Chapter 2

Operations on Large Numbers

Curricular Goals

- CG-1: Carries out the four basic operations with whole numbers, and discovers and recognises patterns in number sequences
- CG-4: Develops problem-solving skills with procedural fluency to solve mathematical puzzles as well as daily-life problems, and as a step towards developing computational thinking

Competencies

- C-1.3: Understands and visualises arithmetic operations and the relationships among them, knows addition and multiplication tables at least up to 10 × 10 (*pahade*) and applies the four basic operations on whole numbers to solve daily-life problems
- C-4.1: Solves puzzles and daily-life problems involving one or more operations on whole numbers (including word puzzles and puzzles from 'recreational' areas, such as the construction of magic squares)

Learning Outcomes

At the end of the lesson, learners will be able to:
perform addition and subtraction of large numbers. **evaluate** the product of large numbers. **perform** division of large numbers. **state** the properties of addition, subtraction, multiplication and division. **solve** word problems based on the four operations. **calculate** the average of the given numbers.

Get Ready!

21st CENTURY SKILLS

- Critical Thinking
  - APPLYING

Addition, Subtraction, Multiplication and Divison

Let us revise the terms of addition, subtraction, multiplication and division.

	Th	H	T	O	
		(1)	(1)		
	7	2	8	9	← Addend
+	1	5	2	3	← Addend
	8	8	1	2	← Sum

	Th	H	T	O	
	~~4~~ (3)	~~4~~ (13)	~~5~~ (14)	~~3~~ (13)	← Minuend
–	2	9	7	8	← Subtrahend
	1	4	7	5	← Difference

	H	T	O	
		4	3	← Multiplicand
×		1	2	← Multiplier
	5	1	6	← Product

Divisor → 20 | 4 5 ← Dividend ; Quotient: 2 ← Quotient

– 4 0

5 ← Remainder

Match the following:

a.	1125 + 3271 + 4258	i.	55212
b.	7218 ÷ 9	ii.	16392
c.	321 × 172	iii.	8654
d.	52190 – 35798	iv.	802

Let's Learn

Addition

We are already familiar with the addition of 5- and 6-digit numbers with regrouping. Addition of 7- and 8-digit numbers is also done in the same way.

Start adding from the ones place. If the sum of any column is more than ten, then regroup with the next column. For example, if the sum in the ones column is 13, regroup it as 1 ten and 3 ones. Write 3 in the ones column and carry over 1 ten to the tens column.

Look at the following examples.

Example 1: Add 4,32,576 and 2,51,762.

	L	TTh	Th	H	T	O
			(1)	(1)		
	4	3	2	5	7	6
+	2	5	1	7	6	2
	6	8	4	3	3	8

Thus, 4,32,576 + 2,51,762 = 6,84,338

Example 2: Add 5,36,24,092 and 2,43,65,188.

	C	TL	L	TTh	Th	H	T	O
						(1)	(1)	
	5	3	6	2	4	0	9	2
+	2	4	3	6	5	1	8	8
	7	7	9	8	9	2	8	0

Thus, 5,36,24,092 + 2,43,65,188 = 7,79,89,280

Properties of Addition

Property 1: If P and Q are two numbers, then $P + Q = Q + P$

Example: Consider the numbers 24,62,381 and 35,67,890.

24,62,381 + 35,67,890 = 60,30,271

and 35,67,890 + 24,62,381 = 60,30,271

Thus, 24,62,381 + 35,67,890 = 35,67,890 + 24,62,381

Property 2: If P, Q and R are three numbers, then $(P + Q) + R = P + (Q + R)$

Example: Consider the numbers 36,52,798, 56,87,456 and 10,29,385.

(36,52,798 + 56,87,456) + 10,29,385 = 93,40,254 + 10,29,385

= 1,03,69,639

Again, 36,52,798 + (56,87,456 + 10,29,385) = 36,52,798 + 67,16,841

= 1,03,69,639

Thus, (36,52,798 + 56,87,456) + 10,29,385 = 36,52,798 + (56,87,456 + 10,29,385)

Property 3: When zero is added to any number or a number is added to zero, then the sum is the number itself.

Example: 79,48,567 + 0 = 79,48,567

Similarly, 0 + 79,48,567 = 79,48,567

Property 4: When 1 is added to a number, you get the next number which is called the **successor** of the number.

Example: 3,56,84,598 + 1 = 3,56,84,599, which is the successor of 3,56,84,598.

Subtraction

We are familiar with the subtraction of 5- and 6-digit numbers. Subtraction of 7- and 8-digit numbers is also done in the same way.

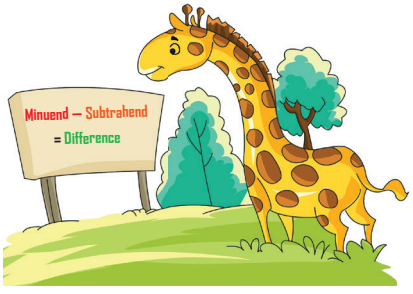
Example 1: Subtract 44,24,897 from 47,52,719.

	TL	L	TTh	Th	H	T	O
			(4)	(11)	(16)	(11)	
	4	7	~~5~~	~~2~~	~~7~~	~~1~~	9
–	4	4	2	4	8	9	7
		3	2	7	8	2	2

Thus, 47,52,719 – 44,24,897 = 3,27,822

Example 2: Subtract 7,81,601 from 9,87,50,210.

	C	TL	L	TTh	Th	H	T	O
		(7)	(16)	(14)	(9)	(12)	(0)	(10)
	9	~~8~~	~~7~~	~~5~~	~~0~~	~~2~~	~~1~~	~~0~~
–			7	8	1	6	0	1
	9	7	9	6	8	6	0	9



Thus, 9,87,50,210 – 7,81,601 = 9,79,68,609

Properties of Subtraction

Property 1: When zero is subtracted from any number, then the difference is the number itself.

Example: 59,57,643 – 0 = 59,57,643

Property 2: When a number is subtracted from itself, then the difference is zero.

Example: 36,53,784 – 36,53,784 = 0

Property 3: When 1 is subtracted from any number, you get the previous number which is called the **predecessor** of the number.

Example: 7,64,82,457 – 1 = 7,64,82,456, which is the predecessor of 7,64,82,457.

Word Problem

Example 1: Mr Smith bought a bike for ₹ 2,46,745 and a car for ₹ 15,80,480. How much money did he spend in all?

Solution:

	TL	L	TTh	Th	H	T	O
Cost of bike		(1) 2	4	(1) 6	(1) 7	4	5
Cost of car +	1	5	8	0	4	8	0
Total amount spent	1	8	2	7	2	2	5

Total amount Mr Smith spent is ₹ 18,27,225.

Example 2: Sabina had ₹ 15,00,000 with her. She bought a new car for ₹ 8,42,800 and a used car for ₹ 2,82,170. How much money does she have left?

Solution:

	TL	L	TTh	Th	H	T	O
Cost of the new car	(1)	(1) 8	4	2	8	0	0
Cost of the used car +		2	8	2	1	7	0
Money spent by Sabina	1	1	2	4	9	7	0

Amount of money left with Sabina = Total money Sabina had – Total money spent by her

	TL	L	TTh	Th	H	T	O
Total money Sabina had	1	(4) ~~5~~	(9) ~~0~~	(9) ~~0~~	(9) ~~0~~	(10) ~~0~~	0
Amount spent –	1	1	2	4	9	7	0
Amount left		3	7	5	0	3	0

Thus, Sabina is left with ₹ 3,75,030.

Exercise 2.1

1. **Add the following:**
   a. 78,91,253 + 4,95,865
   b. 18,59,231 + 48,92,193 + 53,52,476
2. **Subtract the following:**
   a. 89,21,352 – 4,85,189
   b. 35,21,792 –18,39,198
3. **Solve the following:**
   a. 2,54,27,192 + 32,51,678 + 58,41,902
   b. 78,15,929 + 25,28,591 – 59,72,891
4. **Ms Shrishti invested ₹ 15,50,500 in her business last year. The total sales was ₹ 8,78,450. What is the difference between her sales and investment?**
5. **Rahul's father saved ₹ 12,85,925 in the last 15 years. How much more should he save to make it ₹ 15,00,000?**

   Savings are an important part of financial planning for everyone. With your parents, discuss some ways to save money. Note down two points that you learn from the discussion.

6. **21,32,481 people live in State A. 2,42,745 people moved from State B to State A and 18,452 people moved from State A to State C. How many people now live in State A?**
7. **Fill in the missing digits.**

a.

	L	TTh	Th	H	T	O
	8	2	□	4	2	5
+	1	□	5	□	7	8
	9	5	9	8	0	3

b.

	L	TTh	Th	H	T	O
	7	8	□	5	7	2
–	4	□	1	□	2	□
	3	5	5	3	4	9

HOTS

21st CENTURY SKILLS • Applying

Think and Solve

1. Write the largest 7-digit number that ends with 1 and the smallest 7-digit number that ends with 2, using the digits 7, 8, 9, 2, 0, 1, 4 without repeating any digit.
2. What number should be added to the sum of the above two numbers to make it 1,25,42,179?

Multiplication

We have already learnt how to multiply two 3-digit numbers and how to multiply a 4-digit number by a 2-digit number. Let us discuss the steps involved in the multiplication of any number by a 3-digit or a 4-digit number.

Multiplication of a Number by a 3-digit Number

Multiplication of a number by a 3-digit number involves 3 steps. First, multiply the multiplicand by the place value of ones digit of the multiplier, then by the place value of tens digit of the multiplier, and then by the place value of hundreds digit of the multiplier. Then add the three answers.

Example: Multiply 1275 by 428.

Here, 1275 is the multiplicand and 428 is the multiplier.

		L	TTh	Th	H	T	O	
				1	2	7	5	← Multiplicand
	×				4	2	8	← Multiplier
Step 1: 1275 × 8 =			1	0	2	0	0	
Step 2: 1275 × 20 =			2	5	5	0	0	
Step 3: 1275 × 400 =	+	5	1	0	0	0	0	
		5	4	5	7	0	0	← Product

Therefore, 1275 × 428 = 5,45,700

Multiplication of a Number by a 4-digit Number

Multiplication of a number by a 4-digit number involves 4 steps. First, multiply the multiplicand by the place value of ones digit, then by the place value of tens digit, then by the place value of hundreds digit and then by the place value of thousands digit. Then add the four answers.

Example: Multiply 5297 by 1025.

Here, 5297 is the multiplicand and 1025 is the multiplier.

		TL	L	TTh	Th	H	T	O	
					5	2	9	7	← Multiplicand
	×				1	0	2	5	← Multiplier
Step 1: 5297 × 5				2	6	4	8	5	
Step 2: 5297 × 20			1	0	5	9	4	0	
Step 3: 5297 × 0			0	0	0	0	0	0	
Step 4: 5297 × 1000	+	5	2	9	7	0	0	0	
		5	4	2	9	4	2	5	← Product

Therefore, 5297 × 1025 = 54,29,425

Properties of Multiplication

Property 1: The product of any number and 1 is the number itself.

Example: 8521 × 1 = 8521; 24,683 × 1 = 24,683

Property 2: The product of any number with 0 is 0.

Example: 38,567 × 0 = 0 ; 4,29,732 × 0 = 0

Property 3: If P and Q are two numbers, then $P \times Q = Q \times P$.

Example: 24,613 × 124 = 30,52,012

Also, 124 × 24,613 = 30,52,012

So, 24,613 × 124 = 124 × 24,613

Know More

The product of an even number and an odd number is an even number.

Property 4: The product of two even numbers is an even number.

Example: 214 × 4 = 856

Property 5: The product of two odd numbers is an odd number.

Example: 117 × 7 = 819

Word Problem

Example: A basket of apples costs ₹ 1346. What is the cost of 96 such baskets?

		L	TTh	Th	H	T	O
Cost of 1 basket of apples				1	3	4	6
Total number of baskets	×					9	6
				8	0	7	6
	+	1	2	1	1	4	0
Cost of 96 baskets of apples		1	2	9	2	1	6

Hence, 96 baskets of apples will cost ₹ 1,29,216.

Exercise 2.2

1. **Multiply the following:**
   a. 1028 × 321 b. 4721 × 521 c. 1231 × 482
   d. 1845 × 240 e. 4837 × 103 f. 3421 × 120
2. **A silk saree costs ₹ 2428. What will be the cost of 134 such sarees?**
3. **There are 1520 employees in an office. The office collects ₹ 125 from each employee for charity. Find the total amount collected.**

4. **Find the product of the largest 3-digit number and the smallest 4-digit number.**
5. **A toy store sells 363 dolls in a day. How many dolls will be sold in 1268 days?**

6. **A restaurant sells 456 idlis in a day. How many idlis will the restaurant sell in 15 weeks?**

Short Cut Multiplication

Consider 48 × 102.

102 is 100 + 2.

48 × 102 ⟶ 48 × 100 = 4800

48 × 2 = + 96

4896

Try 121 × 39.

39 is 40 – 1.

121 × 39 ⟶ 121 × 40 = 4840

121 × 1 = – 121

4719

Division

Choose the answers from the box and fill in the blanks with the letter beside each answer in the correct order. What name do you get?

726 (U)	421 (A)	95 (M)	451 (J)	12622 (N)
31713 (A)	808 (A)	7722 (N)	28 (R)	

1. 448 divided by 16 ..... 2. 5052 divided by 12 .....
3. 9500 divided by 100 ..... 4. 95139 divided by 3 .....
5. 69498 divided by 9 ..... 6. 7986 divided by 11 .....
7. 8118 divided by 18 ..... 8. 80800 divided by 100 .....
9. 75732 divided by 6 .....

Dividing a Number by 2- and 3-digit Numbers

Example 1: Divide 4932 by 38.

Step 1: 38 is a 2-digit number. So, consider the number formed by the thousands and hundreds place in the dividend.

49 > 38, so divide 49 by 38.

Step 2: Bring down the next digit and divide.

Step 3: Bring down the last digit and divide.

Step 4: No more digits are left to bring down.

Therefore, the quotient is 129 and remainder is 30.

```
   129
38 | 4932
   - 38
   ----
    113
   - 76
   ----
    372
   -342
   ----
     30
```

Checking Division

You can check your division by using the following formula.

Quotient × Divisor + Remainder = Dividend

129 × 38 + 30 = 4932

Example 2: 320 metres of cloth is needed to make a circus tent. How many tents can be made with 64,320 metres of cloth?

Number of tents made from 320 metres of cloth = 1

Number of tents made from 64,320 metres of cloth

= 64,320 ÷ 320

(Here, 32 < 320, so we put a zero in the quotient and bring down the next digit.)

Therefore, 201 tents can be made from 64,320 metres of cloth.

```
      201
320 | 64320
     - 640
       320
     - 320
         0
```


Properties of Division

Property 1: If a number is divided by itself, then the quotient is always 1.

Example: 95,462 ÷ 95,462 = 1

Property 2: If a number is divided by 1, then the quotient is the number itself.

Example: 95,462 ÷ 1 = 95,462

Property 3: If zero is divided by a number other than zero, then the quotient is always zero.

Example: 0 ÷ 721 = 0; 0 ÷ 4124 = 0

21st CENTURY SKILLS

- Information Literacy
- INDIAN CITY

Exercise 2.3

1. **Divide the following and verify your answer.**

   a. 10,427 ÷ 28 b. 51,755 ÷ 25 c. 12,579 ÷ 33 d. 68,572 ÷ 124

2. **The cost of 11 identical mobile phones is ₹ 91,300. What is the cost of 1 mobile phone?**

3. **100 bananas are required to feed animals in a sanctuary in one day. How many days will 3200 bananas last in the sanctuary?**
4. **68 pearls are needed to make a necklace. If there are 14,620 pearls, then how many necklaces can be made?**

Hyderabad is popularly known as the City of Pearls. Find out why.

HOTS • Problem Solving

Think and Solve

1. A family eats 52 kg of rice in a month. How many complete months will 768 kg of rice last?

   How much more rice is needed to make it last for one more month? If the family reduces its consumption of rice by 4 kg per month, how many months will the given quantity last?
2. Fill in the circles with >, < or = sign without actually performing the calculations.

   a. 482542 ÷ 32 ◯ 42 + 482542 b. 817 – 415 ◯ 415 × 105

Average

What is an average?

Why do we need averages?

An **average** is a single value which represents a group of values.

Amit and Arjun are two friends who go to play volleyball on the beach every day and on their way back, they collect seashells. The number of shells that they collected during a week is given below.

Day	Amit	Arjun
Monday		
Tuesday		

Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

At the end of the week, they find that the total number of shells collected by both is the same. But Amit would not accept this and said only on the last day, Arjun collected more shells than him because, he was very tired that day and could not collect more. On all the other days, he had collected more than Arjun.

Does it mean that Amit has collected more seashells?

No, on an average, Amit has collected $\frac{28}{7}$ = 4 shells per day. Arjun's average is also the same ($\frac{28}{7}$ = 4 shells) as Amit's. This means that both collected the same number of shells.

How do we calculate the average?

Step 1: Find the sum of all the given numbers.

Step 2: Divide the sum by the number of addends given.

Step 3: The quotient is the average.

Example 1: The runs scored by a cricketer in 11 matches are as follows:
111, 98, 42, 79, 101, 89, 97, 82, 89, 67, 58
Find his average score.

Solution: Total runs scored by the cricketer
= 111 + 98 + 42 + 79 + 101 + 89 + 97 + 82 + 89 + 67 + 58 = 913

$$\textbf{Average score} = \frac{\text{Total runs}}{\text{No. of matches played}} = \frac{913}{11} = 83$$

$\therefore$ The average score of the cricketer is 83.

Example 2: Mr Khan has decided to take his family to his village over the weekend by car. During the first hour, he covered 55 km. During the second hour, he covered 52 km. During the third hour, he covered 48 km and during the fourth hour, he covered 57 km. What is his average speed?

Total distance covered in 4 hours

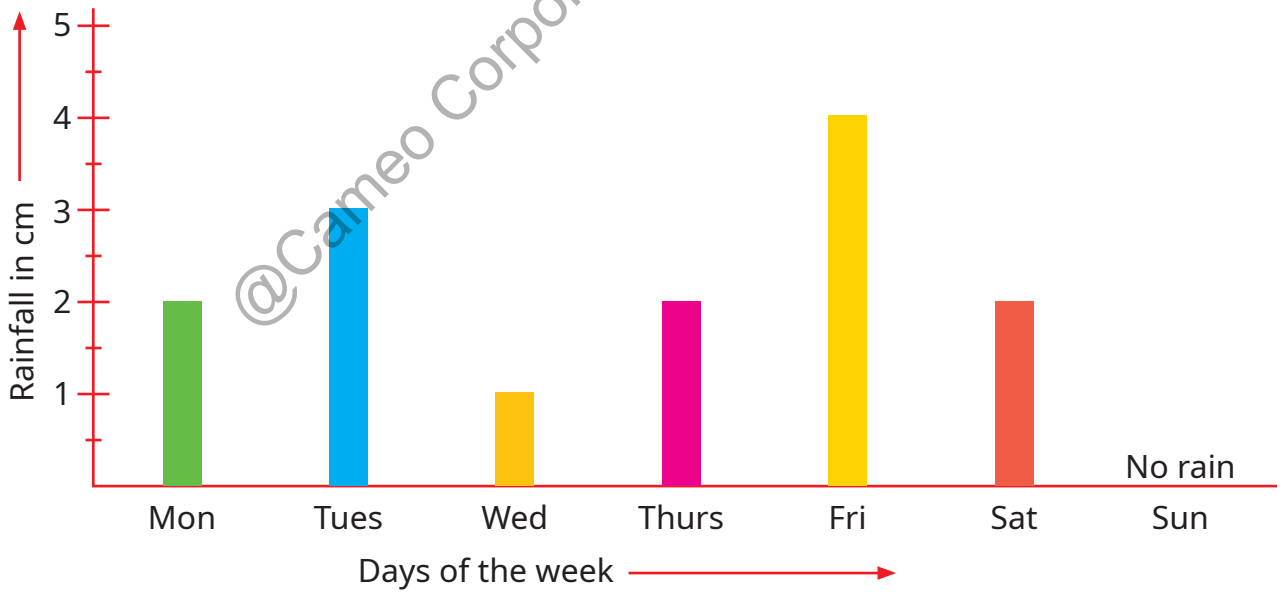
= 55 km + 52 km + 48 km + 57 km

= 212 km

$$\textbf{Average Speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{212}{4}$$

= 53 kilometres per hour

Exercise 2.4

1. **Find the average of the first 10 even numbers.**
2. **Find the average of the first five multiples of 4.**
3. **The marks scored by Ravi in 5 Maths tests are 81, 78, 93, 85 and 88. His marks in 5 English tests are 68, 72, 90, 88 and 82. Find his average marks in both Maths and English. In which subject did he score better?**
4. 

The above bar graph shows the amount of rainfall in centimetres during a week.

a. What is the average rainfall?

b. On which day was the rainfall less than the average?

c. On which days was the rainfall more than the average?

d. Was the rainfall on any one day equal to the average rainfall over the week?

5. The runs scored by two teams of cricket players in 7 matches are as follows:

Match	1	2	3	4	5	6	7
Team A	247	328	521	128	272	391	247
Team B	198	228	361	408	521	452	12

a. Which team's performance was better?

b. In how many matches did Team A score better than their average?

c. In how many matches did Team B score less than their average?

HOTS • Problem Solving

Think and Solve

1.

3	13	C	D	E	2	G	I

If the sum of any three consecutive numbers is 18, find the value of I.

2.

6						6	

Given above is a grid to fill an 8-digit number. Fill in the empty boxes with digits so that the sum of any three consecutive digits is 19 and that 8-digit number is an even number.

Can there be more than one answer?