if you think of a very-very big number, even then on adding 1 to that number, you can get the next number, that is the succeeding number.
6. The predecessor of 50 is 49, the predecessor of 17 is 16. Is there any whole number that precedes zero?

Operations on the Number Line

1. Addition of Whole Numbers

ACTIVITY 1

Show 3+2=5 on the number line.

Steps:

1. Draw a number line.
2. Move 3 steps to the right of zero (reach 3).
3. Now, move 2 steps to the right from 3.
4. Now, the distance from 0 position is 5 steps. Therefore 3+2=5.

Fig 3

Practice 1

a. Now, draw number lines yourself and check the following questions.

1) 4 + 5 2) 6 + 4 3) 5 + 7

b. Is 3 + 4 = 4 + 3. Verify this on the number line.

2. Subtraction of Whole Numbers

From a greater whole number, the smaller whole number can be subtracted. If a whole number is subtracted from the same number, we get 0. Let us do another activity.

ACTIVITY 2

How to show 8 - 5 = 3 on the number line?

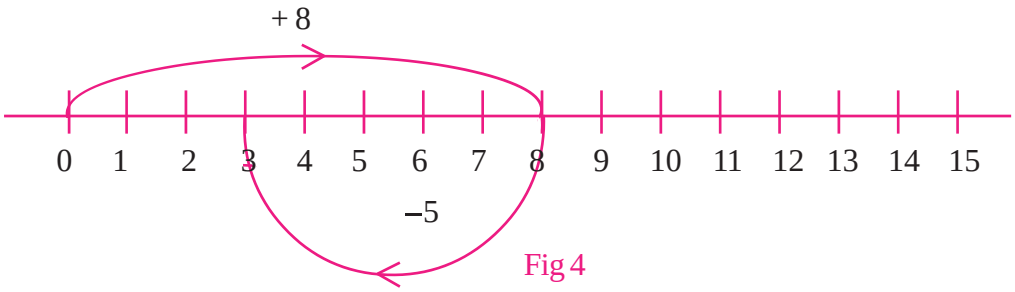


Fig 4

Steps :

1. Draw a number line.
2. Move 8 steps from 0 towards right.
3. Now, move back towards left from 8 by 5 steps (because on subtraction we move back towards left).
4. The position obtained is 3 steps to the right of 0. So, the answer we get is 8 - 5 = 3.

   Suppose, a greater number is subtracted from the smaller number, shall we get a whole number?

Practice 2

Draw number line and verify the following :

(i) 6 - 2 (ii) 7 - 4 (iii) 8 - 3

3. Mutiplication of Whole Numbers

The multiplication of whole numbers can be represented on the number line.

Example : 3 × 4 = 12 or 3 + 3 + 3 + 3 = 12

Multiplication is repeated addition of a number. Let us do this on the number line.

ACTIVITY 3

First of all, draw a number line.

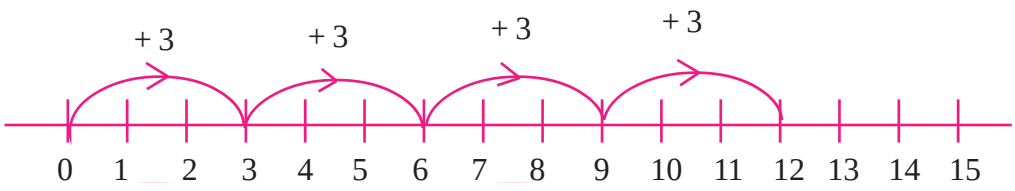


Fig 5

When we move 3 ,3 steps four times from 0, we represent it by moving from 0 to 3, 3 to 6, 6 to 9 and 9 to 12.

Therefore, 3 × 4 = 12.

Practice 3

1. Represent the following on the number line.

   (i) 4 × 3 (ii) 3 × 2 (iii) 0 × 2

   (iv) 2 × 3 (v) 3 × 3

4. Division of Whole Numbers

Can you tell how many times shall we move towards left in 3 , 3 steps from 12 so that we reach to zero? To find out this, let us take up an activity.

ACTIVITY 4

You know that division is repeated subtraction.

Therefore, In 12 ÷ 3 we shall have

12 - 3 = 9 (once)

9 - 3 = 6 (twice)

6 - 3 = 3 (three times)

3 - 3 = 0 (four times)

So, if we move 3,3 steps from 12 four times, we shall reach zero.

Therefore, 12 ÷ 3 = 4.

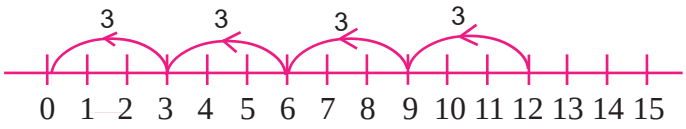


Fig 6

Can you represent on the number line and verify whether 8 is completely divisible by 3?

Practice 4

1. Show the following divisions of whole number on the number line.

   (i) 8 ÷ 2 (ii) 8 ÷ 4 (iii) 8 ÷ 1 (iv) 8 ÷ 8

Face and Place Value

For counting we use the ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. This system is called the decimal system. In decimal system, the value of a digit in the ten's place is 10 times the unit's place. The place value of a digit in the hundred's place is 10 times, the place value of ten's place. The place value of a digit in the thousand's place is 10 times the place value of the hundred's place.

We can thus count places for bigger numbers in the number system ahead.

Example. 769 = 7 × 100 + 6 ×10 + 9 ×1

In the number 769, the place value for 7, 6 and 9 are 700, 60 and 9 respectively.

Plate	Hundreds	Tens	Units
Place valvue	7 × 100 = 700	6 × 10 = 60	9 × 1 = 9

Hence in expanded notation 769 is written as 700 + 60 + 9.

Example 1.

Find the place value of 5 in the number 4579.

Solution :

In the number 4579, 5 is in hundred's place.

$\therefore$ The place value of $5 = 5 \times 100 = 500$.

Example 2.

Verify the number 3214 with the help of place value of each digit in the number.

Solution :

In the number 3214, 4 is in the unit's place. Similarly, 1 is in ten's, 2 is in hundred's and 3 is in the thousand's place.

Thus, the place value of $4 = 4 \times 1 = 4$

the place value of $1 = 1 \times 10 = 10$

the place value of $2 = 2 \times 100 = 200$

the place value of $3 = 3 \times 1000 = 3000$

Verification:

$3214 = 3000 + 200 + 10 + 4$

$= 3214.$

Example 3.

Find out the number next to 393237310.

Solution :

The number that comes after 393237310 is one more than this number

$= 393237310 + 1$

$= 393237311$

Example 4.

Find out the number that comes before 393237310.

Solution :

The predecessor or number before 393237310 will be 1 less than this number

$= 393237310 - 1$

$= 393237309$

EXERCISE 2.1

1. What is the smallest natural number?
2. Find the whole number which is not a natural number?
3. Which whole number comes before 5?
4. Write three consecutive numbers after 45.
5. Which is greater, 41608 or 41806?
6. Which of the following statements are true or false.
   (i) The smallest natural number is zero. (.....)
   (ii) The smallest whole number is zero. (.....)
   (iii) If any natural number is subtracted from the same natural number, we get zero. (.....)
   (iv) In 4215, the place value of 2 is 200. (.....)
   (v) In 4215, the face value of 2 is 2. (.....)
   (vi) The greatest whole number cannot be obtained. (.....)
   (vii) In 3857, 8 is in the thousands place. (.....)
7. Write the predecessor of the given number -
   (i) 25 (ii) 79 (iii) 520 (iv) 1100 (v) 52332
8. Write the successor (the number that comes after) of the numbers -
   (i) 25 (ii) 79 (iii) 520 (iv) 1100 (v) 52332
9. Write the smallest six digit whole number.
10. Write the greatest five digit whole number.
11. Find the difference between greatest five digit number and smallest six digit number.
12. Write the number in increasing (ascending) order -
    252, 557, 18, 421, 497, 731
13. Write the number in decreasing (descending) order -
    252, 458, 69, 59, 617
14. Which of the following numbers is 7 lac 5 thousand and six-
    (i) 750006 (ii) 705006 (iii) 7005006
    (iv) 75006

15. Write the natural number for the expanded form -

$6 \times 1000 + 3 \times 100 + 8 \times 10 + 7 \times 1$

16. Represent on a number line to check whether the solution is correct -

(i) a. $4 + 3 = 7$ b. $3 + 4 = 7$

c. $0 + 2 = 2$ d. $2 + 0 = 2$

e. $4 + 3 = 3 + 4$

(ii) a. $4 - 3 = 1$ b. $7 - 4 = 3$

c. $6 - 2 = 4$ d. $10 - 5 = 5$

e. Verify $5 - 2$ and $2 - 5$.

(iii) a. $2 \times 3 = 6$ b. $3 \times 2 = 6$

c. $2 \times 5 = 10$ d. $5 \times 2 = 10$

(iv) a. $6 \div 2 = 3$ b. $8 \div 4 = 2$

You know that the sum of two whole numbers is always a whole number. This is the **closure property** of whole numbers.

If the multiplication of two whole numbers is always a whole number, then the whole numbers follow the closure property of whole numbers. Similarly, the rule will exist for divisions of two whole numbers giving always a whole number as the quotient and for the difference of two whole number is always a whole number, then the rule will follow for subtraction too.

Let us see, which of operations follow the closure property of whole numbers.

ACTIVITY 5

You are given a list of the whole numbers, look at the numbers filled in the table as example and fill in the rest of the blank spaces yourself after serial number 8. (See table in next page)

Observe the above table and verify in which of the operations the result is always a whole number and in which it is not a whole number. Also think about the conclusion we draw from this.

It is clear that whole numbers are added, the sum is always whole number and the product of two whole numbers is also always a whole number. But the subtraction and quotient of two whole numbers divided, may not always be a whole number. So the subsequent rule follows the property of whole numbers of addition and multiplication but the rule is not follow the process of subtraction and division.

Activity 5

S. No.	First whole number	Second whole no.	First W.N.+ Second W.N.	Sum is a whole no. Yes/No	First W.N.- Second W.N.	Diffi. is a whole no. Yes/No	First W.N. × Second W.N.	Product is a whole no. Yes/No	First W.N.÷ Second W.N.	Quotient is a whole no. Yes/No
1.	3	12	3 + 12 = 15	Yes	3 – 12 = ?	No	3 × 12 = 36	Yes	3 ÷ 12 = ?	No
2.	39	13								
3.	5	0								
4.	0	8								
5.	11	15								
6.	99	1								
7.	27	9								
8.	111	11								
9.										
10.										
11.										
12.										

The Other Properties of Operation on Addition

Let us consider three friends A, B and C. In another situation, in one situation, A and B meet first then they both meet C. B and C meet first, then they meet A. What is difference between these two situations? Are these two conditions the same? In these two conditions, A, B and C meet together. If any two conditions have similar nature, then in mathematics, they are said to follow the Associative rule. Is this property true for addition of whole numbers?

Let us look at one example :-

Let us take the numbers 3, 4 and 5.

First add (3 + 4) and to their sum, add 5, the result will be -

$(3 + 4) + 5 = 7 + 5 = 12.$

Now, add 3 to the sum of (4 + 5), the result will be -

$3 + (4 + 5) = 3 + 9 = 12.$

So, what do you see? Are the sums equal in both the conditions?

ACTIVITY 6

Check the associative law for addition, for the following numbers -

1. 2, 3, 4
2. 6, 7, 8
3. 0, 1, 2
4. 4, 13, 17, 20

Is this relation true for subtraction also?

$(13 - 6) - 5 = 13 - (6 - 5)$

Are they equal? Verify.

You will observe that Associative Law is not true for subtraction.

Take 3 examples of each addition and subtration and examine the Associative Law.

Practice 5

Fill in the blanks with the correct whole numbers-

1. $(4 + 6) + 5 = \square$
2. $4 + (6 + 5) = \square$
3. $12 + (6 + \square) = 20$
4. $(\square + 6) + 2 = 20$
5. $(8 + 9) + \square = 25$
6. $(12 + 8) + \square = \square + (8 + 10)$
7. $(6 + 2) + \square = \square + (2 + 3)$

The Study of Multiplication

1. Fill in the blanks for following multiplications :-

To check whether

whole number × whole number = the product, whole number or not.

Example -

7 × 9 =	63, whole number	8 × 12 =	
23 × 15 =		12 × 0 =	
0 × 12 =			

Can you think two whole numbers whose product is not a whole number.

ACTIVITY 8

On the basis of multiplication (×), put the correct whole number in the boxes, In some boxes, the solution is given.

×	0	1	2	3
0	0			
1			2	
2		2		
3				9

The Commutative Law

12 × 5 = 60

Now, if we change the order of these numbers, we have

5 × 12 = 60

In both the conditions, are the products equal?

If 357 × 486 = 173502, then find without multiplying that the value of

486 × 357 = ☐ ?

Practice 6

Fill in the blanks :-

(i) 87 × 887 = 887 × ☐

(ii) 279 × ☐ = 481 × 279

(iii) 303 × 117 = ☐ × 303

(iv) ☐ × 583 = 583 × 179

Test of Associative Law for multiplication

You have learnt the multiplication of two numbers, let us now verify the multipliaction of three numbers.

Take three numbers 2, 5 and 6, multiply them in different ways and write their products in the boxes.

$2 \times (5 \times 6)$	=		$(2 \times 5) \times 6$	=	
$5 \times (6 \times 2)$	=		$(5 \times 6) \times 2$	=	
$6 \times (5 \times 2)$	=		$(6 \times 5) \times 2$	=	
$2 \times (6 \times 5)$	=		$(2 \times 6) \times 5$	=	
$5 \times (2 \times 6)$	=		$(5 \times 2) \times 6$	=	
$(6 \times 2) \times 5$	=		$6 \times (2 \times 5)$	=	

Are the product of all the boxes different? If not, then we can multiply 3 numbers in different ways and see that the result is the same. This is called the Associative Law, you can take any three other numbers and test the law. (Note that, In the process of multplication, first the digits in brackets are multiplied and then the product is multiplied to the digit outside the brackets.)

Practice 7

Fill in the blanks -

(i) $4 \times (5 \times 6) = (4 \times \square) \times 6$ (ii) $8 \times (4 \times 2) = \square \times 2$

(iii) $3 \times (7 \times 5) = (3 \times \square) \times 5$ (iv) $2 \times (8 \times \square) = 8 \times (\square \times 4)$

(v) $7 \times (3 \times 5) = 7 \times (\square \times 5)$

Divisor, Dividend, Quotient and Remainder

You have already learnt these in previous classes, let us revise -

Example 1.

$20 \div 5$

$$5\overline{)20}\,(4$$
$$\underline{20}$$
$$00$$

Here, 5 is divisor, and 4 is quotient.

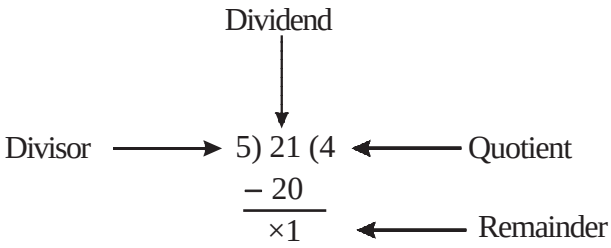
Is there any relationship among divisor, dividend and quotient?

$20 = 5 \times 4$

Dividend = divisor × quotient.

Example 2.

$21 \div 5$



1. The number which is divided is called dividend, 21 is dividend.
2. The number by which any number is divided is called the divisor, 5 is divisor.
3. The number of times it gets divided is called the quotient, 4 is quotient.
4. After division a number that is smaller than the divisor remains. This is called the remainder. Here 1 is remainder.

Therefore, $21 = 5 \times 4 + 1$

Now, Divide 22 by 5

5) 22 (4
– 20
×2

Here, 5 is divisor, 22 is the dividend, 4 is the quotient and 2 is the remainder.

Write the relationship amongst, divisor, dividend, quotient and remainder and test in your notebooks the relationship with the help of an exercise.

Practice 8

Divide

(i) $48 \div 7$ (ii) $36 \div 5$ (iii) $78 \div 9$

In this way, the law you have made is known as the Law of Divisibility, which is -

Divident = Divisor× Quotient + Remainder

Can the remainder be greater than divisor?

Practice 9

Fill in the blanks -

(i) In $8 \div 4$, the quotient is = - - - - - - - - - , remainder = - - - - - - - - -
(ii) In $5 \div 2$, the quotient is = - - - - - - - - - , remainder = - - - - - - - - -
(iii) In $6 \div 4$, the quotient is = - - - - - - - - - , remainder = - - - - - - - - -
(iv) In $7 \div 2$, the quotient is = - - - - - - - - - , remainder = - - - - - - - - -

The Properties of Zero

Let us now learn about zero (0) -

1. $5 + 0 = 5$
2. $0 + 5 = 5$
3. $5 - 0 = 5$
4. $5 \times 0 = 0$
5. $0 \times 5 = 0$
6. $0 \div 5 = 0$
7. $5 \div 0 =$ No solution.

Practice 10

1. Fill in the blanks with the correct numbers -

(i)	0 + 0 = - - - - - - - - - -	(ii)	0 – 0 = - - - - - - - - - -
(iii)	7 + 0 = - - - - - - - - - -	(iv)	0 + 7 = - - - - - - - - - -
(v)	7 – 0 = - - - - - - - - - -	(vi)	7 × 0 = - - - - - - - - - -
(vii)	0 × 7 = - - - - - - - - - -	(viii)	0 ÷ 7 = - - - - - - - - - -

From the above exercise you have understood the following properties of zero.

1. If '0' is added to any whole number, the value of that number remains unchanged.So **"0"** is known as **additive identity**. Think and write four examples.
2. If '0' is subtracted to any whole number, the value of that number remains unchanged. Write four examples.
3. If '0' is multiplied by whole number, then the product is zero.
4. If '0' is divided by whole number, then the quotient is zero.
   5 ÷ 0 = ? We may subtract 0 from 5, as many times, we wish, but we always get the same number. We repeat this process many times, but the number remains unchanged.
   This means, if we divide any whole number by zero, we will not get any particular number as the quotient. In the same way 0 ÷ 0 is also not defined.
   Discuss this with your teacher.

EXERCISE 2.2

Oral Questions

Q.1 On the basis of the following information, solve the following without multiplying or adding -

(i)	17 × 23 = 391	then,	23 × 17 = ...
(ii)	15 + 25 = 40	then,	25 + 15 = ...
(iii)	40 + 0 = 40	then,	0 + 40 = ...
(iv)	39 × 1 = 39	then,	1 × 39 = ...
(v)	a × b = c	then,	b × a = ...

Q.2 Add the given number by putting them in such an order that the addition becomes easy.

(i)	23589 + 411 + 1248	(ii)	32 + 2546 + 68 + 544
(iii)	247 + 376 + 153	(iv)	143 + 456 + 857
(v)	32958 + 5000 + 12042		

Q.3 Which whole number will be obtained if "0" is multiplied to any number?

Q.4 What is the closure property for addition?

Q.5 Fill in the blank on the basis of characteristics/properties of operations.

(i) 2376+4559= ……. + 2376

(ii) 1×0= 0×1= ……

(iii)
$$\begin{array}{r} 8\ 7\ 6 \\ -\ \square\ 3\ \square \\ \hline 6\ \square\ 7 \end{array}$$

Q.6 Which is the number, that when divided by the same number, gives the same number again?

Q.7 What is the product of the largest 4-digit number and the smallest 1-digit?

Q.8 If 76 × 16 = 1216, then 1216 ☐ 76 = 16 (Put right symbol in box.)

Written Questions :

Q.9 Rama planted a total 544 plants in 17 rows. How many plants did she put in each row?

Q.10 In a city, out of every 15 people, 1 person is a government servant. If 1354 persons in that city are in government jobs, what is the total population of that city?

Q.11 Find out the quotient and remainder and verify the Law of Divisibility.

(i) 7772 ÷ 36 (ii) 12425 ÷ 835 (iii) 92845 ÷ 300

Q.12 Write down a suitable number in every blank.

(i)
$$\begin{array}{rrr} 7 & 3 & 5 \\ -4 & 2 & \square \\ \hline \square & \square & 6 \end{array}$$
(...) (..)

(ii)
$$\begin{array}{rrrr} 4 & 9 & 3 & 1 \\ - \square & \square & 7 & 8 \\ \hline 1 & 8 & \square & \square \end{array}$$
(...) (..) (..)

Q.13 Manjulata went to the market with Rs.1800/-. She bought a purse for Rs.135/- , a handkerchief for Rs.75/- and a gold chain for Rs.1200/-. Find out how much money remained with her after the purchasing.

Q.14 Ashok deposited Rs.4539/- in the bank on Tuesday. On Saturday, he withdrew Rs.2556/- and the next week, he again deposited Rs.1431/-. How much money does he have in his bank account?

Q.15 In a Model school, the fees for a student of class VI is Rs.95/-. If the number of students is 335, find out total amount to be paid as fees?

Q.16 The product of two numbers is 117. If one of the numbers is 13, find the other one.

Q.17 Nisha purchased 24 radio sets for Rs.18720/-. If all radio sets are of the same cost, find out the cost of one radio set.

Q.18 For the given magic square, add the numbers in the square, vertically, horizontally and diagonally.
Is the sum the same every time?

14	1	9
3	8	13
7	15	2

Q.19 Fill in the blanks in the given magic square. Remember it the addition of numbers in the square, vertically, horizontally, diagonally should be same.

22		6	13	20
	10	12	19	
9	11	18	25	
15	17	24	26	
16			7	14

What Have We Learnt ?

1. Zero is a whole number.
2. Two Whole Numbers when added or multiplied give another Whole Number.
3. The Commutative Law is applicable to operations with addition multiplication for Whole Numbers but not applicable to operations with subtraction and division.
4. The Associative Law is applicable to operations with addition and multiplication in Whole Numbers but is not applicable to operations with division and subtraction.
5. Zero is known as the additive elements.
6. 1 is known as the identical multiplication elements.
7. 0 added to or subtracted from any Whole Number does not change its value.
8. If 1 is multiplied to any Whole Number, the value of the number remains unchanged.
9. If 0 is multiplied to any Whole Number, its value becomes 0.
10. Any whole number divided by zero, is not defined.
11. Divident = divisor × quotient + remainder.