Vision Empower & XRCVC Teacher Instruction KIT Whole Numbers

Syllabus: Karnataka State Board Subject: Mathematics Grade: 6 Textbook Name: Math Text cum workbook Chapter Number & Name: 2. Whole numbers

1. OVERVIEW

1.1 OBJECTIVE AND PREREQUISITES **Objective**

Students will be able to:

- understand the concept of whole numbers.
- perform basic math operations on the number line.
- understand the properties of whole numbers.

Prerequisite Concept

• Natural numbers, predecessor and successor of natural numbers. TIK_MATH_G5_CH2_Numbers.

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Kindly Note: Activities marked with * are mandatory

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name : Whole numbers

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user: admin@example.com

2. LEARN

2.1 KEY POINTS

- Whole numbers: Whole numbers are a set of numbers including the set of natural numbers (1 to infinity) and the integer 0. A whole number is called whole because it is not a mixed fraction or any rational number.
- The numbers 1, 2, 3,... which we use for counting are known as natural numbers.
- Every natural number has a successor. Every natural number except 1 has a predecessor.
- If we add the number zero to the collection of natural numbers, we get the collection of whole numbers.

- All-natural numbers are whole numbers, but all whole numbers are not natural numbers.
- Adding two whole numbers always gives a whole number. Similarly, multiplying two whole numbers always gives a whole number. We say that whole numbers are closed under addition and also under multiplication. However, whole numbers are not closed under subtraction and under division.
- Zero is the identity for the addition of whole numbers. The whole number 1 is the identity for multiplication of whole numbers.
- You can add two whole numbers in any order. You can multiply two whole numbers in any order. We say that addition and multiplication are commutative for whole numbers.

2.2 LEARN MORE

3 ENGAGE

3.1 INTEREST GENERATION ACTIVITY

Activity 1: Counting

Materials Required: Marbles/seeds and cups. *Prerequisites:* None

Activity Flow

- Divide the students into a group of 4.
- Give a cup full of marbles to each group.
- Tell the students, the group who finish the counting first will be the winner of the game.
- When the facilitator says start, ask the students to count the number of marbles in their cup.
- After the game, ask the following questions.
 - 1. How did you count the marbles?
 - 2. What is the use of numbers?
 - 3. How did you start the count?
- Explain to the students, numbers are used for calculating and counting. To count objects, we use numbers i.e. 1, 2, 3, 4,....., 10 etc. These are called counting numbers and are also called natural numbers.
- Explain to the students, while counting, we start from 1.

3.2 CONCEPT INTRODUCTION ACTIVITIES

WHOLE NUMBERS

Activity 2: Introduction to whole numbers. Materials Required: None Prerequisites: Natural numbers

Activity Flow

- We use 1, 2, 3, 4,... when we begin to count. They come naturally when we start counting. Hence, mathematicians call the counting numbers as Natural numbers. Also, we learnt about the preceding and succeeding numbers for any natural number. Example: preceding number of 34 is 33 and the succeeding number is 35.
- Ask the students to tell the preceding number or predecessor for the numbers from 10 to 6.

Answer: The predecessors are 9, 8, 7, 6, 5 respectively.

- Ask the students, what were they doing to get a predecessor for any natural number? Answer: In order to get a predecessor we should subtract 1 from the given number.
- Now, ask the students to find the predecessor from 5 to 2. Answer: 4, 3, 2, 1.
- How about number 1? What is its predecessor? We know that subtracting 1 from the number 1 is zero. Hence zero is a predecessor of number 1.
- Therefore, the natural numbers along with zero form the collection of whole numbers.

Ask the following questions to the students.

- 1. Are all natural numbers also whole numbers? Answer: No, because natural numbers do not include zero.
- 2. Are all whole numbers also natural numbers? Answer: Yes. Since natural numbers along with zero will give whole numbers.
- 3. Which of the following statements are true (T) and which are false (F)?
 - (a) Zero is the smallest natural number. Answer: False
 - (b) 400 is the predecessor of 399. Answer: False
 - (c) Zero is the smallest whole number. Answer: True
 - (d) 600 is the successor of 599. Answer: True
 - (e) All natural numbers are whole numbers. Answer: True
 - (f) All whole numbers are natural numbers. Answer: False

(g) The predecessor of a two-digit number is never a single-digit number. Answer: False

- (h) 1 is the smallest whole number. Answer: False
- (i) The natural number 1 has no predecessor. Answer: True
- (j) The whole number 1 has no predecessor. Answer: False

(k) The whole number 13 lies between 11 and 12. Answer: False (l) The whole number 0 has no predecessor. Answer: True

Activity 3: The number line for whole numbers and basic math operations on the number line.

Materials Required: Tactile ruler, Nemeth code for brackets, parchment paper, stylus. *Prerequisites:* None

Activity Flow

- Ask the students to observe the arrangement of numbers from 1 to 15 on the calliper. Ask them what is the distance between successive numbers? Answer: It is 1cm.
- Ask the students to draw a measuring calliper on a parchment paper. That is, keep the tactile ruler on the paper draw line and mark each number from 1 to 15 with a unit distance between each number. In general, we don't mark zero as the first value in a calliper, even if we don't mention explicitly, it is considered to be zero.
- Hence, calliper with zero as its first number is the best example of a number line of whole numbers.

Ask the following questions to the students.

- 1. What is the distance between 7 and 8? The answer is 1.
- 2. How far is 40 from 12? The answer is 28.
- 3. Is number 9 right to 7 or 8? Answer: 9 is to the right side of 8.
- 4. Is number 1 left of 2 or 0? Answer: 1 is to the left side of 2.

Note: We can observe that the numbers which are on the right side are greater than the previous number and numbers which are on the left side of a number are lesser than the next number.

Symbolically, we write 9 greater than 8 as 9 > 8 and 8 less than 9 as 8 < 9.

Activity 4: Basic math operations on the number line.

Materials Required: Tactile ruler or the number line which was made in the previous activity

Prerequisites: Addition and subtraction

Activity Flow

Addition on the number line:

Addition of whole numbers can be shown on the number line. Let us see the addition of 2 and 7.

- Start from 2. Since we add 7 to this number we make 7 jumps to the right; from 2 to 3, 3 to 4, 4 to 5, 5 to 6, 6 to 7, 7 to 8 and 8 to 9.
- Finally, after 7 jumps from 2, we will be at number 9 on the number line. Also, we can verify by finding the sum of 2 and 7 is 9.

Try these:

Find 4+5=9; 2+6=8; 3+5=8 using the number line.

Subtraction on the number line:

The subtraction of two whole numbers can also be shown on the number line. Let us find 7-5.

• Start from 7. Since 5 is being subtracted, so move towards left with 1 jump of 1 unit. Make 5 such jumps. We reach point 2. We get 7-5=2.

Try these:

Find 8-3=5; 6-2=4; 9-6=3 *using the number line.*

Multiplication on the number line:

We now see the multiplication of whole numbers on the number line. Let us find 4×3 .

• Start from 0, move 3 units at a time to the right, make such 4 moves. Where do you reach? You will reach 12. So, we say, $3 \times 4 = 12$.

Try these:

Find $2 \times 6 = 12$; $3 \times 3 = 9$; $4 \times 2 = 8$ using the number line.

Properties of Whole Numbers

Activity 5: Properties of whole numbers. Materials Required: None Prerequisites: None

Activity Flow

We will learn about the properties of whole numbers, in addition, multiplication, subtraction and division.

Closure property for addition:

 Let each one of them in the class take any two whole numbers and add them and write. Is the result always a whole number? Example: 3+8=11, is a whole number 9+5=14, is a whole number 0+15=15, is a whole number, and so on.

Hence, we say that the sum of any two whole numbers is a whole number i.e. the collection of whole numbers is closed under addition. This property is known as the closure property for the addition of whole numbers.

Activity 6: Closure property of multiplication, subtraction and division.

Materials Required: None Prerequisites: Subtraction, division, multiplication Activity Flow

- Are the whole numbers also closed under multiplication? Let's check it.
 7×9 = 63, is a whole number
 5×3 = 15, is a whole number
 0×1 = 0, is a whole number
- The multiplication of two whole numbers is also found to be a whole number again. We say that the system of whole numbers is closed under multiplication.
- Are the whole numbers closed under subtraction? No.

Observe the examples below.

- 6-2=4, a whole number
- 7-8=?, not a whole number
- 5-4=1 , a whole number
- 3-9=?, not a whole number

Similarly, are the whole numbers closed under division? No. Check with examples below.

> $8 \div 4 = 2$, a whole number $5 \div 7 = 5$ divided by 7, not a whole number $12 \div 3 = 4$, a whole number

$6 \div 0$ is not defined.

Commutative Property

Activity 7: Commutative property for addition Materials Required: Tactile ruler Prerequisites: Addition.

Activity Flow

- Ask the students to take a tactile ruler which represents the number line and ask them to add 3 and 4 on the number.
 i.e. start at 3 and make 4 jumps towards right then you will arrive at number 7, which is nothing but 3+4 = 7.
- Similarly, ask them to add 4+3, i.e. start at 3 and make 4 jumps towards right then you will arrive at number 7, which is nothing but 4+3=7.
- Ask them what can they conclude from this?
- We can add two whole numbers in any order. We say that addition is commutative for whole numbers. This property is known as commutativity for addition.

Let us see some real examples:

- a. Putting sugar first then coffee powder or putting coffee powder then sugar to milk will give the same result.
- b. First light the stove then place the vessel or first place the stove then light it.

Examples which are not commutative.

Putting socks first then shoes will not be the same if we put shoes first then socks. Similarly, ask the students to give their own examples for both commutative and noncommutative property.

Activity 8: Commutative property for multiplication.

Materials Required: Tactile ruler Prerequisites: Addition.

Activity Flow

- Imagine you have a small party at home. You want to arrange 6 rows of chairs with 8 chairs in each row for the visitors. The number of chairs you will need is 6×8. You find that the room is not wide enough to accommodate rows of 8 chairs. You decide to have 8 rows of chairs with 6 chairs in each row. How many chairs do you require now?
- Will you require more chairs? No. It is the same as 6 times 8 = 48 chairs.

- Is there a commutative property of multiplication? Yes.
- Multiply numbers 4 and 5 in different orders and 3 and 7 in different orders. You will observe that
 - $4 \times 5 = 5 \times 4 = 20$ and 3 times 7 = 7 times 3 = 21.
- Therefore we can multiply two whole numbers in any order. We say multiplication is commutative for whole numbers.

Subtraction is not commutative for whole numbers.

• Ask the students to subtract numbers with the change of order, use at least three different pairs of numbers to verify it.

Example:

5-3=2 is a whole number but 3-5 is not a whole number.

9-4=5 is a whole number but 4-9 is not a whole number.

• Similarly, the division is not commutative for whole numbers.

Example:

4 divided by 2 is 2 a whole number but 2 divided by 4 is not a whole number. 18 divided by 6 is 3 a whole number but 6 divided by 18 is not a whole number.

Associative Property

Activity 9: Associative property for addition.

Materials Required: Marbles *Prerequisites:* Addition.

Activity Flow

Associative property deals with any 3 whole numbers in general.

Consider the example

- a. (2+3)+4=5+4=9
- b. 2 + (3 + 4) = 2 + 7 = 9
- To explain an example to the students, take marbles to play with numbers.
- Take 2 marbles and 3 marbles and add them to get 5 marbles. Then for the 5 marbles add 4 more marbles then will have 9 marbles altogether.

Similarly, for the second example.

- First, take 3 marbles along with 4 marbles and add them, and you will get 7 marbles. Then with the 7 marbles add 2 more marbles than will have 9 marbles altogether.
- So, here you can observe that in whichever order you add the answer will be the same.

• Ask the students to write 2 examples for the associativity of the addition of whole numbers.

Answer:

1.
$$(7+8)+4=15+4=19$$

 $7+(8+4)=7+12=19$
2. $(23+13)+9=36+9=45$
 $23+(13+9)=23+22=45$

Notice how we grouped the numbers for convenience of adding.

Activity 10: Associative property for multiplication.

Materials Required: Stickers *Prerequisites:* Multiplication

Activity Flow

Associative property for multiplication:

• Take 3 sticker packets having 4 stickers arranged in vertical and 2 stickers in horizontal. So each packet has 8 stickers in total. Therefore the number of stickers in all the 3 packets are 3 times 8 = 24 stickers.

Mathematically, we write it as

3 times (4 times 2) = 3 times 8 = 24 is a whole number.

• Likewise, Take 2 sticker packets having 3 stickers arranged in vertical and 4 stickers in horizontal. So each packet has 12 stickers in total. Therefore the number of stickers in the 2 packets are 2 times 12 = 24 stickers.

Mathematically, we write it as

(3 times 4) times 2 = 12 times 2 = 24 is a whole number.

- Ask the students, what do they observe from both. The final answer is the same, which is 24. But the order in which we multiply is different but the result is the same answer.
- Hence, we can conclude that associativity of multiplication on whole numbers holds good.

Explain the following examples to the students.

- 1. Which is easier and why? $(6 \times 5) \times 3$ or $6 \times (5 \times 3)$. The answer is 90.
- 2. Find 12×35 Solution : $12 \times 35 = (6 \times 2) \times 35 = 6 \times (2 \times 35) = 6 \times 70 = 420$

Here, in this 2nd example, we see that the calculation is made easy by splitting the numbers 12 into 2 times 6 and multiplying them first and applying associative property then multiplying with 35 will get an answer as 420.

3. Find 8×1769×125 Solution :8×1769×125=8×125×1769 (we group 8 and 125 together with braces and use associative property) = (8×125)×1769 = 1000×1769 = 17,69,000.

Think, discuss and write.

1. $Is(16 \div 4) \div 2 = 16 \div (4 \div 2)$?

The answer is no because consider numbers on the left-hand side of the above equation, first, we divide 16 by 4 will give 4 and this 4 is again divided by 2 which will give 2 as an answer. Whereas numbers on the right-hand side of the above equation, first we divide 4 by 2 will give 2 and this 2 will divide 16 which will give 8 as an answer. Hence the answers are different and by which we can say that associative property for the division will not hold good.

2. Is (34-6)-7=34-(6-7)

The answer is no. Ask the students to justify by solving this problem.

Here, we can observe that we are just shifting the braces from the first two numbers to the last two numbers to make a group of two, and to know which are the two numbers are going to be added together first to observe associative property. Similarly for multiplication, division and subtraction.

Distributive Property

Activity 11: Distributive property of multiplication over addition.

Materials Required: Tactile graph sheet/Parchment paper. *Prerequisites:* Multiplication

Activity Flow

- Take a graph paper of size 6 cm(columns) by 8 cm(rows) having squares of size 1 cm × 1 cm.
- How many squares do you have in all? Answer: 6 times 8=48.

Ask the students to solve the following questions.

- 1. $2 \times (3+5) = (2 \times 3) + (2 \times 5)$ Answer is 16
- 2. $4 \times (5+8) = (4 \times 5) + (4 \times 8)$ Answer is 52

- 3. $6 \times (7+9) = (6 \times 7) + (6 \times 9)$ Answer is 96
- 4. $7 \times (11+9) = (7 \times 11) + (7 \times 9)$ Answer is 140
- 5. The school canteen charges 25 for lunch and 5 for milk for each day. How much money do you spend in 6 days on these things? Solution: This can be found in two methods.

Method 1 :

Find the amount for lunch for 6 days. Find the amount for milk for 6 days. Then add. i.e. Cost of lunch = $6 \times 25 = 150$ Cost of milk = $6 \times 5 = 30$ Total cost = (150+30) = 180

Method 2 : Find the total amount for one day. Then multiply it by 6 i.e. Cost of (lunch + milk) for one day = (25+5)Cost for 6 days = $6 \times (25+5) = (6 \times 30) = 180$.

Hence, you can observe method 2 involves the distributive property of multiplication over addition which will reduce the steps and be more efficient compared to method1.

Identity (for addition and multiplication):

• Ask the students to add zero to any whole number and see what they get as an answer? It is zero.

Example:

1+0=19+0=90+17=170+36=36 and so on.

- It is the same whole number again! Zero is called an identity for addition of whole numbers or additive identity for whole numbers.
- Zero has a special role in multiplication too. Any number when multiplied by zero becomes zero!

For example, observe the pattern of the 5th table in the multiplication table.

 $5 \times 6 = 30$ $5 \times 5 = 25$ $5 \times 4 = 20$ $5 \times 3 = 15$ $5 \times 2 = 10$ $5 \times 1 = ?$ Answer is 5

 $5 \times 0 = ?$ Answer is 0.

Observe how the products decrease.

- Ask the students to guess the last step? We can observe that the product is decreasing with a difference of 5 in each step, so the last step has to have an answer as zero.
- We came across an additive identity for whole numbers. A number remains unchanged when added to zero. Similar is the case for a multiplicative identity for whole numbers, a number remains unchanged when multiplied by 1.

Observe the following examples.

 $17 \times 1 = 17$ $5 \times 1 = 5$ $1 \times 122 = 122$ $1 \times 1000 = 1000$

• 1 is the identity for multiplication of whole numbers or multiplicative identity for whole numbers.

Patterns

Activity 12: Patterns in whole numbers.

Materials Required: Sticker packets to represent dots *Prerequisites:* None

Activity Flow

- Ask the students the following question.
- 1. What is the difference between a square shape and a rectangular shape? Answer: Square shape has an equal length in all the 4 sides, but the rectangle has 2 opposite sides with equal lengths.
- Ask the students to observe the following sequence of numbers and guess the next number.

a) 1, 2, 3, 4, 5, 6_?

The answer is 7, i.e. successor of number 6.

b) 2, 4, 6, 8, 10, 12, _?

The answer is 14. A sequence of all consecutive even numbers or sequence of numbers with a difference of 2.

c) 4, 9, 16, 25, _?

The answer is 36=6 times 6. In the sequence of square numbers, say 2 times 2=4, 3 times 3=9, 4 times 4=16, 5 times 5=25.

Hence, these are all the few examples of patterns in numbers.
 i.e. Anything which is generated or written with the logic which is carried throughout the sequence.

- Similarly, ask the students to try to find their own pattern of numbers.
- We shall try to arrange numbers in elementary shapes made up of dots. The shapes we take are line, rectangle, square and triangle. Every number should be arranged in one of these shapes.

For example:

- a. Every number can be arranged as a line.
 - Take 2 stickers and paste horizontally next to each other.

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Take 4 stickers and paste horizontally next to each other.

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Similarly, for any number.

b. Some numbers can be shown also as rectangles.

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For example, The number 6 = 2 times 3.
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Take 2 stickers and paste horizontally next to each other. Then take 2 stickers and paste it below the 1st two stickers. Again take 2 stickers and paste it below the 2nd set of two stickers. Finally, will have stickers arranged in 2 columns(vertical) with 3 rows(horizontal) which gives rise to a rectangular shape.

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Similarly, ask the students to do it for the following numbers.

- 1. 15 = 3 times 5.
- 2. 12 = 2 times 6.

And these numbers are also called rectangular numbers.

c. Some numbers like 4 or 9 can also be arranged as squares.

Example: 4 = 2 times 2.

Take 2 stickers and paste it horizontally. Again take 2 stickers and paste it below the first 2 stickers.

Then we will get a shape of a square.

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- ••

Similarly, 9 = 3 times 3.

So take 3 stickers 3 times and paste it horizontally one below the other.

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d. Some numbers can also be arranged as triangles.

For example, 3,6,10,15 etc.

We know that 3 = 1+2.

Take two stickers, paste it on the corner of the sheet, again take one sticker and paste it above any one of the two dots which are pasted in the beginning.

• •

Similarly, do it for 6 = 1+2+3. So first start with large digit 3, take 3 stickers and paste it horizontally on the paper. Then take 2 stickers and paste it above the 3 stickers. At last, take one sticker and paste it above the two dots. So, it will have a triangular shape formed by the dots which have a single dot at the top then below 2 dots and then below 2 dots, there will be 3 dots.

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Note that the triangle should have its two sides equal. The number of dots in the rows starting from the bottom row should be like 4, 3, 2, 1. The top row should always have 1 dot.

Patterns Observation:

• Observation of patterns can guide you in simplifying processes. Study the following: 117+9=117+10-1=127-1=126 117-9=117-10+1=107+1=108 $84\times9=84\times(10-1)=84\times10-84\times1=840-84=756$ $84\times999=84\times(1000-1)=84\times1000-84\times1=84000-84=83916$ $96\times5=96\times10/2=960/2=480$ We can observe that, if we can find patterns which will simplify the calculations.

3.3 LET'S DISCUSS: RELATE TO DAILY LIFE*

The whole numbers that we're most used to working with, including zero. We see whole numbers on nutrition labels, or signs on the highway telling us how many miles are to the next exit/city and in all other activities wherever we use numbers.

- 1. Calling a member of a family or a friend using a mobile phone.
- 2. Calculating your daily budget for your food, transportation, and other expenses.
- 3. Cooking, or anything that involves the idea of proportion and percentage.

4. Weighing fruits, vegetables, meat, chicken, and others in the market.

- 5. Using elevators to go places or floors in the building.
- 6. Looking at the price of discounted items in a shopping mall.
- 7. Looking for the number of people who liked your post on Facebook.
- 8. Switching the channels of your favorite TV shows.
- 9. Telling time you spent on work or school.

4 EXERCISES & REINFORCEMENT

4.1 PRACTICE EXERCISES

Activity 13: Practise and Recall *Materials required: None*

Prerequisites: None Activity Flow

- 1. Write the next three natural numbers after 10999.
- 2. Write the three whole numbers occurring just before 10001.
- 3. Which is the smallest whole number?
- 4. How many whole numbers are there between 32 and 53?
- 5. Write the successor of:
 - a. 2440701
 - b. 100199
- 6. Write the predecessor of:
 - a. 94
 - b. 1000
- 7. In each of the following pairs of numbers, state which whole number is on the left of the other number on the number line.
 - a. 530, 503
 - b. 370, 307
- 8. Find the sum by suitable rearrangement:
 - *a.* 837+208+363
- 9. Find the product by suitable rearrangement:
 - *a.* 4×166×25
 - *b.* 8×291×125
- 10. Find the value of the following:
 - a. $297 \times 17 + 297 \times 3$
- 11. Find the product using suitable properties.
 - *a.* 738×103
 - *b.* 854×102
- *12. Which of the following will not represent zero:*

- *a.* 1+0
- *b.* 0×0
- 13. If the product of two whole numbers is zero, can we say that one or both of them will be zero? Justify through examples.
- 14. If the product of two whole numbers is 1, can we say that one or both of them will be 1? Justify through examples.
- 15. Find using distributive property :
 - *a.* 728×101
 - *b.* 824×25
 - *c.* 504×35

4.2 IMPORTANT GUIDELINES*

Exercise Reading

It is very important that the children practice their learnings as well as their Reading. Hence have the children read out the newly learned concepts from their textbooks or other available resources.

Perform Textbook Activity

It is good practice to have the children perform the textbook activities. Your textbook activities might not be accessible hence go through this resource to learn how to make textbook content accessible

Provide Homework

To evaluate their understanding and to help the student revise and implement the new learnt concept ensure to provide them with homework. Students should perform one or two of the questions mentioned above or from the textbook exercises with the teacher in Class and the remaining may be given for homework. Also, ensure that the student knows their special skills linked to independently using their accessible books as it will be critical to doing homework independently

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