2 Whole Numbers

We have already learnt about numbers, their place value, face value, estimation, Roman numbers, etc. In this chapter, we will learn about numbers in detail and their properties. We will also learn addition, subtraction and multiplication of numbers on a number line.

Natural Numbers

Answer the following questions before we proceed further.

1. *How many footballs are required to play a soccer match?*
2. *How many eyes do we have?*
3. *How many months are there in a year?*

To answer these questions, we need to count beginning from 1. The numbers 1, 2, 3, 4, ... are called counting numbers. Counting of these numbers comes naturally to us. Therefore, mathematicians also called these numbers natural numbers. Hence, the numbers 1, 2, 3, ..., 1,000, ..., 10,00,00,000, ..., etc. are called **natural** or **counting numbers**.

Successor and predecessor of natural numbers

On adding 1 to a natural number, we get the next natural number. This number is called the **successor** of the given number. For example, the successor of 3 is 4. We can obtain successor of any number by adding 1 to it. There is always a number next to the given number irrespective of its value. Therefore, there is no last or greatest number. Similarly, the number 15 comes before 16, we say that on subtracting 1 from the given natural number, we get its **predecessor**.

The number 1 is the only natural number which has a successor but no predecessor because on subtracting 1 from it, we get 0 which is not a natural number. All natural numbers except 1 have both successor and predecessor.

Whole Numbers

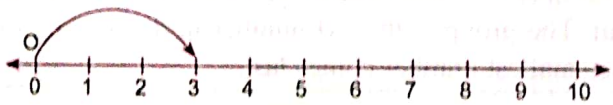
In natural numbers, we have seen that there is no predecessor of 1. A collection of natural numbers along with 0 are called **whole numbers**. Every natural number is a whole number but, on the other hand there exists a whole number '0' which is not a natural number.

Addition of Whole Numbers on a Number Line

Let's add whole numbers 3 and 5.

Step 1: Draw a number line as shown.

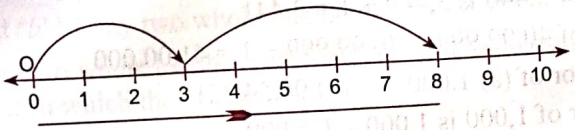
Step 2: First move three units to the right from '0' to reach at 3.



Do you know?

The word zero originated from the Hindu word sunya which means 'void'. Then sunya was translated into the Arabic sifr, which when translated to Latin gave zero.

Step 3: Now move five units further to the right to reach at 8.

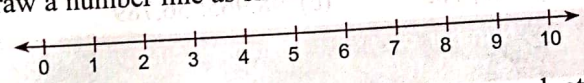


Clearly, 3 + 5 = 8

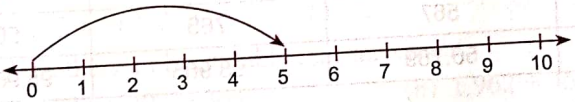
Subtraction of Whole Numbers on a Number Line

Let's subtract whole number 3 from 5.

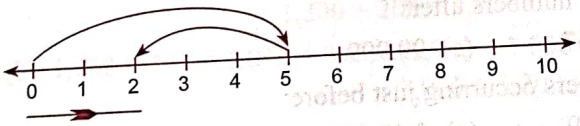
Step 1: Draw a number line as shown below.



Step 2: First move five units to the right from '0' to reach at 5.



Step 3: Now move three units to the left from 5 to reach at 2.

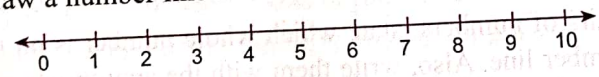


Clearly, 5 – 3 = 2

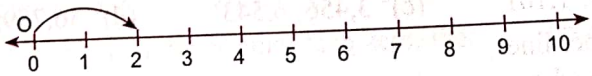
Multiplication of Whole Numbers on a Number Line

Let's multiply whole numbers 2 and 4.

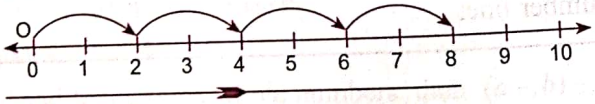
Step 1: Draw a number line as shown below.



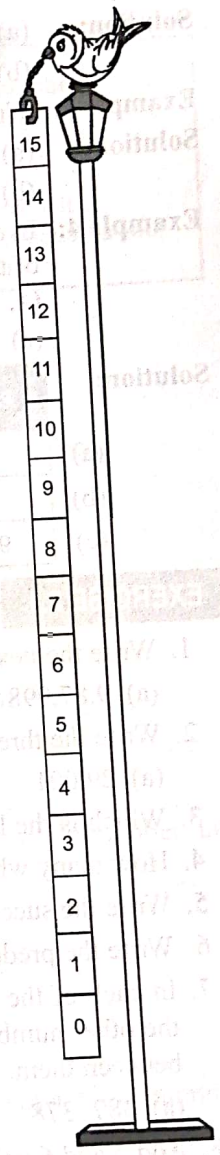
Step 2: First move two units to the right from '0' to reach at 2.



Step 3: Now make three more such moves to reach at 8.



Clearly, 2 × 4 = 8



Example 1: How many whole numbers are there between 33 and 53?

Solution: Whole numbers between 33 and 53 are 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 and 52.

Therefore, there are 19 whole numbers between 33 and 53.

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Example 2: Write the successor of (a) 3,440 (b) 40,99,999

Solution: (a) The successor of 3,440 is 3,440 + 1 = 3,441

(b) The successor of 40,99,999 is 40,99,999 + 1 = 41,00,000

Example 3: Write the predecessor of (a) 1,000 (b) 96,54,321

Solution: (a) The predecessor of 1,000 is 1,000 – 1 = 999

(b) The predecessor of 96,54,321 is 96,54,321 – 1 = 96,54,320

Example 4: In each of the following pairs of numbers, state which whole number is on the left of the other number on the number line. Also, write them with the appropriate sign (>, <) between them.

(a) 640; 604 (b) 567; 765 (c) 98,965; 56,789

Solution:

	Pair of numbers	Number on the left	Number on the right	Comparison
(a)	640; 604	604	640	640 > 604
(b)	567; 765	567	765	567 < 765
(c)	98,965; 56,789	56,789	98,965	98,965 > 56,789

EXERCISE 2.1

1. Write the next three natural numbers after:
   (a) 9,87,098 (b) 10,867 (c) 99,999
2. Write the three whole numbers occurring just before:
   (a) 29,001 (b) 34,799 (c) 5,62,301
3. Which is the largest whole number?
4. How many whole numbers are there between 46 and 77?
5. Write the successor of (a) 2,35,679 (b) 7,86,420 (c) 9,80,099
6. Write the predecessor of (a) 5,67,000 (b) 34,59,080 (c) 89,00,120
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. Also, write them with the appropriate sign (>, <) between them.
   (a) 387; 378 (b) 1,001; 1,101 (c) 3,456; 6,543 (d) 36,789; 3,67,899
8. Add 5 and 6 using the number line.
9. Subtract 5 from 9 using the number line.
10. Multiply 5 by 3 using the number line.

Properties of Whole Numbers

I. Addition

➢ **Closure property**

Let 'a' and 'b' be any two whole numbers, then the sum of 'a' and 'b' is also a whole number. This property is known as closure property of addition of whole numbers.

For example, $3 + 5 = 8$

➢ **Commutative**

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➢ **Existence of**

Let 'a' be any

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➢ **Associative**

Let 'a', 'b' a

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Example 5: Fi

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Solution: (a

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II. Subtraction

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- **Commutative property**

  Let 'a' and 'b' be any two whole numbers, then $a + b = b + a$.

  The sum of two whole numbers remains the same irrespective of the order in which they are added.

  For example, $5 + 3 = 8 = 3 + 5$

- **Existence of additive identity**

  Let 'a' be any whole number, then $a + 0 = a = 0 + a$.

  The number '0' is called additive identity for whole numbers.

  For example, $6 + 0 = 6 = 0 + 6$

- **Associative property**

  Let 'a', 'b' and 'c' be any three whole numbers, then $(a + b) + c = a + (b + c)$

  The sum of the whole numbers remains unchanged even if the grouping is changed.

  For example, $(7 + 5) + 2 = 14 = 7 + (5 + 2)$

Maths Fun

Think of a number.
Multiply it by 5.
Add 5 to it.
Divide it by 5.
Subtract 1 from it
The result is equal to your original number.

Example 5: Find the sum by suitable rearrangement.

(a) $837 + 208 + 363$ (b) $1{,}962 + 453 + 1{,}038 + 747$

Solution: (a) $837 + 208 + 363 = (837 + 363) + 208$
$= 1{,}200 + 208 = 1{,}408$

(b) $1{,}962 + 453 + 1{,}038 + 747 = (1{,}962 + 1{,}038) + (453 + 747)$
$= 3{,}000 + 1{,}200 = 4{,}200$

II. Subtraction

- Let 'a' and 'b' be two whole numbers such that $a \geq b$, then $(a - b)$ is a whole number, but $(b - a)$ is not a whole number as it is negative.

  Thus, subtraction is **not closed** under whole numbers.

  For example, $6 - 2 = 4$, but $2 - 6$ is negative, hence not a whole number.

- Let 'a' and 'b' be two whole numbers, then $a - b \neq b - a$.

  Subtraction of whole numbers is **not commutative**.

  For example, $5 - 3 \neq 3 - 5$ (since $5 - 3 = 2$ and $3 - 5$ is negative, hence not a whole number)

- Let 'a' be any whole number other than zero, then $a - 0 = a$.

  When zero is subtracted from any whole number we get the same whole number as the answer. This is known as **property of zero**.

  For example, $4 - 0 = 4$

- Let 'a', 'b' and 'c' be three whole numbers, then $(a - b) - c \neq a - (b - c)$.

  Subtraction of whole numbers is **not associative**.

  For example, $(9 - 3) - 2 \neq 9 - (3 - 2)$,

  as LHS $= (9 - 3) - 2 = 6 - 2 = 4$; RHS $= 9 - (3 - 2) = 9 - 1 = 8$

- Let 'a', 'b' and 'c' be three whole numbers such that $a - b = c$, then $a = b + c$.

  For example, $7 - 3 = 4$, then $7 = 3 + 4$

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III. Multiplication

- **Closure property**

  Let 'a' and 'b' be any two whole numbers, then their product '$a \times b$' is also a whole number.

  This property is known as closure property of multiplication of whole numbers.

  For example, $3 \times 6 = 18$

- **Commutative property**

  Let 'a' and 'b' be any two whole numbers, then $a \times b = b \times a$.

  The product of whole numbers is commutative.

  For example, $3 \times 5 = 15 = 5 \times 3$

- **Existence of multiplicative identity**

  Let 'a' be any whole number, then $a \times 1 = a = 1 \times a$.

  The number 1 is called the multiplicative identity for whole numbers.

  For example, $7 \times 1 = 7 = 1 \times 7$

- **Associative property**

  Let 'a', 'b' and 'c' be any three whole numbers, then $(a \times b) \times c = a \times (b \times c)$.

  The product of numbers remains unchanged if the grouping is changed.

  For example, $(2 \times 3) \times 4 = 24 = 2 \times (3 \times 4)$

- **Property of zero**

  Let 'a' be any whole number, then $a \times 0 = 0 = 0 \times a$.

  For example, $4 \times 0 = 0 = 0 \times 4$

- **Distributive property of multiplication over addition**

  Let 'a', 'b' and 'c' be any three whole numbers, then $a \times (b + c) = a \times b + a \times c$.

  In whole numbers, multiplication distributes over addition.

  For example, $4 \times (5 + 7) = 4 \times 5 + 4 \times 7$

  $$\text{LHS} = 4 \times (5 + 7) = 4 \times 12 = 48$$

  $$\text{RHS} = 4 \times 5 + 4 \times 7 = 20 + 28 = 48$$

- Distributive property can also be written as, $(b + c) \times a = b \times a + c \times a$.
- Multiplication distributes over subtraction also, $a \times (b - c) = a \times b - a \times c$, provided $b \geq c$.

Example 6: Find the products by suitable rearrangement.

(a) $4 \times 167 \times 25$ (b) $625 \times 348 \times 16$ (c) $125 \times 40 \times 8 \times 25$

Solution: (a) $4 \times 167 \times 25 = (4 \times 25) \times 167 = 100 \times 167 = 16{,}700$

(b) $625 \times 348 \times 16 = (625 \times 16) \times 348 = 10{,}000 \times 348 = 34{,}80{,}000$

(c) $125 \times 40 \times 8 \times 25 = (125 \times 8) \times (40 \times 25) = 1{,}000 \times 1{,}000 = 10{,}00{,}000$

Example 7: Find the values of the following:

(a) $297 \times 17 + 297 \times 3$ (b) $38{,}443 \times 94 + 6 \times 38{,}443$

(c) $81{,}265 \times 169 - 81{,}265 \times 69$

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Solution: (a) $297 \times 17 + 297 \times 3 = 297 \times (17 + 3) = 297 \times 20 = 5{,}940$

(b) $38{,}443 \times 94 + 6 \times 38{,}443 = 38{,}443 \times 94 + 38{,}443 \times 6 = 38{,}443 \times (94 + 6)$
$= 38{,}443 \times 100 = 38{,}44{,}300$

(c) $81{,}265 \times 169 - 81{,}265 \times 69 = 81{,}265 \times (169 - 69) = 81{,}265 \times 100 = 81{,}26{,}500$

Example 8: Find the products using suitable properties.

(a) $8{,}431 \times 110$ (b) 854×99 (c) $1{,}007 \times 168$

Solution: (a) $8{,}431 \times 110 = 8{,}431 \times (100 + 10) = 8{,}431 \times 100 + 8{,}431 \times 10$
$= 8{,}43{,}100 + 84{,}310 = 9{,}27{,}410$

(b) $854 \times 99 = 854 \times (100 - 1) = 854 \times 100 - 854 \times 1$
$= 85{,}400 - 854 = 84{,}546$

(c) $1{,}007 \times 168 = (1{,}000 + 7) \times (100 + 68)$
$= 1{,}000 \times 100 + 1{,}000 \times 68 + 7 \times 100 + 7 \times 68$
$= 1{,}00{,}000 + 68{,}000 + 700 + 476 = 1{,}69{,}176$

Example 9: A bus driver filled the bus tank with 33 L of diesel. Two days later he filled the tank with 17 L of diesel. If the diesel costs ₹ 28 per litre, how much did he spend in all on diesel?

Solution: Diesel filled on first day = 33 L

Diesel filled two days later = 17 L

Cost of diesel = ₹ 28 per litre

Total expenditure on fuel = $33 \times 28 + 17 \times 28$
$= (33 + 17) \times 28 = 50 \times 28 =$ ₹ 1,400

Example 10: Match the following:

(a) $325 \times 136 = 325 \times (6 + 30 + 100)$	(i) Commutativity under multiplication
(b) $3 \times 49 \times 50 = 3 \times 50 \times 49$	(ii) Commutativity under addition
(c) $80 + 740 + 20 = 80 + 20 + 740$	(iii) Distributivity of multiplication over addition

Solution: (a) (iii), (b) (i), (c) (ii)

Example 11: If the product of two whole numbers is zero, can we say that one or both of them will be zero? Justify. *(NCERT)*

Solution: (a) Let's assume that the two whole numbers 'a' and 'b' are such that neither 'a' nor 'b' is zero. The product of any two non-zero whole numbers is a non-zero whole number. But it is given that $a \times b = 0$, which is not possible. Hence, both 'a' and 'b' cannot be non-zero.

(b) Let's assume that any one of the two whole numbers 'a' and 'b' is zero and the other is non-zero. Therefore, the product of 'a' and 'b' would be zero.

(c) Now let's assume that both the whole numbers 'a' and 'b' are zeros. Then their product will also be zero.

Therefore, we can say that if the product of two whole numbers is zero, either one or both of them are zeros.

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Example 12: If the product of two whole numbers is one, can we say that one or both of them will be one? Justify. *(NCERT)*

Solution: (a) Let's assume that the two whole numbers 'a' and 'b' are such that $a = 1$ and $b \neq 1$. Now $a \times b = 1 \times b = b \neq 1$. Hence $a = 1$ and $b \neq 1$ is not possible.

(b) Let's take $a = 1$ and $b = 1$.

Now, $a \times b = 1 \times 1 = 1$.

Since no other values of a and b give the product 1, hence the only possibility is that both the whole numbers a and b should be 1.

IV. Division

- Let 'a' and 'b' be any two whole numbers such that $b \neq 0$, then $a \div b$ is not necessarily a whole number.

  Division of whole numbers is **not closed.**

  For example, $9 \div 3 = 3$, which is a whole number

  $22 \div 5 = \frac{22}{5}$, which is not a whole number

- Let 'a' and 'b' be non-zero whole numbers, then $a \div b \neq b \div a$.

  Division of whole numbers is **not commutative.**

  For example, $8 \div 2 = 4$, but $2 \div 8$ is not a whole number

- Let 'a', 'b' and 'c' be any three whole numbers, then $(a \div b) \div c \neq a \div (b \div c)$.

  Division of whole numbers is **not associative.**

  For example, $(24 \div 6) \div 2 \neq 24 \div (6 \div 2)$

  LHS $= (24 \div 6) \div 2 = 4 \div 2 = 2$; RHS $= 24 \div (6 \div 2) = 24 \div 3 = 8$

- Let 'a' be any whole number, then $a \div 1 = a$.

  Any whole number 'a' when divided by 1 gives the quotient 'a'.

  For example, $6 \div 1 = 6$

- Let 'a' be any non-zero number, then $a \div a = 1$.

  Any non-zero whole number 'a' when divided by itself gives the quotient 1.

  For example, $15 \div 15 = 1$

- When zero is divided by any non-zero whole number, the quotient is always zero.

  For example, $0 \div 9 = 0$

- Let 'a', 'b' and 'c' be any three whole numbers such that $b \neq 0$ and $a \div b = c$, then $b \times c = a$.

  For example, $16 \div 8 = 2$, then $8 \times 2 = 16$

- Let 'a', 'b' and 'c' be any three whole numbers such that $b \neq 0$, $c \neq 0$ and $b \times c = a$, then $a \div b = c$ and $a \div c = b$.

  For example, $2 \times 3 = 6$, then $6 \div 2 = 3$ and $6 \div 3 = 2$

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Division Algorithm

If a whole number x is divided by a non-zero whole number y, then there exists a quotient q and a remainder r such that $x = yq + r$, where q and r are whole numbers and $r < y$, i.e.,

$$\begin{array}{r|l} & \quad q \\ \hline y & \;\; x \\ & -qy \\ \hline & \;\; r \\ \hline \end{array}$$

Thus, **Dividend = quotient × divisor + remainder**

Let's divide 14 by 3.

$$\begin{array}{r|l} & \quad 4 \\ \hline 3 & \;\; 14 \\ & -12 \\ \hline & \;\; 2 \\ \hline \end{array}$$

We have, dividend = 14, divisor = 3, quotient = 4, remainder = 2.

Let's verify, dividend = quotient × divisor + remainder

RHS = 4 × 3 + 2 = 14 = dividend = LHS, hence true.

EXERCISE 2.2

1. Fill in the blanks with suitable numbers.
   (a) 456 + 567 = 567 + _____ (b) 9,876 + 124 + 1,000 = 1,000 + _____ + 9,876
   (c) 8,769 + 3,000 + 231 = 231 + 3,000 + _____
2. Add the following by suitable rearrangements.
   (a) 437 + 680 + 363 + 220 (b) 1 + 2 + 3 + 4 + 5 + 95 + 96 + 97 + 98 + 99
   (c) 14,419 + 888 + 112 + 581 (d) 21 + 22 + 23 + 24 + 25 + 75 + 76 + 77 + 78 + 79
3. Find the products by applying suitable properties.
   (a) 238 × 103 (b) 154 × 99 (c) 387 × 11 (d) 1,003 × 138
4. Find the products using suitable rearrangements.
   (a) 250 × 35 × 40 (b) 125 × 60 × 8 (c) 25 × 451 × 4 (d) 625 × 20 × 50 × 8
5. Find the values of the following:
   (a) 497 × 37 + 497 × 13 (b) 4,279 × 92 + 8 × 4,279
   (c) 8,126 × 169 − 8,126 × 69 (d) 1,684 × 782 + 1,684 × 218
6. Divide 6,750 by 13 and verify the result by division algorithm.
7. Divide 26,755 by 16 and verify the result by division algorithm.
8. Evaluate the following:
   (a) (625 ÷ 25) ÷ 5 (b) 0 ÷ 21 (c) 22 ÷ 0 (d) (15,625 ÷ 125) ÷ 25
9. In the number 6,43,590 the digits 3 and 9 were interchanged by mistake. Find the difference of the original number and the number formed by mistake.
10. Find the difference between the smallest five-digit number and the largest three-digit number.
11. How many digits are there in a successor of a three-digit number?
12. A theatre is to be constructed in which each row must have 40 seats. If the required seating capacity of the theatre is 960, find the number of rows in the theatre.
13. Find the number which on dividing by 25 gives 30 as the quotient and 15 as the remainder.

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Patterns

Patterns in numbers are not only interesting, but are useful tools for verbal calculations. They also help us to understand various properties in a better way.

Let's observe the following pattern:

$$1 + 3 = 4 = 2^2$$
$$1 + 3 + 5 = 9 = 3^2$$
$$1 + 3 + 5 + 7 = 16 = 4^2$$
$$\vdots$$
$$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 64 = 8^2$$

We observe the sum of the first two odd numbers is equal to square of 2, the sum of the first three odd numbers is equal to square of 3, the sum of the first four odd numbers is equal to square of 4, etc. In patterns like these, we may estimate the sum without actual calculations.

Example 13: Observe the pattern and fill in the blanks.

$$3 \times 3 - 2 \times 2 = 9 - 4 = 5 = 3 + 2$$
$$4 \times 4 - 3 \times 3 = 16 - 9 = 7 = 4 + 3$$
$$5 \times 5 - 4 \times 4 = 25 - 16 = 9 = 5 + 4$$
$$21 \times 21 - 20 \times 20 = 441 - 400 = 41 = 21 + 20$$
$$51 \times 51 - 50 \times 50 = 2{,}601 - 2{,}500 = 101 = 51 + 50$$
$$101 \times 101 - 100 \times 100 = \ldots\ldots\ldots\ldots\ldots\ldots$$
$$525 \times 525 - 524 \times 524 = \ldots\ldots\ldots\ldots\ldots\ldots$$

Solution:
$$101 \times 101 - 100 \times 100 = 101 + 100 = 201$$
$$525 \times 525 - 524 \times 524 = 525 + 524 = 1{,}049$$

Example 14: Study the pattern.

$$1 \times 8 + 1 = 9$$
$$12 \times 8 + 2 = 98$$
$$123 \times 8 + 3 = 987$$

Write the next two steps. Can you explain how the pattern works?

Solution: The next two steps are as follows:

$$1{,}234 \times 8 + 4 = 9{,}876$$
$$12{,}345 \times 8 + 5 = 98{,}765$$

To know how it works, let's observe the following:

$$12 \times 8 + 2 = (11 + 1) \times 8 + 2 = (88 + 8) + 2$$
$$= (88 + 1) + (8 + 1) = 89 + 9 = 98$$
$$1{,}234 \times 8 + 4 = (1{,}111 + 111 + 11 + 1) \times 8 + 4 = (8{,}888 + 888 + 88 + 8) + 4$$
$$= (8{,}888 + 1) + (888 + 1) + (88 + 1) + (8 + 1)$$
$$= 8{,}889 + 889 + 89 + 9 = 9{,}876$$

Puzzle

Each of the boxes in the given 3 × 3 grid are filled by one of the digits 0, 1, 2, 3, 4, 5, 6, 7 and 8. Each letter represents a distinct digit.

If the products AEI, GEC, DEF and BEH are equal, what digit does E represent?

A	D	G
B	E	H
C	F	I

Do you know?

1 GOOGOL = 10^{100}

EXERCISE 2.3

Observe the following pattern and fill in the blanks.

(a)
$1 \times 9 + 1 = 10$
$12 \times 9 + 2 = 110$
$123 \times 9 + 3 = 1{,}110$
$1{,}234 \times 9 + 4 =$ _____
$12{,}345 \times 9 + 5 =$ _____

(b)
$15{,}873 \times 7 \times 1 = 1{,}11{,}111$
$15{,}873 \times 7 \times 2 = 2{,}22{,}222$
$15{,}873 \times 7 \times 3 = 3{,}33{,}333$
$15{,}873 \times 7 \times 4 =$ _____
$15{,}873 \times 7 \times 5 =$ _____

Reason It Out!

I. Identify the pattern and write the next two numbers in the series.

(i) 1, 6, 31, 156, ☐, ☐

(ii) 1, 3, 6, 10, ☐, ☐

II. Place the whole numbers 0, 1, 2, 3, 5 and 6 in the given table so that no box has a number greater than the one directly below it and no box has a number greater than the one directly to the right of it.

Are there more ways to place these numbers?

AT A GLANCE

1. The numbers 1, 2, 3, ... are called **natural numbers.**
2. A successor is obtained by adding 1 to a given number. A predecessor is obtained by subtracting 1 from a given number.
3. Collection of natural numbers along with 0 is called **whole numbers.**
4. Addition or multiplication of two whole numbers gives a whole number. These are known as **closure property** of addition and multiplication with respect to whole numbers. On the other hand, if we subtract or divide two whole numbers the result may not necessarily be a whole number, i.e., whole numbers are not closed with respect to subtraction and division.
5. **Properties of whole numbers**

   For whole numbers a, b and c, we have the following properties.

   (a) $a + b = b + a$ — Commutative property of addition
   (b) $a + 0 = a = 0 + a$ — Existence of additive identity
   (c) $(a + b) + c = a + (b + c)$ — Associative property of addition
   (d) $a \times b = b \times a$ — Commutative property of multiplication
   (e) $a \times 1 = a = 1 \times a$ — Existence of multiplicative identity
   (f) $(a \times b) \times c = a \times (b \times c)$ — Associative property of multiplication
   (g) $a \times (b + c) = a \times b + a \times c$ — Distributive property of multiplication over addition

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6. **Division algorithm**
Dividend = divisor × quotient + remainder

REVIEW EXERCISES

MULTIPLE CHOICE QUESTIONS

1. The product of first five whole numbers is:
   (a) 0 (b) 120 (c) 24 (d) 10
2. The difference between the successor and predecessor of 37,45,129 is:
   (a) 0 (b) 1 (c) 2 (d) 37,45,129
3. The product of the predecessor and successor of 99 is:
   (a) 9,702 (b) 9,800 (c) 9,900 (d) 9,988
4. The product of two odd numbers is:
   (a) an even number (b) an odd number (c) either even or odd (d) prime number
5. If a whole number is subtracted from 10, as well as added to 10, then the sum of the resulting numbers is:
   (a) 0 (b) 20 (c) 40 (d) 80
6. The product of a non-zero whole number and its successor is always:
   (a) an even number (b) an odd number (c) a prime number (d) divisible by 5

SOLVE MENTALLY

True or False

1. Every natural number is also a whole number.
2. Predecessor of an even natural number is always an odd natural number.
3. Successor of a two-digit number can never be a three-digit number.
4. The product of two whole numbers is 1 only if both of them are 1.
5. Division by zero is meaningless, hence it is not defined.

Fill in the Blanks

1. On multiplying any whole number a by 1 we get back _____, hence 1 is called the _____ of the whole numbers.
2. Since $8-2 \neq 2-8$, hence _____ property is not true for subtraction of whole numbers.
3. According to the division algorithm, dividend = quotient × _____ + remainder.
4. The _____ property of addition of whole numbers states that on adding any two whole numbers the result is again a _____ number.
5. Since the whole numbers satisfy _____ property of multiplication over addition, we can say that $5 \times (3 +$ _____$) = 5 \times 3 + 5 \times 2$.
6. When zero is divided by any natural number, the answer is always _____.

Answer in One Word or a Line

1. Which whole number has no predecessor?
2. Is there any whole number having no successor?

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3. How many whole numbers have their squares equal to themselves?
4. Is division of two whole numbers always defined? Is it commutative?
5. Name a four-digit number whose predecessor is a three-digit number.

Let's Evaluate

1. Write the three whole numbers occurring just after 9,998.
2. Write the three whole numbers occurring just before 20,001.
3. Write the predecessor of 1,02,999.
4. Write the successor of 76,85,949.
5. Find the sum of 2 and 7 using a number line.
6. Find the product of 3 and 6 using a number line.
7. Simplify $256 \times 55 + 45 \times 256$ using properties of whole numbers.
8. Find the value of $1{,}738 \times 125 - 1{,}738 \times 25$.
9. Simplify $(256 \div 16) \div 4$.
10. Find the least 5-digit number exactly divisible by 33.
11. By studying the pattern given below, evaluate the following:

$1 + 2 = \frac{2 \times 3}{2}$ $\quad$ $1 + 2 + 3 = \frac{3 \times 4}{2}$ $\quad$ $1 + 2 + 3 + 4 = \frac{4 \times 5}{2}$

(a) $1 + 2 + 3 + ... + 100$ (b) $2 + 4 + 6 + ... + 100$ (c) $30 + 31 + 32 + ... + 50$

Thinking Skills

1. Does an identity element exist in addition of whole numbers? What is it? In which other fundamental operation does an identity element exist? What is it?
2. Is the difference of two whole numbers commutative? What can you say about the absolute values of the difference?
3. If d divides n completely, can we say $\frac{n}{d}$ will also divide n completely?
4. Which is greater, the sum of first hundred whole numbers or the product of first hundred whole numbers?
5. If 4 is removed from the set of whole numbers, is the set closed with respect to addition?
6. If 7 is removed from the set of whole numbers, is the set closed with respect to multiplication?
7. Describe a real life situation that could be represented by the expression $8 \times 4 + 6$.

Values and Life Skills

1. A bus moves at a constant speed of 96 km per hour. How much distance will it cover in 14 h? Is it safe to drive above the speed limit?
2. In a canteen, a dosa costs ₹ 10 and a cup of tea costs ₹ 3. Reena had a dosa and a cup of tea everyday for 11 days. How much money did she spend in the canteen? Is it good for your health to eat canteen's food regularly?

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Some NCERT Textbook Questions

1. Find the value of the following:
   (a) $297 \times 17 + 297 \times 3$ (b) $54279 \times 92 + 8 \times 54279$
   (c) $81265 \times 169 - 81265 \times 69$ (d) $3845 \times 5 \times 782 + 769 \times 25 \times 218$
2. A vendor supplies 32 litres of milk to a hotel in the morning and 68 litres of milk in the evening. It the milk costs ₹ 15 litre, how much money is due to the vendor per day?
3. Match the following:
   (i) $425 \times 136 = 425 \times (6 + 30 + 100)$ (a) Commutativity under multiplication
   (ii) $2 \times 49 \times 50 = 2 \times 50 \times 49$ (b) Commutativity under addition
   (iii) $80 + 2005 + 20 = 80 + 20 + 2005$ (c) Distributivity of multiplication over addition
4. Which of the following will not represent zero:
   (a) $1 + 0$ (b) 0×0 (c) $\frac{0}{2}$ (d) $\frac{10 - 10}{2}$
5. If the product of two whole numbers is 1, can we say that one or both of them will be 1? Justify through examples.
6. Study the pattern:
   $1 \times 8 + 1 = 9$
   $12 \times 8 + 2 = 98$
   $123 \times 8 + 3 = 987$
   $1234 \times 8 + 4 = 9876$
   $12345 \times 8 + 5 = 98765$
   Write the next two steps. Can you say how the pattern works?
   (**Hint:** $12345 = 11111 + 1111 + 111 + 11 + 1$)

Exemplar Problems

1. The product of successor and predecessor of 999 is:
   (a) 999000 (b) 998000 (c) 989000 (d) 1998
2. A whole number is added to 25 and the same number is subtracted from 25. The sum of the resulting numbers is:
   (a) 0 (b) 25 (c) 50 (d) 75
3. Which of the following is not true?
   (a) $(7 + 8) + 9 = 7 + (8 + 9)$ (b) $(7 \times 8) \times 9 = 7 \times (8 \times 9)$
   (c) $7 + 8 \times 9 = (7 + 8) \times (7 + 9)$ (d) $7 \times (8 + 9) = (7 \times 8) + (7 \times 9)$
4. Which of the following statements is not true?
   (a) $0 + 0 = 0$ (b) $0 - 0 = 0$ (c) $0 \times 0 = 0$ (d) $0 \div 0 = 0$
5. The successor of 1 million is:
   (a) 2 millions (b) 1000001 (c) 100001 (d) 10001
6. Sum of the number of primes between 16 to 80 and 90 to 100 is:
   (a) 20 (b) 18 (c) 17 (d) 16

7. Given below
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   (i) The
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   (v) Sma
8. Find the pr

Quiz

Answer the fo
(a) What is t
(b) What is t
(c) What is t
(d) If X, Y a
(e) If Z is 3
(f) If X is 5

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7. Given below are two columns—Column I and Column II. Match each item of Column I with the corresponding item of Column II.

Column I	Column II
(i) The difference of two consecutive whole numbers	(a) 0
(ii) The product of two non-zero consecutive whole numbers	(b) 3
(iii) Quotient when zero is divided by another non-zero whole number	(c) 1
(iv) 2 added three times to the smallest whole number	(d) 6
(v) Smallest odd prime number	(e) even

8. Find the product of 8739 × 102 using distributive property.

Quiz

Answer the following if X + Y = Z, where X, Y, Z each stand for a distinct digit from 1 to 9:

(a) What is the greatest digit that X could be?

(b) What is the greatest digit that Z could be?

(c) What is the smallest digit that Z could be?

(d) If X, Y and Z are odd, what digit(s) could Z be? Why?

(e) If Z is 3 more than X, what digit(s) could Y be?

(f) If X is 5 times as great as Y, then what digit(s) could Z be? Why?

Carl Friedrich Gauss (1777–1855)

Carl Gauss was one of the most famous mathematicians of his times. He was brilliant from his school days. One day his Mathematics teacher asked the students to find the sum of the first 100 natural numbers. When the whole class was struggling with the question, Carl stood up within seconds and said 5050. He probably applied the formula

$$1 + 2 + 3 + \ldots + 100 = \frac{100 \times 101}{2} = 5{,}050.$$

What a genius he was!

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