Chapter 2

Whole Numbers

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Whole Numbers

The numbers used for counting are called natural numbers. The number that comes immediately before another number in counting is called its predecessor. The number that comes immediately after another number in counting is called its successor. To find the successor of any given natural number, just add 1 to the given number. The value of nothing is represented by the number zero. *Example:* $3 - 3 = 0$.

Natural numbers together with the number zero are called whole numbers. When comparing two whole numbers, the number that lies to the right on the number line is greater. When comparing two whole numbers, the smaller number lies to the left on the number line.

IMPORTANT DEFINITIONS

Natural numbers: We are already familiar with the counting numbers 1, 2, 3, 4, 5, 6 etc. Counting numbers are called *natural numbers.*

Whole Numbers: All natural numbers together with '0' are called whole numbers.

Clearly, every natural number is a whole number but 0 is a whole number which is not a natural number.

Properties of Whole Numbers

1. Closure Property

If two whole numbers are added, then the result is again a whole number. Which implies whole numbers are closed with respect to addition?

2. Associative Property

If a, b, c are whole numbers, then
$a + (b + c) = (a + b) + c$
While adding whole numbers, we can group the numbers in any order. This is called the associative property of addition.

3. Identity

If a is a whole number, $a + 0 = 0 + a = a$
A whole number added to 0 remains unchanged. Thus, 0 is called the additive identity in whole numbers.

4. Commutative Property

If a, b, c are whole numbers, then
$a + b = b + a$

The addition of two whole numbers is the same, no matter in which order they are added. This is called the commutative property of addition.

5. Distributive Property of Multiplication over Addition

The sum of the products of a whole number with two other whole numbers is equal to the product of the whole number with the sum of the two other whole numbers. This is called the distributive property of multiplication over addition. i.e., If a, b, c are whole numbers, then $a \times (b + c) = a \times b + a \times c$.

Note

i) Whole numbers are not closed under subtraction and division.

ii) Subtraction and division are not commutative in whole numbers.

iii) No inverse exists for whole numbers.

iv) Associative property does not hold for subtraction and division of whole numbers.

TIPS FOR COMPETITIVE LEVEL

Magic Square

A magic square is an arrangement of different numbers in the form of a square such that the sum of the numbers in every horizontal line, every vertical line and every diagonal line is the same.

One magic square is shown here:

9	2	7
4	6	8
5	10	3

It may be noted that:

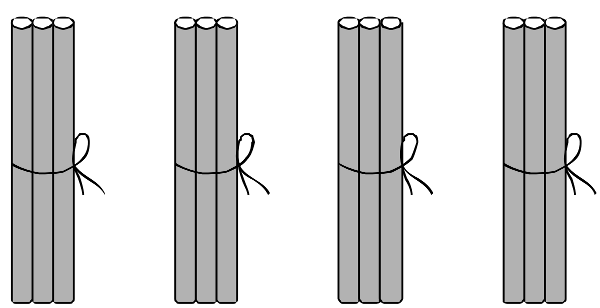
Row-wise sum = (9 + 2 + 7) = (4 + 6 + 8) = (5 + 10 + 3) = 18

Column-wise sum = (9 + 4 + 5) = (2 + 6 + 10) = (7 + 8 + 3) = 18

Diagonal-wise sum = (9 + 6 + 3) = (7 + 6 + 5) = 18

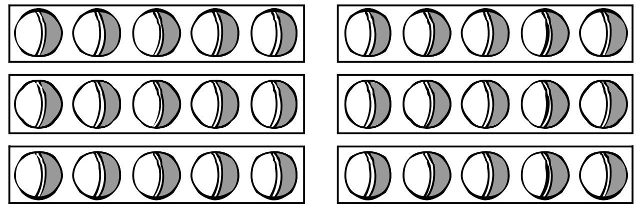
Multiplication of Whole Numbers

Let us consider 4 bundles, each consisting of 3 stacks.



Total number of sticks
= 3 + 3 + 3 + 3 = 12
Also, we may write:
Total number of sticks
= 4 times 3, written as
4 × 3 \ 4 × 3 = 12

Again, consider 6 packets of 5 balls each



Total number of balls
= 5 + 5 + 5 + 5 + 5 + 5 = 30
Also, we may write:
Total number of balls
= 6 times 5, written as 6 × 5
Therefore, 6 × 5 = 30

It follows that multiplication is repeated addition.

If the numbers are small, we can perform the operation of multiplication mentally as above and find the product.

If the numbers are large, we multiply then using the multiplication tables about which you have learnt earlier.

However, we now last the various properties of multiplication on whole numbers. These properties will helps to finding easily the products of numbers, however, large they may be.

Properties of Multiplication of Whole Numbers

1. **Closure Property:** If *a* and *b* are whole numbers, then (a × b) also a whole number.

   Examples: Let us take a few pairs of whole numbers and check in each case whether their product is a whole number.

One whole number	Another whole number	Product	Is the product a whole number?
9	8	9 × 8 = 72	Yes
12	7	12 × 7 = 84	Yes
16	10	16 × 10 = 160	Yes

   Thus, we are that if we multiply two whole numbers, the product is also a whole number.

2. **Commutative Law:** If a and B are any two whole numbers then (a × b) = (b × a)

   Example: i) 7 × 5 = 35 and 5 × 7 = 35
   Is (7 × 5) = (5 × 71)? Yes
   ii) 19 × 12 = 228 and 12 × 19 = 228
   Is (19 × 12) = (12 × 19)? Yes

   In general, commutative law of multiplication holds in whole numbers.

3. **Multiplicative Property of Zero:** For every whole number *a*, we have (*a* × 0) = (0 × *a*) = 0.

Example: i) 9 × 0 = 0 × 9 = 0
ii) 37 × 0 = 0 × 37 = 0
iii) 2386 × 0 = 0× 2386 = 0

4. **Multiplicative Property of 1:** If a, b, c are any whole numbers, then (a × b) × c = a × (b × c).

Example: i) 8 × 1 = 1 × 8 = 8
ii) 76 × 1 = 1 × 76 = 76
iii) 2345 × 1 = 1 × 2345 = 2345

5. **Associative Law:** If a, b, c are any whole numbers, then (a × b) × c = a × (b × c).

Example: Take the whole numbers 9, 7 and 10
(9 × 7) × 10 = 63 × 10 = 630
9 × (7 × 10) = 9 × 70 = 630
∴ (9 × 7) × 10 = 9 × (7 × 10)

6. **Distributive Law of Multiplication over Addition:** For any whole numbers a, b, c are have a × (b + c) = (a × b) = (a × c).

Example: Consider the whole numbers 16, 9 and 8
16 × (9 + 8) = (16 × 17) = 272
(16 × 9) + (18 × 8) = (144 + 128) = 272
∴ 16 × (9 + 8) = (16 × 9) = (16 × 8)

7. **Distributive Law of Multiplication over Subtraction:** For any whole numbers a, b, c we have: a × (b – c) = (a × b) – (a × c).

Example: Consider the whole numbers 11, 6 and 4
11 × (6 – 4) = (11 × 2) = 22
(11 × 6) – (11 × 4) = (66 – 44) = 22
\ 11 × (6 – 4) = (21 × 6) – (11 × 4)

Division in Whole Numbers

Division is the inverse operation of multiplication

Let *a* and *b* be two whole numbers. Dividing a by b means finding *a* whole number *c* such that *b* × *c* = *a* and we write *a* ÷ *b* = *c*.

Thus $a \div b = c \Rightarrow \frac{a}{b} = c \Rightarrow a = b \times c$

Examples: Dividing 48 by 8 is the same as finding a whole number which when multiplied by 8 gives 48.

Clearly such a number is 6, as 8 × 6 = 48

Similarly, we have:

63 ÷ 9 = 7, 84 ÷ 14 = 6, etc

Division Algorithm

Suppose 75 is divided by 9, then the quotient is 8 and the remainder is 3.

Clearly: 75 = (9 × 8) +3

$$9\overline{)75}(8$$
$$\underline{-72}$$
$$\underline{\;\;3}$$

In general, let *a* and *b* be two given whole numbers such that *a* > *b*. On dividing a by b, let q be the quotient and *r* be the remainder.

Then, we have a = bq + r, where $0 \leq r < b$

This result is known as division algorithm.

Thus, dividend = (divisor × quotient) + remainder.

Even and Odd Whole Numbers: A whole number divisible by 2 is called an even numer:

e.g. 0, 2, 4, 6, 8 etc., are all even numbers.

A whole number which is not divisible by 2 is called an odd number.

e.g. 1, 3, 5, 7, 9 etc., are all odd numbers.

Properties of Division

1. If *a* and *b* are nonzero whole numbers, then *a* ÷ *b* is not always a whole number.

   Example: We known that 7 and 2 are whole numbers.

   But 7 ÷ 2 is not a whole number.

2. **Division by 0:** If *a* is a whole number, then a ÷ 0 is meaningless.

3. If *a* is a nonzero whole number, then 0 ÷ a = 0.

   Example: (i) 0 ÷ 3 = 0 (ii) 0 ÷ 57 = 0 etc.

PART – I: MISCELLANEOUS DOMAIN

1. If a, b are whole numbers, then ab, $a + b$ are also whole numbers. Prove it by taking $a = 4$, $b = 5$.

2. Represent the following on the number line:

   (i) 19 (ii) 7 (iii) 0 (iv) 10.

3. Arrange the following whole numbers in ascending order: 9, 4, 29, 6, 3, 1, 18

4. Find the difference between smallest 5 digit whole number and greatest 3 digit whole number.

5. Form the largest and smallest 4 digit number using the digits, 2, 0, 4, 7, 3 repetition of digits is not allowed/

6. Write the successor and predecessor of largest 6 digit number.

7. Which whole number is not a natural number?

8. Which whole number does not have predecessor?

9. How many whole numbers are there between 70935 and 86237?

10. Name the property used in whole numbers:

    If a, b, c are whole numbers, then

    i) $a + b$ is also a whole number ii) ab is also a whole number iii) $a + b = b + a$

    iv) $ab = ba$ v) a + (b + c) = (a + b) +c

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

11. Find the sum using convenient groupings

    i) 414, 5000, 486 ii) 2098, 3002, 3050

12. The cost of T.V is `40000. The T.V dealer allows a discount of `7,500 on Diwali. Find the net selling price.

13. Find the product of greatest 3 digit number and smallest 4 digit number.

14. The bus travels at a uniform speed of 75km/hour. How much it travels in 5.5 hours?

15. The product of two numbers is zero. What can you say about the numbers?

16. Using Distributive property find the value of

    i) 23 x 125 ii) 23 + 125

17. What type of numbers is the product of numbers

    i) Two odd numbers ii) Two even numbers iii) An odd and an even numbers.

18. What is the whole number which multiplied by itself gives the same number?

19. Find the sum of the following numbers in two ways

    i) 24 + 43 + 37 ii) 87 + 54 + 29

20. Verify commutative property of addition and multiplication through two examples.

HIGHER ORDER THINKING SKILLS (HOTS)

21. Find the two consecutive numbers after 5009?

22. Find the three consecutive predecessors of 70010?

23. Write the expanded form of 920, 831?

24. If *a* and *b* are two whole numbers, then commutative law is applicable to subtraction if and only if_______________?

25. On dividing 55,390 by 299 reminder is 75. Find the value of quotient?

26. What least number must be subtracted from 13,601 to get a number exactly divisible by 87?

27. What least number should be added to 1330 to get a number exactly divisible by 43?

28. Find the value of 555 × 193 – 555 × 93?

29. The differences between the largest 5-digit number and smallest 5-digit number?

30. Difference between the place value of 3 and 7 in 61, 380, 942 and 5, 107, 289?

PART – II: MULTIPLE CHOICE QUESTIONS

1. 7589 – ? = 3434
   (a) 11023 (b) 4245 (c) 4155 (d) None of these

2. 587 × 99 = ?
   (a) 57213 (b) 58513 (c) 58113 (d) 56143

3. 4 × 538 × 25 = ?
   (a) 32280 (b) 26900 (c) 43800 (d) 10760

4. 24679 × 92 + 24679 × 8 = ?
   (a) 493580 (b) 1233950 (c) 2467900 (d) None of these

5. 1625 × 1625 – 1625 × 625 = ?
   (a) 1625000 (b) 162500 (c) 156800 (d) None of these

6. (888 + 777 + 555) = (111 × ?)
   (a) 120 (b) 280 (c) 20 (d) 140

7. The sum of two odd numbers is
   (a) an odd number (b) an even number (c) a prime number (d) a multiple of 3

8. The product of two odd numbers is
   (a) an odd number (b) an even number (c) a prime number (d) None of these

9. If *a* is a whole number such that a + a = a, then a = ?
   (a) 1 (b) 2 (c) 3 (d) None of these

10. The predecessor of 16000 is
    (a) 10001 (b) 9999 (c) None of these

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