Secondary

MATHEMATICS

Class-VI

Contents

NATURAL NUMBERS AND WHOLE NUMBERS

INTRODUCTION

Do you remember numbers? Let us solve some problems.

1. **Fill in the following blanks.**

   (a) The place value of 5 in 37572 is _____ .

   (b) 8 occurs at _____ place in 105876.

   (c) Place value of 4 in 42160 is _____ .

   (d) 5 occupies the _____ place in 37652.

   (e) The face value of 7 in 4709606 is _____ .

   (f) $3 \times 100000 + 5 \times 1000 + 7 \times 10 + 8 \times 1 =$ _____ .

   (g) $200000 + 4000 + 800 + 6 =$ _____ .

2. **Find the product of the place value and face value of 5 in 76085432.**

3. **Find the product of the largest 4-digit number and the smallest 4-digit number. Write the product in expanded form also.**

4. **Write all the possible 3-digit numbers using the digits 7, 5, 1.**
   (Repetition not allowed)

5. **Write all the possible 3-digit numbers using the digits 4, 0, 6.**
   (Repetition not allowed)

6. **Write the following numbers in Indian System of Numeration.**

   (a) 8751432   (b) 60002   (c) 491603   (d) 632245687

7. **Write the following numbers in International System of Numeration.**

   (a) 5737802   (b) 411809   (c) 33246951   (d) 898576449

8. **Write the numerals for the following:**

   (a) Thirty two million four thousand three hundred and twenty nine.

   (b) Thirty nine crore forty eight lakh nine thousand and eighty eight.

9. **How many lakhs make 6 millions?**

10. **How many millions make 17 crores?**

ROMAN NUMERALS

Have you ever seen a clock of this type?

See! In place of numerals 1 to 12, symbols like I, II, III, IV are shown here.

These symbols are called **Roman Numerals.**

Now observe these Hindu Arabic Numerals and their corresponding Roman Numerals.

Hindu Arabic Numerals	I	5	10	50	100	500	1000
Roman Numerals	I	V	X	L	C	D	M

The rules for this system of numeration are given below:

- **Rule 1 –**   If a symbol is repeated, its value is added as many times as it occurs.

  For example :   II = 1 + 1 = 2

  XXX = 10 + 10 + 10 = 30

- **Rule 2 –**   A symbol is not repeated more than three times but the symbols V, L and D are never repeated.

- **Rule 3 –**   If a symbol of smaller value is written to the right of a symbol of greater value, its value gets added to the value of greater symbol.

  For example: VI = 5 + 1

                = 6

  LXV = 50 + 10 + 5

                = 65

- **Rule 4 –**   If a symbol of smaller value is written to the left of a symbol of greater value, its value is subtracted from the symbol of the greater value.

  For example: IV = 5 – 1 = 4

  XL = 50 – 10 = 40

  XC = 100 – 10 = 90

- **Rule 5 –**   The symbols V, L and D are never written to the left of a symbol of greater value, i.e. V, L, D are never subtracted.

Observe the Roman Numerals corresponding to some Hindu Arabic Numerals.

1 = I	10 = X
2 = II	20 = XX
3 = III	30 = XXX
4 = IV	40 = XL
5 = V	50 = L
6 = VI	60 = LX
7 = VII	70 = LXX
8 = VIII	80 = LXXX
9 = IX	90 = XC
10 = X	100 = C

Let us study some examples.

Example 1: Write the Roman Numerals corresponding to the following Hindu Arabic Numerals.

(a) 19 (b) 56 (c) 44 (d) 98 (e) 78

Solution:

(a) 19 = 10 + 9   (b) 56 = 50 + 6
    = XIX   = LVI

(c) 44 = 40 + 4   (d) 98 = 90 + 8
    = XLIV   = XCVIII

(e) 78 = 70 + 8

    = (50 + 10 + 10) + 8

    = LXXVIII

Example 2: Convert the following into Hindu Arabic Numerals.
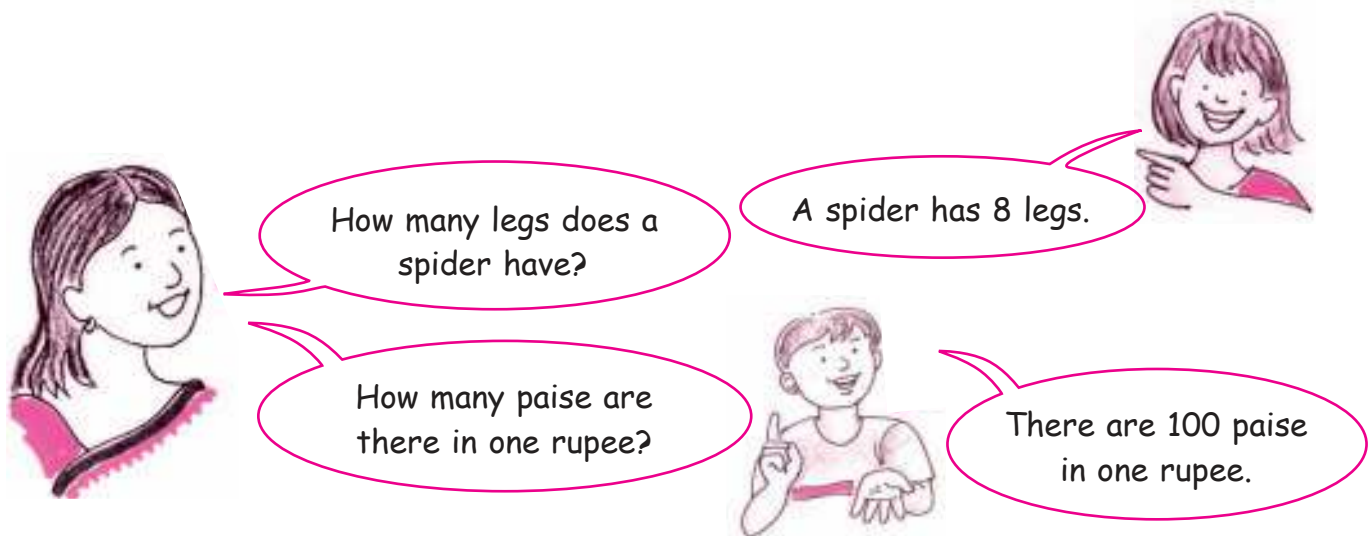
(a) LXXIX (b) XLIX (c) XCVII (d) XCI

Solution:

(a) LXXIX = 50 + 10 + 10 + 9   (b) XLIX = 40 + 9
      = 79   = 49

(c) XCVII = 90 + 7   (d) XCI = 90 + 1
     = 97   = 91

1. **Write the Roman Numeral for each of the following:**

   (a) 33   (b) 500   (c) 48   (d) 76   (e) 95

   (f) 41   (g) 87   (h) 66   (i) 19   (j) 1000

2. **Convert the following into Hindu Arabic Numerals.**

   (a) XXVI   (b) LXXVII   (c) XCI   (d) LXXXV   (e) D

   (f) XCIX   (g) XCVII   (h) LV   (i) XLI   (j) XXIX

3. **Solve and write the results in Roman Numerals.**

   (a) 32 + 67   (b) 216 − 174

   (c) 12 × 7   (d) 3645 ÷ 45

4. **Which of the following is meaningless?**

   (a) VVII   (b) XLI   (c) LIV   (d) IC   (e) LIL

   (f) IVC   (g) XCI   (h) VL

5. **Match the following:**

DXLV	908
MMX	591
CMVIII	545
CCIII	2010
DXCI	203

6. **Write the following in Roman Numerals.**

   (a)   Year in which India got Independence.

   (b)   Year in which India became Republic.

   (c)   Year in which you were born.

   (d)   Present year.

How many legs does a spider have?

A spider has 8 legs.

How many paise are there in one rupee?

There are 100 paise in one rupee.

So we have used the numbers 1, 2, 3, 4, ... for answering these questions.

Numbers 1, 2, 3, 4, ... which we use for counting form the system of **Natural Numbers** (Counting numbers).

Remember
- The smallest natural number is 1.
- We cannot find the greatest natural number.

Look at the following picture. What is the number of boys in this group?

The number of boys in this group is zero (0).

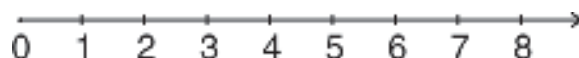Natural numbers along with zero form the system of **Whole Numbers**.

Now look at the whole numbers given on a number line.
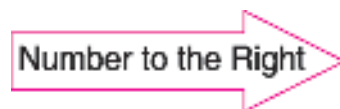

SUCCESSOR AND PREDECESSOR

One more than any whole number is called the **successor** of that whole number.
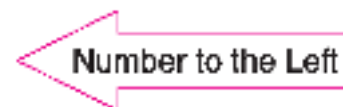
For example: 51 is the successor of 50

10000 is the successor of 9999

Number to the Right

One less than any whole number is called the **predecessor** of that whole number.

For example: 61 is the predecessor of 62

99999 is the predecessor of 100000

Number to the Left

Let us take up some examples.

Example 3: Write the greatest 4-digit number using the digits 5, 0, 2. **(digits may repeat)**

Solution: Any 4-digit number occupies four places, i.e. thousands, hundreds, tens and ones. Since 5 is the largest number here, it will occupy most of the places in the required number and rest of the numbers will occur only once and that too in descending order. So, the required number will be,

Th	H	T	O
5	5	2	0

Example 4: Rearrange the digits of 72094186 to form the smallest 8-digit number.

Solution: We write the digits in ascending order–

0, 1, 2, 4, 6, 7, 8, 9

Since we cannot start a number with zero, we start the number with 1. So the required number is–

1, 02, 46, 789

1. **Complete the statements by filling in the blanks.**

    (a) The smallest whole number is _____.

    (b) There is _____ largest whole number.

    (c) In whole numbers, _____ has no predecessor.

    (d) The predecessor of the smallest 5-digit number has _____ digits.

    (e) The successor of the greatest 5-digit number is _____.

    (f) The smallest 7-digit number ending in 5 is _____.

    (g) 387 is to the _____ of 388 on the number line.

    (h) 4397 is to the _____ of 4396 on the number line.

2. **Write the successor of the following:**

    (a) 45638   (b) 10009   (c) 220209   (d) 4226372

3. **Write the predecessor of the following:**

    (a) 33801   (b) 100000   (c) 6698979   (d) 80115670

4. **Find the next three successors of 647999.**

5. **Find the three immediate predecessors of 552002.**

6. **Compare the following numbers:**

    (a) 729 ◯ 279   (b) 10899 ◯ 10799

    (c) 9785 ◯ 7835   (d) 135629 ◯ 136529

7. **Arrange the following in ascending order.**

    43, 287, 15769, 833, 49538, 34, 798665

8. **Arrange the following in descending order.**
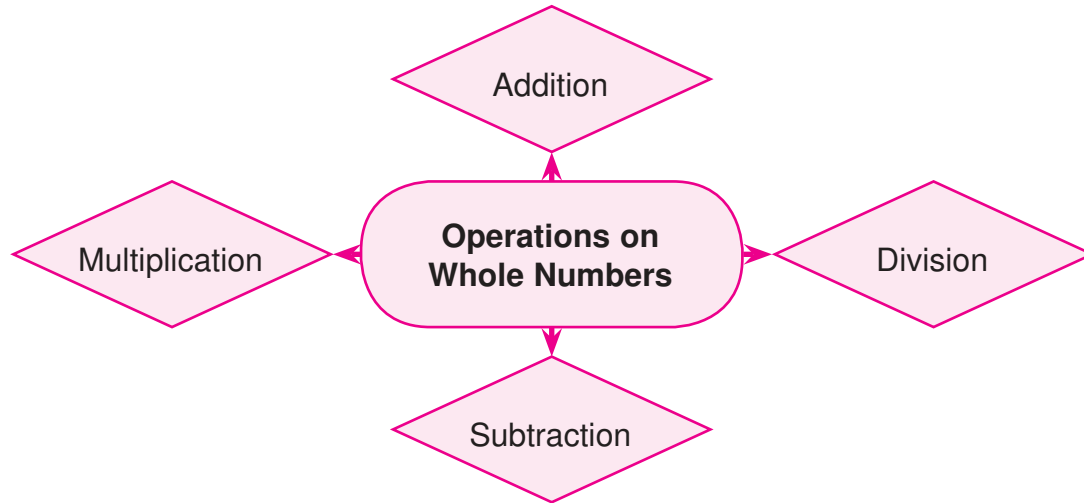
    3951, 1024, 977, 422596, 38675, 560832, 67.

9. **Form the greatest 7-digit number using the digits 3, 8, 9.**
    (digits may repeat)

10. **Write the smallest 6-digit number using the digits 4, 5, 0.**
    (digits may repeat)

OPERATIONS ON WHOLE NUMBERS

Let us take up the properties of each and every operation one by one.

A. ADDITION OF WHOLE NUMBERS

Properties of Addition

Property-1: The sum of two whole numbers is again a whole number.

e.g. 3 + 8 = 11

Property-2: The sum remains the same even after changing the order of addends.

e.g. 23 + 18 = 18 + 23

Property-3: The sum remains the same, when the order or the grouping of three or more addends is changed.

e.g. 11 + (18 + 25) = (11 + 18) + 28

Property-4: When a number is added to zero or zero is added to the number, sum is the number itself.

e.g. 7 + 0 = 0 + 7 = 7

Let us take up an example to see that the sum remains same even if the order of the addends is changed.

Example 5: Add 469, 35, 31, 5 in 2 different ways.

Solution:

469 + 35 + 5 + 31   469 + 31 + 35 + 5

504   +   36   500   +   40   (By interchanging the order of the addends.)

540   540

B. SUBTRACTION OF WHOLE NUMBERS

Properties of Subtraction

Property-1: The difference between two whole numbers may or may not be a whole number.
e.g. $5 - 4 = 1$ (is a whole number). But $4 - 5 = -1$ is not a whole number.

Property-2: The difference between two same whole numbers is always zero.

e.g. $5 - 5 = 0$

Property-3: For any three whole numbers, say 6, 4, 2 $(6 - 4) - 2$ is not equal to $6 - (4 - 2)$.

Property-4: When zero is subtracted from a whole number, the difference is the number itself.

e.g. $5 - 0 = 5$

Property-5: If 8, 5, 3 are whole numbers, such that $8 - 5 = 3$ then $5 + 3 = 8$
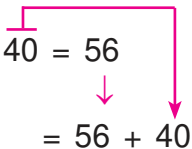
Let us study an example based on Property-5.

Example 6: Subtract 40 from 96

Solution: $96 - 40 = 56$

or 96 $= 56 + 40$

Worksheet 3

1. **Fill in the blanks to make the following statements true.**

    (a) $1794 + 624 = 624 + $ _____

    (b) $(287 + 163) + 800 = 287 + ($ _____ $+ 800)$

    (c) $432 + $ _____ $= 111 + 432$

    (d) $97 + 561 = $ _____ $+ 97$

    (e) $(200 + 1020) + 3303 = $ _____ $+ (200 + $ _____ $)$

    (f) $0 + 268 = $ _____

    (g) $469 - 0 = $ _____

    (h) $1238 - $ _____ $= 1238$

    (i) $29487 + $ _____ $= 29487$

2. **Replace (*) with the appropriate digit.**

(a)
```
   2 9 4 2 2
 −   6 8 * 5
 ───────────
   2 * 5 4 7
```

(b)
```
   4 7 8 * 5
 + 3 * 3 3 4
 ───────────
   8 4 * 3 9
```

(c)
```
     2 3 9 * 8
 + 1 * 9 8 0 *
 ─────────────
   1 4 3 * 6 9
```

(d)
```
   8 0 0 1 9
 − * 4 3 * *
 ───────────
   2 5 * 0 3
```

3. **Add 718662 to 360895. Now add 360895 to 718662. Are the two results same?**

4. **Add the following numbers by rearranging them: (Use property here)**

(a) 786 + 342 + 214

(b) 479 + 2000 + 21

(c) 225 + 725 + 275 + 275

(d) 67 + 1376 + 624 + 933

(e) 637 + 908 + 363

(f) 2062 + 547 + 938 + 353

5. **Subtract the following and check your answer by corresponding addition.**

(a) 29435 − 17005

(b) 100000 − 62581

(c) 75691 − 45512

(d) 77426 − 71236

6. **In a school, the number of students is 5637. If 142 students took admission during that year, find the total number of students in the school.**

7. **The price of a car is ₹ 3,76,866. If it is increased by ₹ 42,049, find the new price of the car.**

8. **A club organises a trip to the Disney World. The cost of the whole package is ₹ 1,83,420. The club gives a discount of ₹ 47,632. What is the cost of the package after the discount?**

9. **Rahul deposited ₹ 57,630 in the bank. After a week, he withdrew ₹ 19,211. What is the current balance in Rahul's account?**

10. **A garment factory produces 33000 trousers every year. Out of these, 12309 are for men and 9538 are for women. Find the number of trousers produced for children.**

C. MULTIPLICATION OF WHOLE NUMBERS

Properties of Multiplication

Property-1: If two whole numbers are multiplied in either order, the product remains the same.

e.g. $3 \times 8 = 8 \times 3 = 24$

Property-2: If three numbers are multiplied in any grouping or order, the product remains the same.

e.g. $2 \times (5 \times 7) = (2 \times 5) \times 7 = (2 \times 7) \times 5 = 70$

Property-3: The product of a whole number and 1 is the number itself.

e.g. $1 \times 5 = 5 \times 1 = 5$

Property-4: The product of any whole number and zero is zero.

e.g. $2 \times 0 = 0 \times 2 = 0$

Worksheet 4

1. **Use the properties of multiplication and fill in the following blanks.**

   (a) $0 \times 489 =$ _____

   (b) $1 \times 741 =$ _____

   (c) $27 \times 635 = 635 \times$ _____

   (d) $(242 \times 197) \times 581 = 242 \times (197 \times$ _____ $)$

   (e) $479 \times$ _____ $= 479$

   (f) _____ $\times 831 = 0$

   (g) $162 \times 0 \times 1025 =$ _____

2. **If the cost of one burger is ₹ 50.50, what will be the cost of 25 such burgers?**

3. **In a library, there are 27 book shelves. If there are 479 books on each book shelf, find the total number of books in the library.**

4. **A store has 432 dresses for girls. If the cost of each dress is ₹ 583.50, find the cost of all dresses.**

MORE ABOUT MULTIPLICATION PROPERTIES

Consider the numbers 3, 4 and 5.

Let us add 3 and 4 and multiply the sum by 5

$$(3 + 4) \times 5$$
$$\downarrow$$
$$7 \times 5$$
$$= 35$$

Now multiply 3 and 4 separately by 5 and then add the products.

$$3 \times 5 + 4 \times 5$$

$$15 \quad + \quad 20$$

$$35$$

In both the cases, we get 35. So, we can say that–

$$(3 + 4) \times 5 = 3 \times 5 + 4 \times 5$$

Similarly, $\qquad (7 - 3) \times 5 = 7 \times 5 - 3 \times 5$

> This is known as **Distributive Property of Multiplication.** It is useful for multiplying large numbers.

Example 7: Multiply 172×97

Solution: We know that $97 = (100 - 3)$

$172 \times (100 - 3)$

or $\qquad 172 \times (100 - 3) = 172 \times 100 - 172 \times 3$

$$= 17200 - 516$$

$$= 16684$$

Example 8: Solve $569 \times 45 + 569 \times 55$

Solution: $569 \times (45 + 55)$ $\qquad \leftarrow$ Taking out 569 as common factor from both the products.

$= 569 \times 100$ $\qquad \leftarrow$ Multiplying by 100 orally.

$= 56900$

Example 9: Solve $361 \times 162 - 361 \times 60 - 2 \times 361$

Solution: $361 \times (162 - 60 - 2)$ $\qquad \leftarrow$ Taking out 361 as common factor and putting rest of the terms in a bracket.

$= 361 \times (162 - 62)$

$= 361 \times 100$

$= 36100$

Worksheet 5

1. **Fill in the following blanks by using different properties of multiplication.**

    (a) $52 \times (63 + 37) = (52 \times$ _____ $) + ($ _____ $\times 37)$

    (b) $297 \times ($ _____ $+ 43) = (297 \times 88) + (297 \times$ _____ $)$

    (c) _____ $\times (84 + 16) = 36 \times 84 + 36 \times$ _____

    (d) $218 \times 94 = (218 \times$ _____ $) - (218 \times 6)$

    (e) $778 \times 994 = (778 \times 1000) - (778 \times$ _____ $) - 778.$

2. **Rearrange the numbers and then multiply them.**

    (a) $125 \times 488 \times 8$ (b) $625 \times 25 \times 20 \times 4$

    (c) $16 \times 125 \times 8 \times 625$ (d) $20 \times 1975 \times 5$

    (e) $8 \times 25 \times 125 \times 40$ (f) $200 \times 625 \times 16 \times 50$

3. **Find the product by using distributive property.**

    (a) 241×107 (b) 685×94

    (c) 439×995 (d) 1009×1392

    (e) 98×553 (f) 999×399

4. **Find the value by using distributive property.**

    (a) $1562 \times 62 + 1562 \times 38$ (b) $638 \times 176 - 638 \times 75 - 638$

    (c) $85 \times 15 + 15 \times 15$ (d) $688 \times 10 \times 437 - 6880 \times 337$

    (e) $125 \times 8 \times 883 + 117 \times 25 \times 40$

    (f) $750 \times 17 + 750 \times 38 + 27 \times 750 + 18 \times 750$

5. **Rohan buys 12 computers and 12 printers. If the cost of one computer and one printer is ₹ 56,233 and ₹ 7,867 respectively, find the total cost incurred by Rohan. (Use distributive property of multiplication.)**

6. **In a school, the monthly fee of a child is ₹ 497. If there are 2983 students in a school, find the total fee collected in a month.**

   (Use distributive property of multiplication.)

D. DIVISION OF WHOLE NUMBERS

Property-1: If two whole numbers are divided, their quotient may or may not be a whole number.

e.g. $3 \div 6 = ½$ but $6 \div 3 = 2$

Property-2: A number divided by itself, gives the quotient as 1.

e.g. $5 \div 5 = 1$.

Property-3: A number divided by one gives the quotient as the number itself.

e.g. $4 \div 1 = 4$

Property-4: A multiplication fact of two distinct and non-zero whole numbers gives two division facts.

e.g. $4 \times 5 = 20$ and $20 \div 5 = 4$, $20 \div 4 = 5$

Property-5: Zero divided by any number gives the quotient as zero.

e.g. $0 \div 3 = 0$

We also know

In division

Dividend = Divisor × Quotient + Remainder

Let us take up some examples.

Example 10: Find the least number that should be subtracted from 1000 so that 30 divides the difference exactly.

Solution: Divide 1000 by 30

```
30 | 1000 | 33
      90
     ----
      100
       90
     ----
       10
```

$1000 - 10 = 990$

So, 10 should be subtracted from 1000 so that the difference, i.e. 990 is exactly divisible by 30.

Example 11: Find the least number that should be added to 1000 so that 35 divides the sum exactly.

Solution:

```
35 | 1000 | 24
      70
     ----
      300
      280
     ----
       20
```

The difference between divisor and remainder is 35 − 20 = 15

Therefore, 15 should be added to 1000 so that the sum 1015 is exactly divisible by 35.

Worksheet 6

1. **Divide and check your answer.**

   (a) 2781 ÷ 35   (b) 49277 ÷ 511

   (c) 7335 ÷ 122   (d) 64895 ÷ 247

2. **Find the least number that should be subtracted from 1000 so that 35 divides the difference exactly.**

3. **Find the least number that should be added to 2000 so that 45 divides the sum exactly.**

4. **Find the largest 5-digit number which is exactly divisible by 40.**

5. **In a parade, the soldiers are arranged in 14 rows. If the number of soldiers is 504, find the number of soldiers in each row.**

6. **In a dance class, 137 students got themselves enrolled. If the total fee collected is ₹ 3,56,200, find the fee paid by each student.**

ESTIMATION

Do you remember Rounding off numbers? Let us recall.

1. **Round off the given numbers as directed.**

   (a) 48 (to the nearest ten)

   (b) 3,285 (to the nearest thousand)

   (c) 87,08,463 (to the nearest ten lakh)

   (d) 4,53,73,043 (to the nearest crore)

2. Round off the given numbers as directed.

   (a) 3.84 (to the nearest ones)

   (b) 21.472 (to the nearest hundredth)

   (c) 1.53 (to the nearest tenth)

3. Round 4,25,163 to the nearest hundred, ten thousand and lakh.

ESTIMATION OF OUTCOMES OF NUMBER SITUATIONS

Let us take some situations.

Situation 1: Rohan plans to give a treat to his eight friends in school on his birthday. His father gave him ₹ 500 for this. He decides to give a sandwich, pastry and fruit juice to these friends. One sandwich costs ₹ 20, one pastry costs ₹ 25 and one fruit juice costs ₹ 15. Rohan roughly calculates the amount he needed. This will be the sum of amount he spends on these three items.

Situation 2: On a particular day a businessman has to receive ₹ 5,38,485 and ₹ 2,19,560 from two different parties. He also has to pay a sum of ₹ 6,35,750 to someone on the same day. He quickly round off the numbers to the nearest lakh and then works out if he will be able to pay the money by evening. Will he be able to pay back the amount?

The estimation of outcomes of numbers is a reasonable guess of the actual value.

Remember

- **Estimating** means approximating a quantity to the accuracy required.
- Estimation is done by rounding off the numbers involved and getting a quick and rough answer.

ESTIMATION OF SUM OR DIFFERENCE

When we estimate sum or difference, we should have an idea of why we need to round off and therefore, the place to which the rounding is needed.

Example 12: Estimate 4,356 + 13,849

Solution: We shall round off the numbers to the nearest thousands.

       13,849 is rounded off to 14,000

       4,356 is rounded off to 4,000

       Estimated sum   = 14,000 + 4,000

                       = 18,000

Example 13: Estimate 7,412 – 236

Solution: Let us round off these numbers to the nearest thousands.

7,412 is rounded off to 7,000

236 is rounded off to 0

Estimated difference = 7000 – 0

= 7000

This is not a reasonable estimate. Why?

We need a closer estimate.

Let us round the numbers to the nearest hundreds.

7,412 is rounded off to 7,400

236 is rounded off to 200

Estimated difference = 7,400 – 200

= 7,200

This is a better and more meaningful estimate.

Worksheet 7

Estimate.

1. 215 + 436

2. 1,238 + 4,298

3. 15,409 + 3,288

4. 618 + 561 + 372

5. 869 – 341

6. 8,565 – 4,341

7. 1,048 – 692

8. 78,432 – 71,496

ESTIMATE OF PRODUCT OF NUMBERS

Let us estimate 63 × 182

If we round off 63 to the nearest hundred, we get 100

If we round off 182 to the nearest hundred, we get 200

Hence, the estimated product = 100 × 200 = 20,000

This is much greater than the actual product.

So to get a more reasonable estimate, we try rounding off 63 to the nearest tens that is 60, and also 182 to the nearest tens that is 180.

We get 60 × 180 = 10800

This is a good estimate but not quick enough.

So we round off 63 to the nearest ten which is 60 and 182 to the nearest hundred which is 200.

Now the estimated value of 63 × 182 = 60 × 200

$$= 12,000$$

12,000 is a quick and good estimate of the product of numbers.

> **Remember**
>
> To estimate the product, round off each factor to its greatest place, then multiply the rounded off factors.
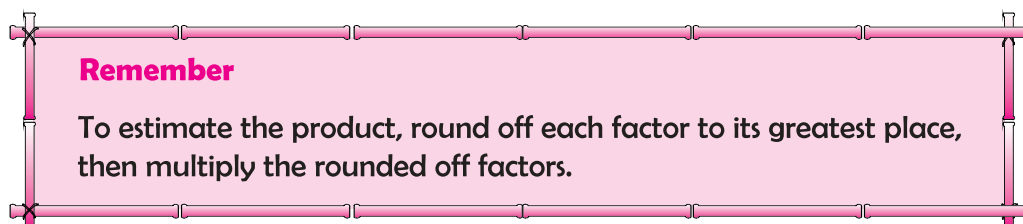
Example 14: Estimate 52 × 786

Solution: 52 can be rounded off to the nearest ten as 50.

786 can be rounded off to the nearest hundred as 800.

Hence, the estimate product = 50 × 800 = 40,000

Worksheet 8

Estimate the given products.

1. 61 × 47
2. 589 × 245
3. 9 × 677
4. 864 × 342

5. 913 × 752
6. 4,329 × 609
7. 1,234 × 5,678
8. 13,459 × 7,801

BRACKETS AND THEIR USE

Do you remember solving numerical expressions involving the fundamental operations of addition, subtraction, multiplication and division?

Recall the DMAS Rule—

Division	→	First
Multiplication	→	Second
Addition	→	Third
Subtraction	→	Last

Use this rule to simplify:

1. $3 + 6 \div 2 - 4$

2. $49 \div 7 + 7 \times 2$

3. $1\dfrac{1}{2} + \dfrac{3}{4} \times \dfrac{4}{5} - \dfrac{1}{5}$

4. $3.5 - 0.1 \times 5 + 1.2$

Let us now learn to solve numerical expressions involving brackets. Most commonly used brackets are:

Brackets symbol	Name
( )	Parentheses or Round brackets
{ }	Curly brackets
[ ]	Square brackets

In writing mathematical expressions consisting of more than one brackets, Round brackets are used in the innermost part followed by Curly brackets and these two are covered by Square brackets.

We first perform the operations within the Round brackets followed by the operations within the Curly brackets and lastly within the Square brackets.

Example 15: Simplify $27 - [5 + \{28 - (17 - 7)\}]$

Solution: We have $27 - [5 + \{28 - (17 - 7)\}]$

$= 27 - [5 + \{28 - 10\}]$ ⟵—— Removing Round brackets

$= 27 - [5 + 18]$ ⟵—— Removing Curly brackets

$= 27 - 23$ ⟵—— Removing Square brackets

$= 4$

Example 16: Simplify 45 − [38 − {60 ÷ 3 − (9 − 7 + 3)}]

Solution: We have 45 − [38 − {60 ÷ 3 − (9 − 7 + 3)}]

$$= 45 − [38 − \{60 ÷ 3 − 5\}]$$
$$= 45 − [38 − \{20 − 5\}]$$
$$= 45 − [38 − 15]$$
$$= 45 − 23$$
$$= 22$$

Worksheet 9

Simplify the following numerical expressions.

1. 25 + 14 ÷ (5 − 3)

2. 3 − (5 − 6 ÷ 3)

3. 36 − [12 + (3 × 10 ÷ 2)]

4. 20 − 3 − [7 − {2 + (4 − 3)}]

5. 15 + [18 − {4 + (16 − 5)}]

6. $22 − \dfrac{1}{4} \{16 − (8 ÷ 4 + 2)\}$

7. 18 − [18 − {18 − (18 − 18) − 18}]

8. 150 − [70 − {60 − (30 + 20)} − 10]

✓ALUE BASED QUESTIONS

1. **Members of an NGO decided to provide blankets to an old age home. For this purpose a sum of ₹ 8435 was collected and 35 blankets were purchased. The old people were very happy with the blankets. They blessed the NGO members for their concern for the old people.**

   (a) What is the cost of one blanket donated?

   (b) Name any two items that you can donate to an old age home.

2. **Trees not only make the air pure but also beautify the environment. In a school, the members of Eco club were taken for a trip to a nearby nursery. As a part of a project the children planted 95 saplings of different trees in the nursery. The cost of each sapling was ₹ 175. The children were very thrilled and happy with the project.**

   (a) What is the amount spent on the saplings? (Use distributive property)

   (b) Name any two saplings that you will like to plant in your garden or nearby park.

BRAIN TEASERS

1. **A. Tick (✓) the correct answer.**

   (a) Which of the following is meaningless?

      (i) XLVI   (ii) ICVII   (iii) XML   (iv) XLIX

   (b) The greatest 2-digit number exactly divisible by 17 is–

      (i) 68   (ii) 91   (iii) 85   (iv) 97

   (c) The smallest 5-digit number formed by using the digits 3, 0, 1 (Repetition of digits allowed) is–

      (i) 10003   (ii) 10013   (iii) 13000   (iv) 00013

   (d) The estimated value of $36 + 71 - 55$ is–

      (i) 40   (ii) 50   (iii) 70   (iv) 150

   (e) Which of the following is not a natural number?

      (i) $3 + 5 - 2$ (ii) 4×0 (iii) $8 \div 8$ (iv) $6 - 3 + 1$

   B. Answer the following questions.

   (a) How many millions make 3 crores?

   (b) Which whole number does not have a successor?

   (c) What is the estimated value of 786×1385?

   (d) What is the value of $125 \times 4 \times 25 \times 8$?

   (e) What is the difference between the place value and face value of 8 in 38,46,197?

2. **Write the greatest 6-digit number using three different digits.**

3. **Find the smallest and greatest 7-digit and 8-digit numbers using the digits 5, 0, 4, 1.**

4. **Find the difference between the largest and the smallest 7-digit numbers formed by using the digits in the number 6427310. (digits should not repeat)**

5. **Using distributive property, simplify:**

   $223 \times 25 \times 6 - 223 \times 10 \times 15$

6. **Complete the series–**

   1, 1, 2, 3, 5, 8, 13, 21, 34, _____, _____,

7. **Fill in the blanks in the following magic square.**

	10	3	6
4	5		9
	11	2	7
1	8		

8. **Form the greatest 6-digit number using the digits of prime numbers between 80 and 100.**

9. **Find the number which is–**

   (a) the successor of the successor of 304998.

   (b) the predecessor of the predecessor of the smallest 6-digit number.

10. **Fill in the blanks using Roman Numerals.**

   (a) CXIX – ☐ = XXV   (b) ☐ + XLVI = LXX

11. **Arrange the following in ascending order.**

   LVII, XC, XV, LXIV, LXXI, XXIX

12. **Estimate the following:**

   (a) 234 + 649 − 186   (b) 9483 − 6321 − 2178

   (c) 3284 × 639   (d) 12345 × 6789

HOTS

1. **How many times does the digit 7 occurs if we write all the numbers from 1 to 200?**

2. **Write all the 2-digit numbers which when added to 27 get reversed.**

ENRICHMENT QUESTIONS

1. **Get 100 using four 9's and some of the symbols like +, −, ×, ÷**

2. **A number is three times the sum of its digits. Find the number.**

YOU MUST KNOW

1. Various systems of numerations are used in different parts of the world. We use the Hindu–Arabic System of Numeration. Another systems of writing numerals is called Roman System.

2. The numbers 1, 2, 3, ... which we use for counting are called Counting numbers or Natural numbers. The numbers 0, 1, 2, 3, ... form the set of Whole numbers. All natural numbers are whole numbers but all whole numbers are not natural numbers.

3. Every whole number can be represented on the number line. Every whole number has a successor. Every whole number except zero has a predecessor.

4. Addition of two whole numbers always give a whole number. Similarly multiplication of two whole numbers is always a whole number. But this is not true for the operations of subtraction and division.

5. Zero is the identity element of addition and one is the identity element of multiplication.

6. The sum remains the same if the order or group of three or more addends is changed. Similarly when three or more numbers are multiplied the product remains the same.

7. Multiplication is distributive over addition for whole numbers.

8. In division, Dividend = Divisor × Quotient + Remainder

9. There are number of situations in which we do not need the exact number of quantity but only a reasonable guess or estimation. Estimation involves approximating a quantity to an accuracy required.

10. In some situations, we need to estimate the outcome of number operations. A quick rough answer is obtained by rounding off the numbers involved in the operation.

FACTORS AND MULTIPLES

INTRODUCTION

Do you remember factors and multiples? Let us recall them once again.

Multiples: For getting multiples of a number, we recite the multiplication table of that number.
e.g. multiples of 4 are 4, 8, 12, 16 .....

Factors: A factor of a number divides the number exactly (with zero as the remainder).
e.g. the factors of 12 are 1, 2, 3, 4, 6, 12.

Prime Number: A number which has only two different factors, 1 and the number itself is called prime number.
e.g. 2, 3, 5, 7 .....

Composite Number: A number which has more than two different factors is called composite number.
e.g. 4, 6, 8, 9 .....

MORE ABOUT FACTORS

One (1) is a factor of every number.

Every number is a factor of itself.

Two prime numbers whose difference is 2 are called **Twin Prime Numbers.**
e.g. 5 and 3; 41 and 43.

Two numbers are said to be **Co-prime** when they have only 1 as common factor.
e.g. 3 and 5; 19 and 20.

Example 1: State whether the following are prime or composite by listing their factors:

(a) 36 (b) 13

Solution: (a) 36

We have $1 \times 36 = 36$

$2 \times 18 = 36$

$$3 \times 12 = 36$$
$$4 \times 9 = 36$$
$$6 \times 6 = 36$$

Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, 36.

Therefore, 36 is a composite number.

(b) 13

We have $\quad\quad\quad 1 \times 13 = 13$

Factors of 13 are 1 and 13.

Therefore, 13 is a prime number.

Example 2: List the first five multiples of 19.

Solution: The required multiples are–

$$1 \times 19 = 19$$
$$2 \times 19 = 38$$
$$3 \times 19 = 57$$
$$4 \times 19 = 76$$
$$5 \times 19 = 95$$

19, 38, 57, 76 and 95 are the first five multiples of 19.

Worksheet 1

1. **Fill in the following blanks.**

   (a) Numbers which have more than two different factors are called _____ .

   (b) Numbers which are not divisible by any other number except 1 and the number itself are called _____ .

   (c) 1 is neither _____ nor composite.

   (d) 6 is a composite number as it has _____ factors.

   (e) _____ is the only even prime number.

   (f) The smallest prime number is _____ .

   (g) The smallest composite number is _____ .

   (h) The smallest odd composite number is _____ .

   (i) The greatest 2-digit prime number is _____ .

2. Are the following numbers prime or composite. Show by finding the factors.

   (a) 9   (b) 48   (c) 89   (d) 96   (e) 78   (f) 101

3. Write down the first ten prime numbers.

4. Write down all the prime numbers between 50 to 110.

5. A number lies between 2000 and 2070 and has 5 in its ones place. Is it a prime or composite number? Give reasons.

6. List the first five multiples of–

   (a) 25   (b) 17   (c) 100   (d) 41

7. List all the multiples of 15 between 50 to 100.

8. Between which multiples of 10 does 3486 lie?

9. Write any four pairs of twin primes.

10. Which of the following numbers are co-prime?

   (a) 13, 14   (b) 8, 20   (c) 31, 59   (d) 34, 85

TEST OF DIVISIBILITY

There are certain tests which can confirm whether a number is divisible by some other number. Given below are the tests of divisibility.

I. Divisibility by 2

Is 368 divisible by 2?	(Yes/No)
Is 490 divisible by 2?	(Yes/No)
Is 43 divisible by 2?	(Yes/No)
Is 48 divisible by 2?	(Yes/No)

Here we see that 368, 490 and 48 are divisible by 2 whereas 43 is not divisible by 2.

> A number is divisible by 2 if the digit at ones place is divisible by 2, i.e. if the digit at ones place is 0, 2, 4, 6 or 8.

II. Divisibility by 5

Is 8955 divisible by 5?	(Yes/No)
Is 6320 divisible by 5?	(Yes/No)

Is 7939 divisible by 5?   (Yes/No)

Is 387 divisible by 5?   (Yes/No)

Here we can see that 8955 and 6320 are divisible by 5 but 7939 and 387 are not divisible by 5.

> **A number is divisible by 5 if the digit at ones place is 0 or 5.**

III. Divisibility by 10

Is 7442 divisible by 10?   (Yes/No)

Is 10240 divisible by 10?   (Yes/No)

Is 73 divisible by 10?   (Yes/No)

Is 1390 divisible by 10?   (Yes/No)

Here the numbers 10240 and 1390 are divisible by 10 but 7442 and 73 are not divisible by 10.

> **A number is divisible by 10 if the digit at ones place is 0.**

IV. Divisibility by 4

Is 6943284 divisible by 4?

Step 1: Separate the number formed by the digits at tens and ones place.

69432 / 84

Step 2: Now divide 84 by 4.

```
      21
  4 ) 84
      8
      ‾‾
       4
       4
      ‾‾
       0    84 is divisible by 4.
```

Hence, 6943284 is also divisible by 4.

> **A number is divisible by 4 if the number formed by its digits at tens and ones place is divisible by 4.**

V. Divisibility by 8

Let us find if 3364280 is divisible by 8?

Step 1: Separate the number formed by the digits at hundreds, tens and ones place.

3364 / 280

Step 2: Divide 280 by 8.

```
        35
    8 / 280
        24
        ___
        40
        40
        ___
         0        280 is divisible by 4.
```

Hence, 3364280 is also divisible by 8.

> **A number is divisible by 8 if the number formed by the digits at hundreds, tens and ones place is divisible by 8.**

VI.   Numbers with trailing zeroes

Divide 2500 by 4.   Is it divisible?   (Yes/No)

Divide 23900 by 4.   Is it divisible?   (Yes/No)

Divide 34000 by 8.   Is it divisible?   (Yes/No)

Now divide 196000 by 8.   Is it divisible?   (Yes/No)

> - **If a number has zeroes in its tens and ones places, it is divisible by 4.**
> - **If a number has zeroes in its hundreds, tens and ones places, it is divisible by 8.**

Worksheet 2

1. **Look at the following numbers and fill in the blanks.**

   (a)   435, 6552, 988, 3870, 5211, 9343

      The numbers that are divisible by 2 are _____, _____, _____.

   (b)   3522, 9765, 1000, 45012, 28775

      The numbers that are divisible by 5 are _____, _____, _____.

   (c)   7780, 10000, 2567, 57514, 82210

      The numbers that are divisible by 10 are _____, _____, _____.

   (d)   4924, 63402, 11507, 36572

      The numbers that are divisible by 4 are _____, _____, _____.

   (e)   789984, 365832, 10098, 395529

      The numbers that are divisible by 8 are _____, _____, _____.

2. **Apply the divisibility rule and show that–**

(a) 432566 is divisible by 2

(b) 352115 is divisible by 5

(c) 868060 is divisible by 10

(d) 3496 is divisible by 4

(e) 117904 is divisible by 8

(f) 784300 is divisible by 4

(g) 694000 is divisible by 8

(h) 35088 is divisible by 2

VII. Divisibility by 3

Is 4392126 divisible by 3?

Step 1: Add all the digits of the given number.

$4 + 3 + 9 + 2 + 1 + 2 + 6 = 27$

Step 2: Divide the sum by 3.

```
        9
   3 ) 27
       27
       ──
        0    27 is divisible by 3
```

Therefore, 4392126 is also divisible by 3.

> **A number is divisible by 3 if the sum of its digits is divisible by 3.**

VIII. Divisibility by 9

Is 8826921 divisible by 9?

Step 1: Add up all the digits of the given number.

$8 + 8 + 2 + 6 + 9 + 2 + 1 = 36$

Step 2: Divide the sum by 9.

```
        4
   9 ) 36
       36
       ──
        0    36 is divisible by 9
```
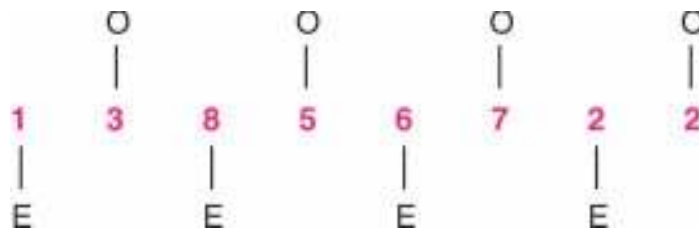
So, 8826921 is also divisible by 9.

> **A number is divisible by 9 if the sum of its digits is divisible by 9.**

IX. Divisibility by 11

Let us consider a number 13856722. To test whether it is divisible by 11, following steps are taken.

Step 1: Add alternate digits (digits in odd places and digits in even places separately) starting from the ones place.

Step 2: Sum of the digits at odd places = 2 + 7 + 5 + 3 = 17

Sum of the digits at even places = 2 + 6 + 8 + 1 = 17

Step 3: Difference of the two sums, i.e.

17 − 17 = 0

> **If the difference between the sum of the digits at even places and sum of the digits at odd places is either 0 or a multiple of 11, the number is divisible by 11.**

MORE ON DIVISIBILITY TESTS

I. A number is divisible by 6 if it is divisible by co-prime factors of six.

e.g. 42 is divisible by 2 and 3, therefore, 42 is also divisible by **2 × 3 = 6.**

Similarly,

- A number is divisible by 12 if it is divisible by 4 and 3.
- A number is divisible by 15 if it is divisible by 3 and 5.
- A number is divisible by 24 if it is divisible by 8 and 3.
- A number is divisible by 36 if it is divisible by 9 and 4.

II. If a number is divisible by another number, then it is divisible by each factor of that number.

e.g.　　　18 is divisible by 6

18 is also divisible by　1, 2, 3

Factors of 6

III. **If a number is divisible by two co-prime numbers, then it is divisible by their product.**

> Two numbers whose HCF is one are called **Co-prime Numbers.**

e.g.   4 and 3 are co-prime numbers.

                   24 is divisible by 4

                   24 is divisible by 3

                   24 is also divisible by   12

                                     ⟶ 4×3

IV. **If two given numbers are divisible by a number, then their sum is also divisible by that number.**

e.g.   8 and 12 are divisible by 4

                   20 is also divisible by 4

     $8 + 12$ ⟵

V. **If two given numbers are divisible by a number, then their difference is also divisible by that number.**

e.g.   15 and 35 are divisible by 5

                   20 is also divisible by 5

     $35 - 15$ ⟵

Worksheet 3

1. **Look at the following group of numbers and fill in the blanks.**

(a)   389510, 7781450, 4203324, 12342

     The numbers divisible by 3 are _____ and _____ .

(b)   3437712, 4222910, 6880172, 9811602

     The numbers divisible by 9 are _____ and _____ .

(c)   362442, 8502153, 774067, 46627207

     The numbers divisible by 11 are _____ and _____ .

2. **Pick out the numbers from the following that are divisible by 3 but not by 9.**

(a) 38721   (b) 422679   (c) 6110586   (d) 257796

3. Test the following for the divisibility by 3 and 9.

    (a) 294414   (b) 145404   (c) 99999

4. Test the divisibility of the following numbers by 11.

    (a) 86611291   (b) 100001   (c) 9427355

    (d) 7023643   (e) 58334661   (f) 602111213

5. Fill in the blanks.

    (a) A number is divisible by 6 if it is divisible by its two co-prime factors _____ and _____ .

    (b) 43185 is divisible by 15 as it is divisible by _____ and _____ .

    (c) The number 8625 is not divisible by 6 as it is divisible by _____ but not by _____ .

    (d) The number 54420 is divisible by 12 as it is divisible by _____ and _____ .

    (e) The number 781022 is divisible by 11 as the difference of the sum of the digits at odd places and the sum of the digits at even places is _____ .

6. Replace ☐ by a digit so that the number is divisible by 9.

    (a) 384 ☐ 62   (c) 9080 ☐

    (b) 1 ☐ 80498   (d) 46 ☐ 21

7. Write 'True' or 'False' for the following statements.

    (a) If a number is divisible by 3, it must be divisible by 9.   ☐

    (b) If a number is divisible by 18, it must be divisible by 6 and 3.   ☐

    (c) If a number is divisible by both 9 and 10, then it must be divisible by 90.   ☐

    (d) All numbers which are divisible by 8 are divisible by 4.   ☐

    (e) If a number is exactly divisible by two numbers separately then it must be exactly divisible by their sum.   ☐

PRIME FACTORISATION

Let us look at the example given below.

Example 3: Find the prime factorisation of 360 by division method.

Solution:

360 is divisible by the prime number 2

45 is divisible by the prime number 3

We divide by the prime number 5

2	360
2	180
2	90
3	45
3	15
5	5
	1 → We stop

Hence, the prime factorisation of 360 = 2 × 2 × 2 × 3 × 3 × 5

Worksheet 4

1. **Find the prime factorisation of the following.**

   (a) 78   (b) 120   (c) 256   (d) 84   (e) 441

   (f) 240   (g) 2304   (h) 3125   (i) 1260

2. **Write the greatest 4-digit number. Express it as a product of primes.**

3. **Write the smallest 4-digit number and show its prime factorisation.**

4. **Express each of the following numbers as sum of two odd primes.**

   (a) 18   (b) 32   (c) 66   (d) 90

5. **Express the following as sum of three odd primes.**

   (a) 41   (b) 23   (c) 75   (d) 59

HIGHEST COMMON FACTOR (HCF)

HCF of two or more numbers is the **Highest Common Factor** of these numbers.

Let us now find HCF of 27 and 36.

(a) Factor Method

27   My factors are 1, 3, 9, 27   36   My factors are 1, 2, 3, 4, 6, 9, 12, 18, 36

27   Our common factors are 1, 3, 9
Our highest common factor is 9   36