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1.1 REVISION

Let us recall what we have learnt in Book 4. We know that :

10 ones = 1 ten (10)

10 tens = 1 hundred (100)

10 hundreds = 1 thousand (1,000)

10 thousands = 1 ten thousand (10,000)

10 ten thousands = 1 lakh (1,00,000)

What is 10 lakhs equal to ? 10 lakhs = 1 ten lakh (10,00,000).

We know that the greatest 6 digit number is 9,99,999 (Nine lakh ninety nine thousand nine hundred ninety nine).

We get ten lakh by adding 1 to 9,99,999.	9,99,999
	+ 1
	10,00,000

Ten lakh is the smallest seven digit number.

EXAMPLE 1   Write the numeral and number name shown on each abacus.
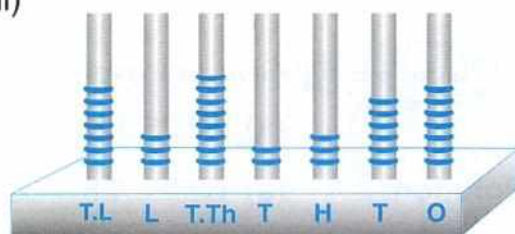
(i)

T.L   L   T.Th   T   H   T   O
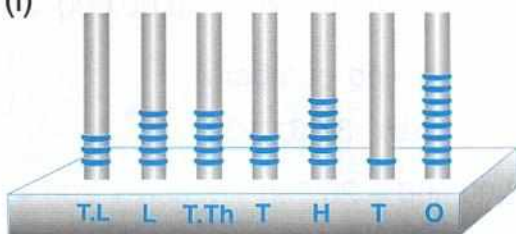
Numeral : 35,53,618

Number name : Thirty five lakh fifty three thousand six hundred eighteen.

(ii)

T.L   L   T.Th   T   H   T   O

Numeral : 73,82,367

Number name : Seventy three lakh eighty two thousand three hundred sixty seven.

EXAMPLE 2 Write the number name for each of the following numerals:

(i) 36,24,925   (ii) 52,69,148

Solution: (i) Thirty six lakh twenty four thousand nine hundred twenty five.

(ii) Fifty two lakh sixty nine thousand one hundred forty eight.

EXAMPLE 3 Write the numeral for each of the following :

(a) Seventeen lakh forty eight thousand seven hundred twenty four.

(b) Seventy five lakh two thousand eight hundred forty five.

Solution: (a) 17,48,724   (b) 75,02,845

EXAMPLE 4 Write the place value of the underlined digit in the following numbers :

(a) 2<u>7</u>,21,358   (b) <u>6</u>4,75,283

(c) 71,<u>3</u>8,408   (d) <u>4</u>2,07,043

Solution:

Number	Place Value
(a) 2<u>7</u>,21,358	7 is in the lakh's place
	7 × 1 lakh = 7,00,000
(b) <u>6</u>4,75,283	6 is in the ten lakh's place
	6 × 10 lakh = 60,00,000
(c) 71,<u>3</u>8,408	3 is in the ten thousand's place
	3 × 1 ten thousand = 30,000
(d) <u>4</u>2,07,043	4 is in the ten lakh's place
	4 × 10 lakh = 40,00,000

EXAMPLE 5 Give the expanded form of the following numbers:

(a) 62,25,728   (b) 37,61,129

Solution: (a) 62,25,728 = 60,00,000 + 2,00,000 + 20,000 + 5,000 + 700 + 20 + 8

(b) 37,61,129 = 30,00,000 + 7,00,000 + 60,000 + 1,000 + 100 + 20 + 9
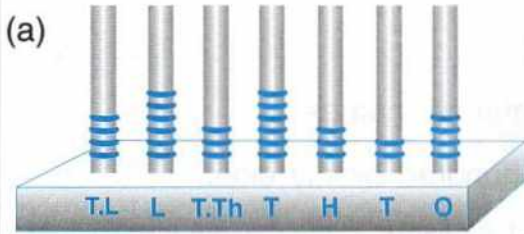
EXAMPLE 6 Give the compact form of the following numbers :

(a) 20,00,000 + 4,00,000 + 50,000 + 3,000 + 900 + 20 + 5

(b) 50,00,000 + 7,00,000 + 90,000 + 8,000 + 300 + 0 + 0

Solution: (a) 24,53,925   (b) 57,98,300

1 Write the numeral and number name that each diagram represents:

(a)

T.L   L   T.Th   T   H   T   O

Numeral _____

Number Name _____

_____

(b)

T.L   L   T.Th   T   H   T   O

Numeral _____

Number Name _____

_____

(c)

T.L   L   T.Th   T   H   T   O

Numeral _____

Number Name _____

_____

(d)

T.L   L   T.Th   T   H   T   O
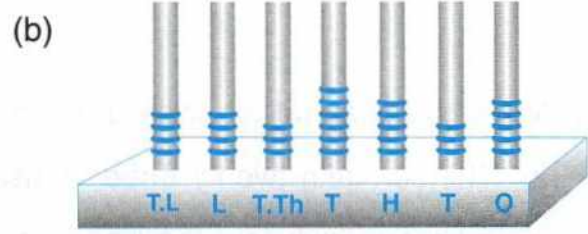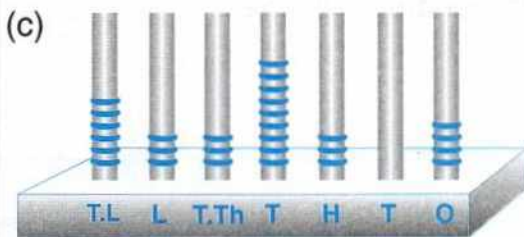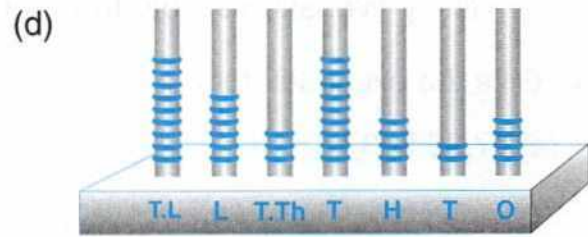
Numeral _____

Number Name _____

_____

2 Write the number name for each of the following numerals:

(a) 76,45,321 _____

_____

(b) 70,25,384 _____

_____

(c) 81,52,025 _____

_____

(d) 38,41,921 _____

_____

(e) 27,00,947 _____

_____

(f) 10,35,455 _____

_____

3 Write the numeral for each of the following number names:

(a) Thirteen lakh twenty three thousand five hundred twenty eight. _____

(b) Sixty five lakh four thousand one hundred fifty two. _____

(c) Ninety five lakh sixty thousand five hundred. _____

(d) Seventeen lakh thirty thousand and five. _____

(e) Thirty three lakh twenty four thousand eight hundred ninety six. _____

(f) Ninety five lakh seventy five thousand five hundred fifty five. _____

4 Give the expanded form :

(a) 17,96,543 _____

_____

(b) 66,75,250 _____

_____

(c) 50,00,000 _____

_____

(d) 24,65,700 _____

_____

(e) 38,06,243 _____

_____

5 Give the compact form :

(a) 10,00,000 + 2,00,000 + 30,000 + 6,000 + 800 + 70 + 0 _____

(b) 40,00,000 + 5,00,000 + 20,000 + 1,000 + 800 + 90 + 0 _____

(c) 10,00,000 + 2,00,000 + 60,000 + 0 + 700 + 40 + 0 _____

(d) 30,00,000 + 1,00,000 + 20,000 + 6,000 + 100 + 10 + 8 _____

(e) 60,00,000 + 4,00,000 + 30,000 + 2,000 + 300 + 50 + 7 _____

6 Give the place value of 7 in :

(a) 27,35,942 _____   (b) 75,14,503 _____

(c) 50,07,065 _____   (d) 16,70,812 _____

7 Write the place value of the underlined digits in the following numbers :

Number	Place Value	Number	Place Value
(a) 24,2<u>6</u>,369	_____	(b) <u>4</u>0,36,275	_____
(c) 1<u>5</u>,16,128	_____	(d) 18,18,0<u>9</u>0	_____
(e) <u>8</u>2,18,157	_____	(f) 27,10,<u>4</u>68	_____
(g) 26,<u>7</u>8,920	_____	(h) 2<u>5</u>,27,842	_____

8 Write the predecessor of the following numerals :

(a) 9,43,072 _____   (b) 28,32,417 _____

(c) 87,32,106 _____   (d) 17,34,581 _____

(e) 73,24,560 _____

9 Write the successor of the following numerals :

(a) 82,31,700 _____   (b) 7,86,543 _____

(c) 9,54,619 _____   (d) 34,57,988 _____

(e) 43,21,789 _____

10 Fill in the boxes using >, < or =.

(a) 5,93,210 ☐ 4,95,210   (b) 3,81,472 ☐ 3,81,582

(c) 4,12,316 ☐ 4,12,099   (d) 3,23,456 ☐ 2,23,456

(e) 7,32,610 ☐ 7,32,610

11 Write the missing numbers.

(a) 98,76,541 98,76,546

(b) 45,69,894 45,69,899

(c) 73,16,897 73,16,902

(d) 12,46,785 12,46,790

(e) 9,67,998 9,68,003

2 INDIAN NUMBER SYSTEM

2.1 LARGER NUMBERS

What is 10 ten lakhs equal to ?

10 ten lakhs = 1 hundred lakh

1 hundred lakh is called **1 crore**.

We write 1 crore as 1,00,00,000.

We know that the greatest 7 digit number is 99,99,999 (ninety nine lakh ninety nine thousand nine hundred ninety nine).

We get 1 crore by adding 1 to 99,99,999.

$$\begin{array}{r} 99,99,999 \\ + 1 \\ \hline 1,00,00,000 \end{array}$$

1,00,00,000 (1 crore) is the smallest 8 digit number.

We read, 6,75,34,618 as six crore seventy five lakh thirty four thousand six hundred eighteen.

We read 8,25,74,800 as eight crore twenty five lakh seventy four thousand eight hundred.

What is the greatest 8 digit number ?

The greatest eight digit number is 9,99,99,999 (*i.e.*) Nine crore ninety nine lakh ninety nine thousand nine hundred ninety nine.

Now what is 10 crores equal to ?

We read 10,00,00,000 as ten crore.

10 crores = 1 ten crore = 10,00,00,000

We get 10 crore by adding 1 to 9,99,99,999.

$$\begin{array}{r} 9,99,99,999 \\ + 1 \\ \hline 10,00,00,000 \end{array}$$

10,00,00,000 = 10 crore is the smallest 9 digit number.

We read 65,52,67,645 as sixty five crore fifty two lakh sixty seven thousand six hundred forty five.

We read 25,65,35,568 as twenty five crore sixty five lakh thirty five thousand five hundred sixty eight.

What is the greatest 9 digit number?

The greatest 9 digit number is 99,99,99,999 (i.e.) Ninety nine crore ninety nine lakh ninety nine thousand nine hundred ninety nine.

When we add 1 to 99,99,99,999 we get 100 crore.

$$99,99,99,999$$
$$+ 1$$
$$\overline{100,00,00,000}$$

The smallest 10 digit number is 100,00,00,000 (100 crore).

We read 300,00,00,000 as three hundred crore.

We read 600,00,00,000 as six hundred crore.

Place value chart upto ten crores

Crores		Lakhs		Thousands		Units		
Ten crore	One crore	Ten lakh	One lakh	Ten thousand	One thousand	Hundreds	Tens	Ones
TC	C	TL	L	TTh	Th	H	T	O
10,00,00,000	1,00,00,000	10,00,000	1,00,000	10,000	1,000	100	10	1

To make it convenient to read a large number, first we divide it into periods starting from the right. First 3 digits from the right is the first period. First period is known as the units period. The next period consisting of two digits is called the thousands period. Next period consisting of two digits is the lakhs period and the next period which also consists of two digits is called the crores period. Usually we use a comma to separate the different periods, but the modern convention is to leave a space to separate different periods instead of putting a comma between them.

Thus the number 24,76,45,348 would be written as 24 76 45 348. While reading a numeral, all digits in the same period are read together and the name of the period (except units) is read along with them. The number 45 62 75 316 is read as forty five crore sixty two lakh seventy five thousand three hundred sixteen.

Do not use the words indicating the periods in plural form.

"Forty five crore", not forty five crores. "Sixty two lakh", not sixty two lakhs.

EXAMPLE 1   Express each of the following numerals in words:

(a) 3,76,48,715   (b) 6,15,37,908

(c) 15,40,90,127   (d)   36,48,72,075

Solution: (a) Three crore seventy six lakh forty eight thousand seven hundred fifteen.

(b) Six crore fifteen lakh thirty seven thousand nine hundred eight.

(c) Fifteen crore forty lakh ninety thousand one hundred twenty seven.

(d) Thirty six crore forty eight lakh seventy two thousand seventy five.

We arrange the numbers in the place value chart as given below:

	Crores		Lakhs		Thousands		Units		
	T.C.	C	T.L.	L	T.Th.	Th	H	T	O
(a)		3	7	6	4	8	7	1	5
(b)		6	1	5	3	7	9	0	8
(c)	1	5	4	0	9	0	1	2	7
(d)	3	6	4	8	7	2	0	7	5

EXAMPLE 2   Write the numeral for each of the following :

(a) Seven crore twenty six lakh eighty five thousand one hundred twenty four.

(b) Three crore six lakh thirty thousand forty three.

(c) Thirty one crore thirty eight lakh sixty two thousand eight hundred.

(d) Ninety crore fifty lakh eight thousand two hundred eighty two.

Solution:

	Crores		Lakhs		Thousands		Units		
	T.C.	C	T.L.	L	T.Th.	Th	H	T	O
(a)		7	2	6	8	5	1	2	4
(b)		3	0	6	3	0	0	4	3
(c)	3	1	3	8	6	2	8	0	0
(d)	9	0	5	0	0	8	2	8	2

The numerals are

(a) 7,26,85,124   (b) 3,06,30,043   (c) 31,38,62,800   (d) 90,50,08,282

EXAMPLE 3   Give the expanded form of the following numbers :

(a) 3,72,86,136   (b) 42,27,35,842

Solution: (a) 3,72,86,136 = 3,00,00,000 + 70,00,000 + 2,00,000 + 80,000 + 6,000 + 100 + 30 + 6

(b) 42,27,35,842 = 40,00,00,000 + 2,00,00,000 + 20,00,000 + 7,00,000 + 30,000 + 5,000 + 800 + 40 + 2

EXAMPLE 4   Give the compact form of the following numbers :

(a) 7,00,00,000 + 80,00,000 + 4,00,000 + 60,000 + 4,000 + 100 + 90 + 5

Solution: 7 84 64 195

(b) 90,00,00,000 + 5,00,00,000 + 60,00,000 + 1,00,000 + 90,000 + 7,000 + 0 + 50 + 3

Solution: 95,61,97,053

EXAMPLE 5 Give the period and place value of the underlined digits of the following numbers :

(a) 3,29,40,783

(b) 26,25,71,816

(c) 8,16,65,563

(d) 32,05,52,265

Solution:

Number	Period	Place Value
(a) 3,29,40,783	Lakhs	9 is in the lakh's place. 9 × 1 lakh = 9,00,000
(b) 26,25,71,816	Crores	6 is in the crore's place. 6 × 1 crore = 6,00,00,000
(c) 8,16,65,563	Lakhs	1 is in the ten lakh's place. 1 × 10 lakh = 10,00,000
(d) 32,05,52,265	Crores	3 is in the ten crore's place. 3 × 10 crores = 30,00,00,000

EXERCISE 2(A)

1 Write the number name for each of the following :

(a) 1,21,43,654 _____

_____

(b) 21,09,54,378 _____

_____

(c) 38,69,56,024 _____

_____

(d) 80,50,50,550 _____

_____

2 Write the numeral for each of the following (either give space or put a comma at the proper place) :

(a) Eight crore seventy lakh fifty thousand six hundred eighty.

_____

(b) Four crore nine lakh twenty four thousand four hundred ninety six.

_____

(c) Ten crore twelve lakh thirty six thousand two hundred twenty five.

_____

(d) Sixty six thousand seven hundred eight. _____

(e) Eighty crore seventy five thousand. _____

3 Give the expanded form of the following numbers :

(a) 1,28,14,601 _____

_____

(b) 16,22,81,946 _____

_____

(c) 24,16,56,782 _____

_____

(d) 18,68,18,127 _____

_____

(e) 32,05,20,600 _____

_____

4 Give the compact form of the following :

(a) 20,00,00,000+6,00,00,000+80,00,000+4,00,000+20,000+7,000+300+50+6

_____

(b) 30,00,00,000+8,00,00,000+40,00,000+6,00,000+40,000+2,000+300+40+6

_____

(c) 50,00,00,000+7,00,00,000+50,00,000+6,00,000+80,000+3,000+100+90+2

_____

(d) 80,00,00,000 + 5,00,00,000 + 20,00,000 + 0 + 20,000 + 5,000 + 500 + 50 + 5

_____

(e) 60,00,00,000 + 0 + 80,00,000 + 1,00,000 + 40,000 + 0 + 0 + 80 + 1

_____

5 Write the period of the digit underlined in each of the following :

(a) 18,<u>7</u>6,12,684 _____   (b) <u>8</u>,14,25,482 _____

(c) 6,46,<u>8</u>4,754 _____   (d) 1<u>6</u>,84,35,135 _____

6 Write the place value of the underlined digit in each of the following :

(a) 58,0<u>8</u>,46,763 _____   (b) 8,14,2<u>5</u>,482 _____

(c) <u>9</u>6,19,68,407 _____   (d) 6,<u>2</u>3,45,679 _____

7 Write the period and place value of the underlined digits in the following :

	Period	**Place Value**
(a) 3<u>6</u>,70,59,963		
(b) <u>6</u>5,19,42,480		
(c) 17,42,1<u>8</u>,168		
(d) 29,57,62,<u>7</u>74		
(e) 2,<u>4</u>3,28,309		

8 Find the difference between the place value of :

(a) the two 4s in 7,48,65,421 ___ 40,00,000 – 400 = 39,99,600 ___

(b) the two 8s in 18,36,84,792 _____

(c) the two 5s in 56,25,70,083 _____

(d) the two 2s in 16,29,15,245 _____

(e) the two 6s in 61,42,69,104 _____

9 Arrange the following in ascending and descending order :

(a) 23,16,348 ; 8,62,16,438 ; 8,26,99,678 ; 45,42,18,089

_____

_____

(b) 3,48,616 ; 95,949 ; 24,26,16,800 ; 88,95,919

_____

_____

(c) 64,00,18,926 ; 9,90,909 ; 1,42,65,814 ; 66,25,576

_____

_____

(d) 5,41,10,105 ; 10,10,10,104 ; 92,85,368 ; 9,94,248

_____

_____

(e) 68,59,795 ; 1,16,04,616 ; 1,61,04,661 ; 2,18,68,714

_____

_____

10 Write the smallest and the largest number using each digit only once:

	The smallest Number	**The largest Number**
(a) 3, 4, 5, 6, 9, 8, 1	_____	_____
(b) 3, 5, 7, 9, 2, 4, 6, 8	_____	_____
(c) 1, 2, 3, 0, 4, 5, 6, 7	_____	_____
(d) 0, 9, 8, 6, 5, 4, 7, 2	_____	_____
(e) 3, 5, 7, 9, 2, 0, 4, 8	_____	_____

11 Which is the largest :

(a) 5 digit number _____ (b) 6 digit number _____

(c) 7 digit number _____ (d) 8 digit number _____

12 Which is the smallest:

(a) 5 digit number _____ (b) 6 digit number _____

(c) 7 digit number _____ (d) 8 digit number _____

2.2 SUCCESSOR AND PREDECESSOR

The number that comes just after a given number is called its **successor**.

The number that comes just before a given number is called its **predecessor**.

EXAMPLE 1 Write the successor of the following numbers.

(a) 47,67,999   (b) 2,87,65,837

Solution : (a) 47,68,000   (b) 2,87,65,838

EXAMPLE 2 Write the predecessor of the following numbers.

(a) 57,86,546   (b) 58,64,000

Solution : (a) 57,86,545   (b) 58,63,999

2.3 COMPARISON OF NUMBERS

To compare two numbers we use the following rules.

Rule 1 : The number having more number of digits is bigger.

Rule 2 : For numbers having the same number of digits, compare their corresponding digits, starting from the left side.

EXAMPLE 1 Compare 2,13,47,807 and 30,57,081.

Solution : The number 2,13,47,807 has 8 digits.

The number 30,57,081 has 7 digits.

Therefore, 2,13,47,807 > 30,57,081.

EXAMPLE 2 Compare 47,63,841 and 47,67,215.

Solution : Both the numbers have 7 digits.

Now start	TL	L	TTh	Th	T	T	O
comparing from	4	7	6	3	8	4	1
left side	4	7	6	7	2	1	5

At ten lakhs place : 4 = 4

At lakhs place : 7 = 7

At ten thousands place : 6 = 6

At thousands place : 3 < 7

Therefore, 47,63,841 < 47,67,215.

2.4 ASCENDING AND DESCENDING ORDER

When numbers are arranged in increasing order (smallest to largest) then numbers are said to be in ascending order.

When numbers are arranged in decreasing order (largest to smallest) then numbers are said to be in descending order.

EXAMPLE 1 Arrange the following numbers in ascending order.
5,67,32,807; 34,72,586; 8,59,23,691; 34,72,359.

Solution :

		C	TL	L	TTh	Th	H	T	O
(iii)		5	6	7	3	2	8	0	7
(ii)			3	4	7	2	5	8	6
Largest	(iv)	8	5	9	2	3	6	9	1
Smallest	(i)		3	4	7	2	3	5	9

Clearly, 34,72,359 < 34,72,586 < 5,67,32,807 < 8,59,23,691.

So the ascending order is :

34,72,359; 34,72,586; 5,67,32,807; 8,59,23,691.

EXAMPLE 2 Arrange the following numbers in descending order :
53,74,264; 5,62,07,579; 53,74,812; 5,67,35,948.

Solution :

		C	TL	L	TTh	Th	H	T	O
Smallest	(iv)		5	3	7	4	2	6	4
(ii)		5	6	2	0	7	5	7	9
(iii)			5	3	7	4	8	1	2
Greatest	(i)	5	6	7	3	5	9	4	8

Clearly, 5,67,35,948 > 5,62,07,579 > 53,74,812 > 53,74,264

So the descending order is :
5,67,35,948; 5,62,07,579; 53,74,812; 53,74,264.

2.5 FORMATION OF NUMBERS WITH GIVEN DIGITS

The following rules help in the formation of numbers with the given digits.

1. To write the largest number using the given digits, without repetition of the digits, write the digits in descending order and then write the number using the digits written in descending order.

2. To write the smallest number using the given digits without repetition of the digits, arrange the digits in ascending order. Two cases arise :

   Case I : If there is no zero among the digits, then write the digits in ascending order and we will get the smallest number

   Case II : If one of the given digits is zero, then put zero at the second place from the left and write the remaining digits in ascending order.

3. To write the smallest or largest number using the given digits when repetition of the digits is allowed, write the smallest or greatest number following the details given in the question.

EXAMPLE 1 Write the largest and smallest number using 4, 7, 8 and 9 only once.

Solution : The required largest number is 9,874.

The required smallest number is 4,789.

EXAMPLE 2 Write the largest and smallest number using 3, 6, 0, 2, 8 and 5 only once.

Solution : The required largest number is 8,65,320.

The required smallest number is 2,03,568.

EXAMPLE 3 Write the largest and smallest number using 5, 3, 7 and 1, repeating 1 two times and 5 three times.

Solution : The required largest number is 75,55,311

The required smallest number is 11,35,557

EXAMPLE 4 Write the largest and smallest number using 2, 5, 0 and 6, repeating 5 and 6 two times each.

Solution : The required largest number is 6,65,520.

The required smallest number is 2,05,566.

EXAMPLE 5 Write the largest and smallest number using 3, 0, 6 and 4, repeating 3 three times.

Solution : The required largest number is 6,43,330

The required smallest number is 3,03,346.

EXERCISE 2(B)

1. Fill in the boxes with '>' or '<' by comparing both the numbers.

(a) 23,165 ☐ 18,742

(b) 4,22,78,173 ☐ 4,22,78,107

(c) 2,31,98,405 ☐ 78,90,546

(d) 54,36,54,372 ☐ 57,43,65,241

(e) 47,03,147 ☐ 8,19,20,375

2 Find out the smallest and greatest numbers from the given sets of numerals.

(a) 2,582; 2,852; 2,285; 2,528

(b) 93,810; 91,380; 90,183; 98,013

(c) 37,581; 38,175; 35,187; 31,758

(d) 5,209; 5,902; 5,092; 5,290

(e) 18,639; 19,638; 19,863; 18,396

3 Write the smallest 5-digit number.

4 Write the largest 7-digit number.

5 Use the digits given below and make the greatest and smallest 4-digit number without repeating the digits.

(a) 8, 7, 3, 1

(b) 4, 5, 6, 2

6 Use the digits given below and make the greatest and smallest 7-digit number without repeating the digits.

(a) 3, 0, 4, 6, 7, 9, 5

(b) 7, 2, 1, 6, 5, 3, 4

3 INTERNATIONAL NUMBER SYSTEM

3.1 INTRODUCTION

We know that 1,00,000 is the smallest six digit number. In India (and some other parts of Asia) this number is called one lakh. But elsewhere in the world, it is known as one hundred thousand and is written like this : 100,000.

The smallest 7 digit number is 10,00,000. In Indian system we call this as 10 lakh. But in International system or English system, this is known as 1 million and is written as 1,000,000.

In Indian number system we have lakhs, crores, etc. as periods. In International number system, instead of lakh and crore, we have million, billion, etc. Thus

1 Lakh = 1 00 000	or 1 Hundred thousand = 100 000
10 Lakh = 10 00 000	or 1 Million = 1 000 000
1 Crore = 1 00 00 000	or 10 Million = 10 000 000
10 Crore = 10 00 00 000	or 100 Million = 100 000 000
100 Crore = 100 00 00 000	or 1 Billion = 1 000 000 000 (1000 Million)

3.2 PLACE VALUE CHART

(a) Indian Number System

CRORES		LAKHS		THOUSANDS		ONES		
Ten crore T.C. 10,00,00,000	One crore C 1,00,00,000	Ten lakh T.L. 10,00,000	One lakh L 1,00,000	Ten thousand T.Th 10,000	One thousand Th 1,000	Hundreds H 100	Tens T 10	Ones O 1
9 Digits	8 Digits	7 Digits	6 Digits	5 Digits	4 Digits	3 Digits	2 Digits	1 Digit

(b) International Number System

MILLIONS			THOUSANDS			ONES		
Hundred Million (H.M.) 100 000 000	Ten Million (T.M.) 10 000 000	One Million (M) 1 000 000	Hundred thousand (H.Th) 100 000	Ten thousand (T.Th) 10 000	One thousand (Th) 1 000	Hundreds (H) 100	Tens (T) 10	Ones (0) 1
9 Digits	8 Digits	7 Digits	6 Digits	5 Digits	4 Digits	3 Digits	2 Digits	1 Digit

What is the basic difference between the Indian place value system and the International place value system? In Indian system, starting from the right, after the first period of three digits, all other periods consist of two digits, but in the International system, each period consists of three digits.
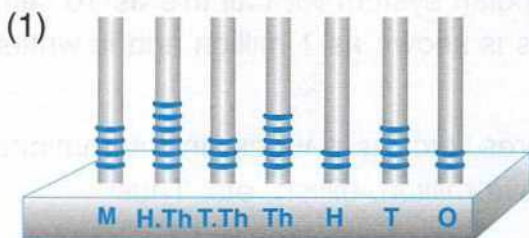
The chart can be extended to the left to include more than 9 digits. In the International system, after the millions period, we have the billions period.

1000 Million = 1 Billion = 1,000,000,000

100 Crore = 1 Billion

EXAMPLES Write in the International system the numeral and the number name that each diagram represents.

(1)

M	H.Th	T.Th	Th	H	T	O

Numeral: 4 635 242

Number Name: Four million six hundred thirty five thousand two hundred forty two.

(2)

T.M	M	H.th	T.Th	Th	H	T	O
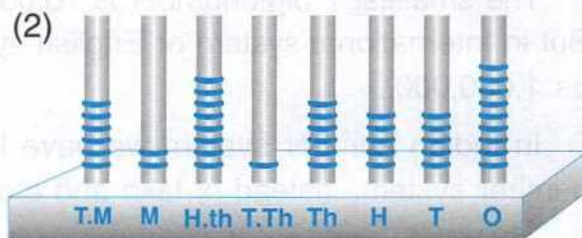
Numeral: 62 816 559

Number Name: Sixty two million eight hundred sixteen thousand five hundred fifty nine.

(3) Write the following numbers according to the International number system and write their number names.

(a) 6716456   (b) 54438676   (c) 176336894

Solution :

(a) 6 716 456 = Six million seven hundred sixteen thousand four hundred fifty six.

(b) 54 438 676 = Fifty four million four hundred thirty eight thousand six hundred seventy six.

(c) 176 336 894 = One hundred seventy six million three hundred thirty six thousand eight hundred ninety four.

(4) Write the numeral for each of the following :

(a) Six million four hundred twenty five thousand seven hundred eighty.

(b) Five hundred sixty million eight hundred thirty thousand four hundred sixteen.

(c) Forty eight million one hundred seventy five thousand eighteen.

	MILLIONS			THOUSANDS			ONES		
	Hundred Million (H.M.)	Ten Million (T.M.)	One Million (M)	Hundred Thousand (H.Th)	Ten Thousand (T.Th)	One Thousand (T)	Hundreds (H)	Tens (T)	Ones (O)
(a)			6	4	2	5	7	8	0
(b)	5	6	0	8	3	0	4	1	6
(c)		4	8	1	7	5	0	1	8

The numerals are :

(a) 6 425 780   (b) 560 830 416   (c) 48 175 018

EXAMPLE   Write 3678475 in (A) Indian system and (B) International system. Write the number names also.

Indian System : 36 78 475

Number Name : Thirty six lakh seventy eight thousand four hundred seventy five.

International System : 3 678 475

Number Name : Three million six hundred seventy eight thousand four hundred seventy five.

EXERCISE 3

1 Write the numeral and number name each diagram (abacus) represents in International System.

(i)

T.M   M H.Th T.Th Th   H   T   O

(ii)

T.M   M H.Th T.Th Th   H   T   O
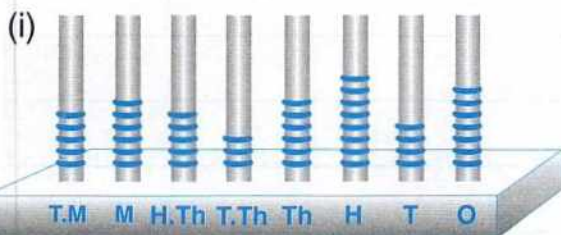
Numeral : _____   Numeral : _____

Number Name : _____   Number Name : _____

_____   _____

(iii)
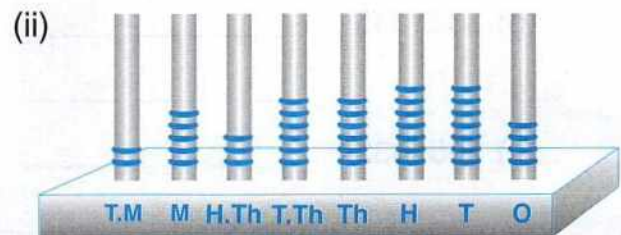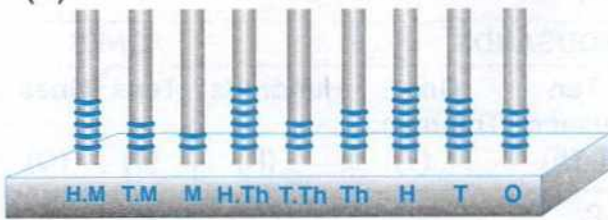
Numeral : _____

Number Name : _____

_____

(iv)
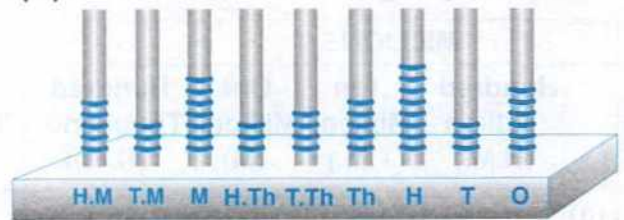
Numeral : _____

Number Name : _____

_____

(v)
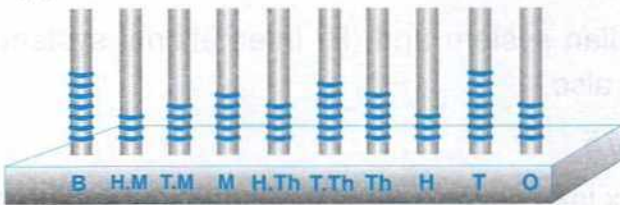
Numeral : _____

Number Name : _____

_____

(vi)

Numeral : _____

Number Name : _____

_____

2 Write each of the following numbers in the International system and write their number names.

(a) 783456 _____

_____

(b) 3521345 _____

_____

(c) 36586324 _____

_____

(d) 614835931 _____

_____

(e) 1232145678 _____

_____

3 Write the numeral for each of the following according to International Number System. Also insert commas to separate the periods.

(a) Six million five hundred fifty four thousand seven hundred thirty.

_____

(b) Twenty four million one hundred seventy one thousand eighty two.

_____

(c) One hundred forty five million eighty eight thousand eighty four.

_____

(d) One billion five hundred fifty eight million three hundred sixty four.

_____

4 Write the following numbers in (A) Indian system (B) International system. Write their number names also.

(a) 374654   (b) 967845   (c) 8547783   (d) 7113944

(e) 81361248   (f) 94431748   (g) 123409876   (h) 432015678

5 Rewrite the following numbers of the Indian system as per the International system.

(a) 7,82,104   (b) 91,34,018   (c) 18,32,456   (d) 1,32,47,002

(e) 28,47,20,123   (f) 67,89,327

6 Rewrite the following numbers of the International system as per the Indian system.

(a) 8,313,410   (b) 23,456,789   (c) 1,748,401   (d) 342,415,012

(e) 32,789,012   (f) 1,789,328
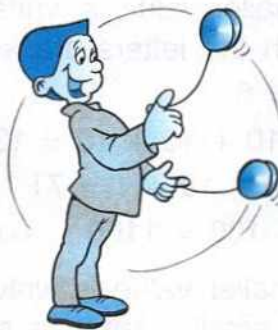
4 ROMAN NUMERALS

4.1 ROMAN NUMERALS

In earlier classes, we have read that the Roman numeral system uses letters of the English alphabet to represent numbers.

These letters and their numeric values are given in the following table.

Roman numerals	I	V	X	L	C	D	M
Numeric value	1	5	10	50	100	500	1000

Romans used different combinations of these letters to write numbers. Now, let us learn how to represent higher numbers using the Roman numeral system.

Note : (1) Numerals 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are called Indo-Arabic numerals.

(2) There is no zero in Roman numerals.

4.2 RULES FOR WRITING ROMAN NUMERALS

There are no rules as such for writing Roman numerals. However, there is an accepted convention in use for the past few years for writing Roman numerals. It is as follows :

1. Letters I, X, C and M can be repeated up to 3 times. Repetition of a Roman numeral means addition.

   e.g. :   I I = 1 + 1 = 2

   XX = 10 + 10 = 20

   CCC = 100 + 100 + 100 = 300

   MM = 1000 + 1000 = 2000

Note : Letters V, L and D are never repeated.

2. Whenever a letter of smaller value is written to the right of a letter of greater value, the values of both the letters are added.

   e.g. :   VI = 5 + 1 = 6

   CXXX = 100 + 10 + 10 + 10 = 130

   LXXI = 50 + 10 + 10 + 1 = 71

   MC = 1000 + 100 = 1100

3. Whenever a letter of smaller value is written to the left of a letter of greater value, the value of the smaller letter is subtracted from that of the greater letter.

Note : (i) V, L and D are never subtracted.

         e.g.   **Wrong** : VL = 50 − 5 = 45

                 Correct : XLV = (50 − 10) + 5 = 45

    (ii) The numeral I can be subtracted from V and X only.

         e.g.   **Wrong** : IL = 50 − 1 = 49

                 Correct : XLIX = (50 − 10) + (10 − 1) = 49

   (iii) The numeral X can be subtracted from L and C only.

   (iv) The numeral C can be subtracted from D and M only.

    (v) A letter of smaller value can be written to the left of a letter of greater value only once. It means that the same letter cannot be subtracted twice or thrice.

         e.g.   **Wrong** : XXC = 100 − 10 − 10 = 80

                        IIX = 10 − 1 − 1 = 8

                 Correct : LXXX = 50 + 10 + 10 + 10 = 80

                        VIII = 5 + 1 + 1 + 1 = 8

4. If a smaller numeral is placed between two greater numerals, then it is always subtracted from the larger numeral to the right of it.

     e.g. :   CXL = 100 + (50 − 10) = 140

             LIX = 50 + (10 − 1) = 59

5. To multiply the value of a numeral by 1000, a small bar (horizontal line) called a vinculum is put over the numeral.

     e.g. :   VII = 7   Therefore $\overline{VII}$ = 7 × 1000 = 7000

              XI = 11 Therefore $\overline{XI}$ = 11 × 1000 = 11000

EXAMPLE 1	Write the following as Roman numerals.

         (a) 69   (b) 229   (c) 924   (d) 2519

Solution :

Procedure :

Step 1 : Express the number in expanded form.

Step 2 : Write Roman numerals for each part.

Step 3 : Remove plus sign and write the number by combining all the parts.

(a)   69 = 60 + 9   (b)   229 = 200 + 20 + 9

           = LX + IX   = CC + XX + IX

           = **LXIX**   = **CCXXIX**

(c)   924 = 900 + 20 + 4   (d)   2519 = 2000 + 500 + 10 + 9

           = CM + XX + IV   = MM + D + X + IX

           = **CMXXIV**   = **MMDXIX**

| EXAMPLE 2 | Write the following in numbers. |

(a) XCIV　　　(b) MDCC　　　(c) MCCLIV

Solution :

Procedure :

Step 1 : Separate the combinations used to form the number by placing '+' sign between them.

Step 2 : Write the numbers for each part.

Step 3 : Add the parts.

(a)　　X C IV = X + C + I + V
　　　 10 ┬ 4 = XC + IV
　　　　 100　 = (100 − 10) + (5 − 1)
　　　　　　　 = 90 + 4 = **94**

(b)　　M D C C = M + D + C + C
　　 1000 100 = 1000 + 500 + 100 + 100
　　　　 500 100 = **1700**

(c)　　M C C L IV = M + C + C + L + I + V
　　 1000 100   4 = 1000 + 200 + 50 + (5 − 1)
　　　　 100 50 = **1254**

Note : It is easier to start from the right and recognize standard numerals for numbers 1 to 9.

e.g. Represent C M L X VI as an Indo-Arabic number.

　　　　　　　　　　　　 6
　　　　　　　　　 10
　　　　 100   50
　　　　　 1000

∴ The number is = (1000 − 100) + 50 + 10 + 6
　　　　　　　　 = 900 + 50 + 10 + 6 = **966**

EXERCISE 4

1 Which of the following are incorrect :

(a) XXC　　　(b) VL　　　　　　(c) XXXV

2 Choose the correct option :

(a) The Roman numeral for 79 is : LXXIX　MCIX　IXXC　IXXL

(b) Indo-Arabic numeral for XCVI is : 86, 96, 76, 97.

3 State true or false

(a) V, L and D are never subtracted.　　(b) XXC = 80

4 Express each of the following in Roman numerals.

(a) 7   (b) 9   (c) 17   (d) 25

(e) 40   (f) 59   (g) 67   (h) 82

(i) 105   (j) 149   (k) 90   (l) 163

(m) 233   (n) 489   (o) 511   (p) 695

(q) 762   (r) 899   (s) 956   (t) 1000

5 Write the following Roman numerals as Indo-Arabic numerals.

(a) XXVIII   (b) XLVI   (c) LIX   (d) LV

(e) LXIX   (f) LXVII   (g) XXXIX   (h) LX

(i) LXXII   (j) XCIII   (k) CXVIII   (l) LXXXIX

(m) CCXXVI   (n) CDXXVI   (o) DLXXXVII   (p) CMLXIX

(q) MDCLXVII   (r) MDCLII   (s) MDCLXXX   (t) MDCLXIX

6 Write the Indo-Arabic numerals for the following :

(a) XCVII   (b) CCCVI   (c) MCCCVI   (d) MCMVI

(e) MDXV   (f) MMCDXXX

7 Cross out the wrongly written Roman numerals.

(a) XIII   (b) DDX   (c) CCCL   (d) XM

(e) MCCCX   (f) XLIX   (g) ICC   (h) LC

5 OPERATIONS ON LARGER NUMBERS

In this book, we will follow the Indian system of numeration. You should express your answers in this system unless you are specifically told to use the International system.

Now we shall deal with problems on addition, subtraction, multiplication and division of larger numbers.

5.1 ADDITION

We have already learnt to add numbers upto ten lakh. Adding larger numbers is quite similar.

Step 1 : Arrange the numbers in columns (ones under ones, tens under tens and so on).

Step 2 : Add the digits in each column (always start with ones). Take the carry over (if any) to the next column and add it with the digits in that column. Continue till the last column.

EXAMPLE 1   Add 63 52 132 ; 8 67 462 ; 8 60 84 126

Solution:

```
     63 52 132
      8 67 462
  + 8 60 84 126
  _____
    9 33 03 720
```

Step 1: Arrange the given numbers in columns

Step 2: Add the digits in each column (always start with ones).

Ans : 9 33 03 720

EXAMPLE 2   Add the following numbers and also write the number name of your answer.

3 65 68 418; 75 80 115; 10 24 37 000; 50 670

Solution: First arrange the numbers in columns and then add.

```
     3 65 68 418
       75 80 115
    10 24 37 000
  +       50 670
  _____
    14 66 36 203
```

Ans : 14 66 36 203

Number name of the answer : Fourteen crore sixty six lakh thirty six thousand two hundred three.

5.2 SUBTRACTION

To subtract one number from another, we follow the steps given below :

Step 1 : Arrange the numbers in columns (ones under ones, tens under tens and so on).

Step 2 : Go on subtracting columnwise beginning with ones. (Borrow, if necessary)

EXAMPLE 1   Subtract 68 56 549 from 94 21 356

Solution: 94 21 356   Arrange the numbers in columns (minuend on
              − 68 56 549   the top and subtrahend under it) and subtract
              ⎯⎯⎯⎯⎯⎯
               25 64 807   **Ans : 25 64 807**

EXAMPLE 2   By how much is 4 16 24 748 greater than 2 28 75 876? Write the number name of your answer.

Solution: To find out by how much 4 16 24 748 is greater than 2 28 75 876, we subtract 2 28 75 876 from 4 16 24 748

                         4 16 24 748
                       − 2 28 75 876
                       ⎯⎯⎯⎯⎯⎯⎯
                         1 87 48 872   **Ans : 1 87 48 872**

Number Name : One crore eighty seven lakh forty eight thousand eight hundred seventy two.

EXERCISE 5(A)

1 Add

(a)   81 43 211
           9 42 879
        + 45 11 377
        ⎯⎯⎯⎯⎯⎯

        ⎯⎯⎯⎯⎯⎯

(b)   2 24 75 616
          6 60 48 478
        + 75 16 250
        ⎯⎯⎯⎯⎯⎯

(c)   75 657
          38 17 625
           9 45 843
        + 24 000
        ⎯⎯⎯⎯⎯⎯

(d)   17 40 75 614
          25 72 33 117
        + 73 62 54 992
        ⎯⎯⎯⎯⎯⎯

(e)   25 00 18 125
          18 83 24 289
        + 8 19 28 333
        ⎯⎯⎯⎯⎯⎯

(f)   28 18 417
           7 78 18 578
        + 20 08 37 800
        ⎯⎯⎯⎯⎯⎯

2 Arrange the following numbers in columns and add :

(a) 28 18 417 ; 43 35 318 ; 16 14 408

(b) 6 82 175 ; 30 42 225 ; 2 13 08 842

(c) 66 24 70 242 ; 7 78 18 478 ; 16 11 27 345

(d) 75 92 48 705 ; 20 08 37 800

(e) 48 16 00 900 ; 75 00 000 ; 8 00 00 000 ; 65 700

3 Arrange the following numbers in columns and add. Also write the number name of your answer.

(a) 14 58 75 215 ; 21 16 38 470 ; 38 66 15 575

(b) 25 75 818 ; 3 64 75 285 ; 4 00 00 000

(c) 5 50 00 000 ; 60 00 000 ; 75 000 ; 9 000

(d) 28 670 ; 49 56 486 ; 6 66 66 666

4 Subtract

(a)	49 56 721	(b)	20 11 048	(c)	48 30 225	(d)	33 52 118
	− 20 34 567		− 19 27 658		− 39 26 343		− 25 75 500

(e)	47 32 008	(f)	3 25 16 432	(g)	6 16 24 715	(h)	8 24 66 278
	− 24 42 366		− 1 28 33 544		− 4 28 74 366		− 54 70 486

(i) 38 20 42 086	(j) 17 35 18 195	(k) 22 10 85 648	(l) 17 04 26 183
− 32 29 48 148	− 9 48 22 086	− 18 25 92 786	− 9 36 86 276

5 Subtract 27 16 426 from 40 00 000

6 Subtract 1 89 45 700 from 6 00 00 000

7 Which is greater and by how much? 48 15 586 or 48 51 568?

8 How much should be added to 38 615 to get 2 01 405?

9 By how much is the sum of 32 16 575 and 16 24 683 less than 1 crore?

10 Which is greater, the sum of 3 42 48 546 and 8 10 36 200 or the sum of 12 04 58 757 and 95 00 700?

11 How much should be added to the sum of 3 72 65 432 and 68 56 385 to get 5 50 00 000?

12 Simplify:

    (a) 16 27 615 – 2 48 428 – 10 75 560 – 82 942

    (b) 2 25 16 400 – 3 44 50 675 + 6 00 60 500 – 3 18 21 791

    (c) 75 614 + 23 18 493 – 18 80 000 – 9 474

    (d) 686 + 74 400 – 40 00 000 + 48 00 000

    (e) 85 800 – 37 42 450 + 42 41 158 – 6 840

WORD PROBLEMS

Addition and subtraction

13 The population of a city consists of 6,32,41,682 male adults, 5,93,24,118 female adults and 1,82,345 children. Find the total population of the city.

14 The costs of three properties are ₹ 3,84,56,721, ₹ 4,53,24,567 and ₹ 5,78,34,532 respectively. Find the total cost of the three properties.

15 The government has allotted ₹ 3,84,32,148, ₹ 5,67,89,329 and ₹ 7,83,45,138 for the social welfare schemes of three backward districts. How much money was allotted altogether ?

16 Aman, Raj and Kavita spent ₹ 3,25,46,786, ₹ 5,78,91,234 and ₹ 7,83,24,132 respectively in a year. How much money did they spend in all ?

17 The income tax collected from four firms in a year were ₹ 3,24,56,783, ₹ 8,32,45,132, ₹ 2,13,23,485 and ₹ 1,03,24,567. How much tax did they pay altogether ?

18 In 2015, 83,78,569 people visited a restaurant. However, in 2016, 8,46,374 less people visited that restaurant. How many people visited the restaurant in 2016 ?

19 The sales proceeds of a company in the first year was 9,35,486. In the second year the sales proceeds increased by 90,387 and in the third year it increased by 1,34,201 over the second year. Find the total sales proceeds of the company for the three years.

20 The sum of two numbers is 89,452. If one of them is 67,842 find the second number.

21 In a mayoral election, candidate 'A' got 5,85,586 votes and candidate 'B' got 3,76,704 votes. Who got more votes and by how much ?

22 Subtract the greatest 8-digit number from the smallest 9-digit number.

23 Rosy had ₹ 54,00,000 with her. She purchased a car for ₹ 12,50,990. How much money was left with her ?

24 Five years ago, the population of a town was 41,37,108. Now the population is 60,48,991. Find the increase in population during the last five years.

25 Out of the population of 3,48,311 of a town, 1,25,387 are women and 95,384 are children. Find the number of men in the town.

26 Of the 37,48,378 students, who had appeared in the Board Examination, 31,97,847 students passed. Find the number of students who have failed.

27 A farmer earned an yearly income of ₹ 3,41,879 by selling rice and wheat. If his income from sale of wheat is ₹ 1,78,411, how much did he earn in selling rice ?

5.3 MULTIPLICATION

EXAMPLE 1 Multiply 42 175 by 243.

Solution:

```
      42175
    ×   243
    126525
   168700×
 + 84350××
  10248525
```

> When we do sums involving very large numbers, we must be careful and accurate at every step.

Ans : 1 02 48 525

EXAMPLE 2 Multiply 67 368 by 12000.

Solution: $67368 \times 12000 = 67368 \times 12 \times 1000$

```
    67368
  ×    12
   808416
```
$= 808416 \times 1000$

$= 80\ 84\ 16\ 000$ **Ans:**

EXERCISE 5(B)

1 Fill in the blanks. Do these mentally.

(a) 12 × 11   = _____   (b) 14 × 12   = _____   (c) 15 × 13   = _____

(d) 16 × 12   = _____   (e) 16 × 16   = _____   (f) 15 × 15   = _____

(g) 13 × 13   = _____   (h) 25 × 1000 = _____   (i) 34 × 1000 = _____

2 Multiply.

(a) 3776 × 15   (b) 17464 × 43   (c) 2154 × 124

(d) 5383 × 332   (e) 6324 × 762   (f) 42616 × 35

(g) 18714 × 176   (h) 88600 × 323   (i) 334810 × 21

WORD PROBLEMS

3 A shopkeeper sold 215 mobile phones, each costing ₹ 15,675. Calculate the total money he has collected through the sale.

4 A playground is 1,325 m long and 275 m wide. Find the area of the playground.

5 A water tank has the capacity of 15,680 litres. Find the quantity of water in 125 such tanks.

6 A public school has 3,127 students. If each student pays ₹ 850 for their school excursion, calculate the amount of money collected by the school for the excursion.

7 A reputed computer firm has 2,37,118 employees. If the company pays ₹ 750 per employee as New year bonus, how much money will be spent by the company ?

5.4 DIVISION

Let us recall what we already know about division:

1 Division means repeated subtraction.

(e.g.) 75 ÷ 8 = 9, remainder 3. It means 8 is subtracted from 75 nine times and 3 is left as the remainder.

2 Division is the inverse of multiplication. That is, in division we break up a given number into equal parts or groups. For example, we know that 16 × 7 = 112.

But when we divide 112 by 7, we break up 112 into 16 parts or groups. Similarly if we divide 112 by 16, we break it up into 7 equal parts or groups.

3 The dividend, divisor, quotient and remainder are related with one another by the following relationship:

$$\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Remainder}$$

4 When we divide a number by 10, 100, 1000, 10000, etc., we get the number formed by as many digits from the right of the dividend as there are zeroes in the divisor as remainder and the number formed by the remaining digits of the dividend as quotient.

e.g.   (i) 13566 ÷ 100   (ii) 46483 ÷ 1000   (ii) 368345 ÷ 10000

          Quotient   = 135   Quotient   = 46   Quotient   = 36

          Remainder = 66   Remainder = 483   Remainder = 8345

5 When we divide a number by 1 the quotient is the number itself e.g. 36 ÷ 1 = 36

6 When we divide a number by the number itself (except 0), we get the quotient as 1, e.g. $48 \div 48 = 1$

7 A division by zero has no meaning e.g. $358 \div 0$ has no meaning

8 '0' divided by a number other than 0 gives '0' as quotient.
e.g. $0 \div 8 = 0$; $0 \div 3 = 0$; $0 \div 0$ is not defined.

EXAMPLE 1 $419634 \div 38$

```
        11043
  38 | 419634
     - 38
       ───
        39
      - 38
       ───
        163
      -152
       ───
        114
      -114
       ───
          0
```

Ans : Quotient = 11043,
Remainder = 0

Method :

Step 1 : As the divisor has two digits, take the first two digits from the left. As 38 goes one time in 41 write 1 in the quotient column above 1, and 38 below 41.

Step 2 : $41 - 38 = 3$. Bring down 9; then we have 39. Again 38 goes in 39, 1 time. Write 1 in the quotient column above 9.

Step 3 : $39 - 38 = 1$. Bring down the next digit 6. Now we have 16. But $38 > 16$. So we get 0 when we divide 16 by 38. **Write 0 in the quotient column above 6.**

Step 4 : Bring down the next digit 3. Now we have 163. To get the trial division, divide 16 by 3 It goes 5 times. So $38 \times 5 = 190 > 163$. Again try 4. $38 \times 4 = 152$. $152 < 163$. Write 4 in the quotient column above 3.

Step 5 : $163 - 152 = 11$. Bring down the next digit 4. We have 114.

Step 6 : To get the trial division, divide 11 by 3. It goes 3 times. So $38 \times 3 = 114$. Write 3 in the quotient column above 4. $114 - 114 = 0$

EXAMPLE 2 $364865 \div 57$

```
         6401
  57 | 364865
     - 342
       ───
        228
      - 228
       ───
          65
        - 57
         ──
           8
```

Method :

As the divisor has two digits, we consider the first two digits from the left. But since $36 < 57$ we consider the first three digits together.

To get the trial quotient we divide 36 by $5 = 7$.

$57 \times 7 = 399$, but $399 > 364$. Try 6. $57 \times 6 = 342$

Remaining steps of the problem are the same as in the previous example.

Ans : Quotient = 6401, **Remainder** = 8

EXAMPLE 3   36648067 ÷ 943

```
            38863
    943 | 36648067
        − 2829
          8358
        − 7544
           8140
         − 7544
            5966
          − 5658
             3087
           − 2829
              258
```

Ans: Quotient: 38863
Remainder: 258

EXERCISE 5(C)

1 Divide the following numbers by (i) 100 (ii) 1000 (iii) 10000. (Do by short method).
Write the quotient and the remainder.

Number	By 100		By 1000		By 10000	
	Quotient	Remainder	Quotient	Remainder	Quotient	Remainder
(a) 85400						
(b) 821600						
(c) 974800						
(d) 96000						
(e) 486000						
(f) 770000						
(g) 3360000						
(h) 9876450						

2. Divide and find the quotient and the remainder. Check your answer using the relationship: Dividend = Divisor × Quotient + Remainder

   (a) 62643 ÷ 56   (b) 342616 ÷ 47   (c) 5177365 ÷ 63

   (d) 4810348 ÷ 75   (e) 51693 ÷ 483   (f) 68085 ÷ 583

   (g) 6635178 ÷ 725   (h) 5017383 ÷ 603   (i) 36217408 ÷ 264

WORD PROBLEMS

3. The product of two numbers is 3,14,48,895. If one of the numbers is 6491, find the other number.

4. A library has 56,700 books. If each shelf has 105 books, find out the number of shelves in the library.

5. A state government has distributed ₹ 2,26,87,875 among 3,015 farmers. Find the share of each farmer.

6. Mrs. Sharma gets an annual income of ₹ 2,98,494 by taking science tuitions of 63 students. Find the amount of fees charged by her per student.

7. The government distributes a scholarship of ₹ 11,47,500 for 255 meritorious university students annually. Calculate the scholarship amount given to each student.

6 ROUNDING OFF — ESTIMATION

6.1 ROUNDING OFF NUMBERS

Look at the following examples :

1. There are 58 students in a class. We may say that about 60 students are there in the class.

2. 484 people came for Ravi's wedding reception. He said that about 500 people came for the reception.

3. How old are you Harsh?
   I am 10 years old, Sir.

   Ritu, what is your height?
   My height is about 120 cm, Sir.

4. Malini paid ₹ 10,200 for a colour T.V. When she was asked how much she had paid, she said that she paid about ₹ 10,000 for the T.V.

Above examples show that some times in our life, for convenience and to make our statements easily understandable, we talk in terms of round numbers instead of exact numbers. What do we mean by round numbers or rounding off ?

Rounding off means that we replace the given exact number by another convenient number which is easy to understand but very close to the original number.

In example 1, we rounded off the number to the nearest ten.

58 comes between 50 and 60. 58 is closer to 60 [since the difference between 60 and 58 is 2 but the difference between 58 and 50 is 8].

So we replace 58 by 60. We say that correct to the nearest ten, 58 rounds off to 60 or approximation for 58 is 60.

In example 2, we rounded off the given number to the nearest hundred. The exact number is 484. It is replaced by 500. Why ?

484 comes between 400 and 500. 484 is closer to 500 [The difference between 500 and 484 is 16, but the difference between 484 and 400 is 84].

Therefore, we say that to the nearest hundred, 484 rounds off to 500 or approximation for 484 is 500.

In example 3, the above answers may not be very accurate because Harsh's age may be 9 years 11 months and 27 days. Similarly, Ritu's height may be 120 cm and 34 mm.

> Sometimes, it is necessary to round off quantities so as to make an approximation that is easy to understand.

In example 4, we rounded off the given number to the nearest thousand.

10,200 comes between 10,000 and 11,000 but 10,200 is closer to 10,000. [The difference between 10,000 and 10,200 is 200 but the difference between 11,000 and 10,200 is 800].

Therefore, we say that 10,200 rounds off to 10,000 to the nearest thousand or approximation for 10,200 is 10,000.

When rounding off numbers, numbers half way and above are rounded off to the higher 10, 100, 1000, etc., while those below half way are rounded off to the nearest 10, 100, 1000, etc.

Similarly, when rounding off larger numbers, look at the last but one digit from the right. If it is 5 or > 5, round off to the higher number. If it is < 5, round off to the lower number.

EXAMPLE

4,73,682 = 5,00,000 [7 > 5]

4,53,071 = 5,00,000 [5 = Half-way number]

4,43,081 = 4,00,000 [4 < 5]

So the general rule is : When we round off a number to the given place (tens, hundreds, thousands, etc.) we see the next digit to the given place at the right side. If this digit is 5 or more than 5, we add 1 to the digit in the required place and all the digits on the right side become zeroes, and if the digit at the right side is less than 5, the digit at the required place remains the same and all the digits at the right side become zeroes.

However, approximation sometimes may not be suitable. Suppose you were going on a tour and were to catch a train that leaves at 10.50 a.m. You should not think for approximate time or you might miss the train !

> Approximation should be done only when required or asked for.

EXERCISE 6(A)

1 Find the half way number between

(a) 18,000 and 19,000 _____ (b) 15,000 and 16,000 _____

(c) 4,00,000 and 5,00,000 _____ (d) 22,00,000 and 23,00,000 _____

(e) 1,60,000 and 1,70,000 _____ (f) 90,000 and 1,00,000 _____

2 Round off the given numbers correct to the nearest tens.

(a) 316 _____ (b) 984 _____ (c) 1,242 _____

(d) 7,486 _____ (e) 1003 _____ (f) 9992 _____

(g) 45,793 _____ (h) 1,06,921 _____ (i) 97,097 _____

3 Round off the given numbers correct to the nearest hundreds.

(a) 269 _____ (b) 2,406 _____ (c) 7,381 _____

(d) 26,178 _____ (e) 42,888 _____ (f) 10,040 _____

(g) 2,35,999 _____ (h) 99,978 _____ (i) 5,09,896 _____

4 Round off the given numbers correct to the nearest thousands.

(a) 1,840 _____ (b) 14,899 _____ (c) 28,706 _____

(d) 10,710 _____ (e) 49,875 _____ (f) 99,786 _____

(g) 89,965 _____ (h) 3,99,899 _____ (i) 2,00,673 _____

5 Round off the given numbers correct to the nearest ten thousands.

(a) 24,784 _____ (b) 88,048 _____ (c) 55,555 _____

(d) 2,16,850 _____ (e) 7,28,173 _____ (f) 24,251 _____

(g) 11,09,571 _____ (h) 43,00,888 _____ (i) 59,82,696 _____

6 Round off the given numbers to the nearest lakh:

(a) 5,72,682 _____ (b) 17,65,925 _____ (c) 9,82,468 _____

(d) 8,42,920 _____ (e) 15,49,300 _____ (f) 3,59,000 _____

(g) 94,51,009 _____ (h) 49,70,999 _____ (i) 63,60,699 _____

7 Round off the given numbers to the nearest crore:

(a) 14,25,56,800 _____ (b) 4,53,60,000 _____

(c) 2,92,50,000 _____ (d) 9,97,96,777 _____

(e) 69,74,25,009 _____ (f) 9,37,90,900 _____

8 For the numbers given below, give the approximation correct to (i) tens and (ii) hundreds

(a) 546 _____ (b) 783 _____ (c) 937 _____

(d) 45,381 _____ (e) 53,712 _____ (f) 6,98,301 _____

(g) 4,939 _____ (h) 9,707 _____ (i) 2,99,999 _____

[Correct to nearest ten, 546 rounds to 550. Correct to nearest hundred, 546 rounds off to 500]

6.2 ESTIMATION IN NUMBER OPERATIONS

Estimation helps us to get a general idea about situations involving addition, subtraction, multiplication or division. It can be extremely useful to calculate costs, expenditure, profits, losses, etc. while dealing with larger numbers.

An estimate is the answer close to the actual answer.

EXAMPLE 1 Estimate the following sum by rounding off to the nearest 10,000.

8,42,399 + 98,559 + 49,308

Solution : Rounding off to the nearest 10,000, we get

8,40,000 + 1,00,000 + 50,000 = 9,90,000

$$
\begin{array}{r}
8,40,000 \\
1,00,000 \\
+ 50,000 \\
\hline
\mathbf{9,90,000}
\end{array}
$$

EXAMPLE 2 Estimate the difference to the nearest 1000 and verify if the estimated difference is close to the actual difference.

88,303 − 69,796

Solution : Rounding off to nearest 1,000, we get —

88,000 − 70,000 = 18,000

Now, actual difference will be

88,303 − 69,796 = 18,507

So, 18,000 is close to the actual difference

i.e. 18,507

$$
\begin{array}{r}
88,000 \\
- 70,000 \\
\hline
\mathbf{18,000}
\end{array}
$$

$$
\begin{array}{r}
{}^{17}\ {}^{12}\ {}^{9} \\
{}^{7}\,{}^{18}\ {}^{13}\,{}^{10}{}^{13} \\
88,303 \\
- 69,796 \\
\hline
\mathbf{18,507}
\end{array}
$$

EXAMPLE 3 Estimate the following by rounding off the multiplicand and the dividend to the nearest 100 and find the difference between the estimated and the actual answer.

(a) 4,792 × 3   (b) 9,573 ÷ 3

Solution :

(a) Rounding off 4,792 to the nearest 100, we get 4,800

4,800 × 3 = 14,400

Now, 4,792 × 3 = 14,376

∴ Estimated product − Actual product

14,400 − 14,376 = **24**

$$
\begin{array}{r}
{}^{2} \\
4,800 \\
\times 3 \\
\hline
\mathbf{14,400}
\end{array}
\qquad
\begin{array}{r}
{}^{2}\ {}^{2} \\
4,792 \\
\times 3 \\
\hline
\mathbf{14,376}
\end{array}
$$

(b) Rounding off 9,573 to the nearest 100, we get 9,600

9,600 ÷ 3 = 3,200

Now, 9,573 ÷ 3 = 3,191

∴ Estimated quotient − Actual quotient

3,200 − 3,191 = **9**

$$
\begin{array}{r}
3200 \\
3\overline{)9600}(\\
-\ 9 \\
\hline
06 \\
-\ 6 \\
\hline
0
\end{array}
\qquad
\begin{array}{r}
3191 \\
3\overline{)9573}(\\
-\ 9 \\
\hline
5 \\
-\ 3 \\
\hline
27 \\
-27 \\
\hline
03 \\
-\ 3 \\
\hline
0
\end{array}
$$

1 Estimate the following sums to the nearest lakh and check with the actual answer.

(a) 29,35,908 + 36,44,009 + 49,99,078 _____

(b) 56,21,424 + 94,52,137 + 13,79,555 _____

(c) 67,00,500 + 39,58,389 + 8,88,642 _____

2 Estimate the following difference to the nearest 10,000 :

(a) 53,708 – 48,677 _____ (b) 66,578 – 19,304 _____

(c) 1,87,355 – 89,856 _____

3 Estimate the following by rounding off the multiplicand and the dividend to the nearest 1,000 :

(a) 7,603 × 2 _____ (b) 6,945 × 8 _____

(c) 41,750 ÷ 3 _____ (d) 5,668 × 11 _____

(e) 27,259 ÷ 9 _____ (f) 89,666 ÷ 15 _____

4 Round off the following as instructed:

(a) To the nearest rupee.

₹ 320 50 p   ₹ 68 25 p   ₹ 32 80 p   ₹ 3 70 p   ₹ 8 96 p

_____   _____   _____   _____   _____

(b) To the nearest hour.

8:50 p.m   10:48 a.m   5:35 p.m

_____   _____   _____

The bus left at 7.45 a.m.

I missed my bus. I thought it leaves at around 8.00 a.m.

6:10 a.m   8:30 a.m   2:45 p.m

_____   _____   _____

Sometimes approximation does not work.

(c) To the nearest year.

10 years 10 months   5 years 3 months   24 years 6 months   15 years 9 months

_____   _____   _____   _____

6.3 ESTIMATION

EXAMPLE 1 Mr. Singh has 193 Pepsi, 187 Coca Cola and 95 Fanta bottles in his shop. Estimate about how many bottles he has in stock by rounding off each number to the nearest tens.

Solution: Round off 193, 187 and 95 to the nearest tens :

193	→	190
187	→	190
95	→	+ 100
		480

So about 480 bottles are in the stock.

EXAMPLE 2 A shopkeeper's monthly income by sale was ₹ 27,650 and his expenditure was ₹ 15,275. Estimate his profit by rounding off to the nearest thousands.

Solution: Round off each number to its greatest place value and subtract.

Round off 27,650 and 15,275 to the nearest thousands.

27,650	→	28,000
15,270	→	− 15,000
		13,000

His profit was about ₹ 13,000.

In case rounding off place value is not specified, we add or subtract numbers having different digits by rounding off all the numbers to the greatest place of the number having the least number of digits.

EXAMPLE 3 Sahil bought a mobile phone for ₹ 6,325 and mobile cover for ₹ 189. Find out about how much money he spent ?

Solution: Of the two given numbers, 189 is the smaller number (3 digit number). So we shall round off both the numbers to the greatest place of 3 digit number, i.e. to the nearest hundreds.

6,325	→	6,300
189	→	+ 200
		6,500

He spent around ₹ 6,500.

When finding the product of numbers, we round off each factor to its greatest place and multiply the rounded off factors.

EXAMPLE 4 A stadium has 28 rows and each row has 437 seats. About how many persons can be accommodated in the stadium ?

Solution : Round off the numbers to their greatest place value and multiply.

$$28 \rightarrow 30$$
$$437 \rightarrow 400$$

No. of seats = 30 × 400 = 12,000

So the stadium can accommodate about 12,000 people.

EXERCISE 6(C)

1 Estimate the sum

(a) 53 + 47 _____

(b) 28 + 69 + 67 _____

(c) 240 + 398 _____

(d) 467 + 176 + 87 _____

(e) 2843 + 4382 + 9324 _____

(f) 83413 + 2567 + 43928 _____

2 Estimate the difference

(a) 85 − 32 _____

(b) 56 − 27 _____

(c) 567 − 84 _____

(d) 3678 − 1256 _____

(e) 3056 − 1506 _____

(f) 93125 − 34123 _____

3 Estimate the product

(a) 33 × 17 _____ (b) 88 × 21 _____ (c) 178 × 4 _____

(d) 486 × 31 _____ (e) 2124 × 112 _____ (f) 997 × 47 _____

4 Choose the best answer from the answers given in the brackets.

(a) 242 + 406   [500, 600, 700] _____

(b) 2415 + 1076 + 3662   [7000, 8000, 9000] _____

(c) 4745 − 1828   [2000, 3000, 4000] _____

(d) 9412 − 6814   [2000, 3000, 4000] _____

(e) 878 × 98   [85000, 92000, 90000] _____

(f) 2488 × 18   [30,000, 60,000, 40,000] _____

5 A cassette costs ₹ 37. Approximately, how much will 21 cassettes cost ?

6 Rohan had ₹ 9846. He bought a music player for ₹ 6248. Estimate the money Rohan is left with.

7 Two water tanks contain 3415 litres and 2756 litres of water respectively. Find the total amount of water contained in the two water tanks and round it off to the nearest 1000.

7 UNITARY METHOD

7.1 INTRODUCTION

The method of finding the value or cost of one article first and then finding the value or cost of a number of articles is called **Unitary Method**. The word unitary is derived from the word 'unit', which means one.

EXAMPLE 1 A factory produces 525 cars each week. How many cars are produced in 15 days?

Solution: 1 week = 7 days

No. of cars produced in 7 days = 525

No. of cars produced in 1 day = 525 ÷ 7 = 75 [less, divide]

∴ No. of cars produced in 15 days = 75 × 15 = 1125 [more, multiply]

Ans. 1125 cars

EXAMPLE 2 A train covers a distance of 432 km in 9 hours. What distance does it cover in 12 hours?

Solution: The distance covered by the train in 9 hours = 432 km.

The distance covered in 1 hour = 432 ÷ 9 = 48 km.

∴ The distance covered in 12 hours = 48 × 12 = 576 km. [more, multiply]

Ans. 576 km.

EXERCISE 7(A)

1. A factory manufactures 1200 scooters in 16 days. How many scooters does it manufacture in 1 day?

2. A cycle factory produces 2500 cycles in 20 days. How many cycles will it produce in a month? (1 month = 30 days)

3. A truck uses 14 litres of diesel for 98 kilometres. How far will it run in 20 litres?

4. A train covers 600 km in 12 hours. How many hours will it take to cover 800 km?

5 In a hostel, 150 students consume 2700 kg of rice in a month. How much rice will be required for 100 students in a month?

6 A car takes 11 hours to cover 770 km. How many hours will it take to cover 350 km?

7 If 336 people can travel in 21 compartments of a train, how many compartments are required for 960 people?

8 A year's rent for a house is ₹ 21600. If the Chatterjee family wants to rent the house for only 8 months, how much rent will they have to pay?

9 Anita buys 37.5 litres of milk in 15 days. If she buys the same quantity of milk every day, how much milk does she buy in a week?

10 Rajan gets a commission of ₹ 900 for selling 6 scooters. How many scooters should be sold to get a commission of ₹ 2250?

11 Mohan purchased 9 metres of cloth to make 5 shirts. How many metres of cloth should he buy for 4 shirts?

12 Madhuri's heart beats 360 times in 5 minutes. About how many times does it beat in half an hour?

7.2 INVERSE CHANGES

We know from everyday life the following facts :

If more people work together, they will take less time to complete a work.

If fewer people work, they will take more time to finish a work.

EXAMPLE 1 5 men will construct a wall in 12 days. If 1 man has to construct the wall, will he take more time or less time? He will take more time. (So, multiply). How long will 12 men take to do the same work ?

Solution: 1 man will construct the wall in 12 × 5 = 60 days.

If 12 men work together, will they take more time or less time? More men are working, so they will take less time. (So, divide)

1 man can construct the wall in 60 days.

∴ 12 men will construct the wall in 60 ÷ 12 = 5 days. **Ans.**

EXAMPLE 2 12 boys take 36 days to finish a work. How long will 18 boys take to do the same work?

Solution: 12 boys take 36 days.

1 boy will take 36 × 12 days (more time, so multiply)

∴ 18 boys will take $(36 \times 12) \div 18$ (less time, so divide)

$$= \frac{\overset{2}{36} \times 12}{\cancel{18}} = 24 \text{ days}$$

Ans. 18 boys will take 24 days to complete the work.

EXAMPLE 3 There are 30 boys in a hostel. They have food to last for 20 days. How long would the same food last if there were 40 boys?

Solution: For 30 boys the food lasts for 20 days

For 1 boy the same food lasts for $20 \times 30 = 600$ days (more time, so multiply)

For 40 boys (less time, so divide) = $\dfrac{\overset{15}{600}}{40} = 15$ days

Ans. 15 days

EXAMPLE 4 16 men can build a wall in 25 days. How many men are required to build the wall in 10 days?

Solution: To build a wall in 25 days, 16 men are required

To build a wall in 1 day, 16×25 men are required (more men are required so, multiply)

∴ To build a wall in 10 days, $(16 \times 25) \div 10$ (less men so divide)

$$= \frac{\overset{8}{16} \times \overset{5}{25}}{\underset{2}{\cancel{10}}} = 40 \text{ men are required}$$ **Ans.** 40 men

We can do the problem in the following way also :

Days	No. of men
25	16
1 (more, multiply)	16×25
10 (less , divide)	$\dfrac{\overset{8}{16} \times \overset{5}{25}}{\underset{5}{\cancel{10}}} = 40$ men

Ans. 40 men
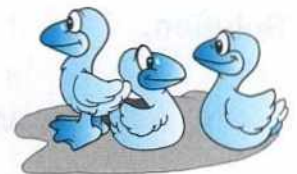
EXERCISE 7(B)

1 A man does a work in 36 days. In how many days will 9 men do it?

2 25 men plough a field in 30 days. How many men will plough it in 1 day?

44

3 12 men take 18 days to construct a road. Find the number of days 9 men take to construct the same road.

4 48 men are employed to construct a building in 75 days. Due to some reason, they wanted the building to be ready in 60 days. How many men should be employed to construct the building in 60 days?

5 20 people are employed to whitewash the school building in 12 days. How many people should be employed if the whitewashing is to be done in 8 days?

6 8 taps can fill up a tank in 20 minutes. How many minutes will 10 taps take to fill up the same tank?

7 In 25 days 18 men complete a work. How many men are required to complete the work in 15 days?

8 For 28 men the provision lasts for 30 days. For how many men will the provision last for 21 days?

9 For a group of 27 students food lasts for 64 days. For how many students will the same food last for 54 days?

10 If 45 cows can graze a field in 18 days, how many days will 30 cows take to graze on the same field?

11 A hostel has provision for 50 students for a month. If 10 more students joined the hostel, how long will the provision last? (1 Month = 30 days)

12 112 men can build a railway tunnel in 72 days. How many more men will be required to build the tunnel in 48 days?

8 FACTORS AND MULTIPLES

8.1 REVISION

Numbers which are multiples of 2 are called even numbers.

e.g. 2, 4, 6, 8, 10, 12, etc.

Numbers which are not multiples of 2 are called odd numbers.

1, 3, 5, 7, 9, 11, etc.

TEST OF DIVISIBILITY TABLE

DIVISIBLE BY	RULE	EXAMPLES
2	If the one's digit is even or zero	0, 8, 36, 48, 54, 120
3	If the sum of all the digits is divisible by 3	18, 36, 54, 111, 162
4	If the number formed by the last two digits is divisible by 4 or if the last two digits are both zeroes	116, 172, 228, 300
5	If the last digit (one's digit) is either zero or 5	50, 65, 115, 160
6	If the number is divisible by 2 and 3	72, 186, 342
9	If the sum of the digits is divisible by 9	27, 108, 135, 261
10	If the one's digit is zero	140, 430, 1000, 2340
11	If the difference between the sums of the digits in the odd places and in the even places is either zero or divisible by 11	132, 143, 396, 1430
12	If the number is divisible by 3 and 4	24, 96, 288, 564
15	If the number is divisible by 3 and 5	30, 105, 2715, 3705

8.2. IMPORTANT FACTS

A **Prime Number** is a whole number greater than 1 which has only two different factors namely 1 and itself. (e.g.) 2, 3, 5, 7, 11, 13, 19, etc.

> 2 is the only even prime number. All other prime numbers are odd.

A number which is not a prime number is called a **Composite Number**, *i.e.* it has more than two factors.

For example, 4, 8, 9, 10, 12, 14, 15,............ etc.

> 1 is a unique number. It is neither a composite number nor a prime number since it has only one factor, that is itself.

A **multiple** of a number is the product of that number and a whole number. Thus the multiples of 4 are 4, 8, 12, 16, 20.................. [4 × 1 = 4, 4 × 2 = 8, 4 × 3 = 12, 4 × 4 = 16, etc.]

A **factor** is a divisor which divides a number exactly or a number is a factor of another number if it divides that number exactly (i.e. remainder is 0) e.g., 6 is a factor of 12 ; 5 is a factor of 15 ; 7 is a factor of 35.

A factor which is a prime number is called a **Prime Factor**. (e.g.) 7 is a prime factor of 35, 3 is a prime factor of 12, etc.

We can find out the prime factors of a number by using short division method.

EXAMPLE   Find the prime factors of 750.

Solution :

2	750
3	375
5	125
5	25
5	5
	1

∴ Prime factors of 750 are 2, 3 and 5.

8.3 CO-PRIME NUMBERS

Those numbers which do not have a common factor between them, except 1, are called **co-prime numbers**.

OR

Two or more numbers are said to be co-prime if their highest common factor (HCF) is 1.

Examples : 16 and 25 have no common factor except 1. Similarly, 65 and 84 do not have any common factor. So, 16 and 25; 65 and 84 are co-prime numbers.

Note : (1) Two prime numbers are always co-prime.

e.g. 5 and 23 ; 7 and 17 ; etc.

(2) Two consecutive numbers are always co-prime as they will not have any common factor.

e.g. consider 24 and 25.

Factors of 24 : 1, 2, 3, 4, 6, 8, 12 and 24.

Factors of 25 : 1, 5 and 25.

As they have no common factor except 1, they are co-prime numbers.

8.4 TWIN PRIME NUMBERS

Twin prime numbers are two consecutive prime numbers whose difference is 2.

Examples : 3 and 5, 11 and 13, 17 and 19, 41 and 43 are all twin prime numbers.

8.5 PROPERTIES OF FACTORS AND MULTIPLES

Factors

1 1 is a factor of every number.

2 Every number (other than zero) is a factor of itself.

3 Every number is a factor of 0.

4 A factor of a number (other than zero) is either less than or equal to the number.

Multiples

1 Every number is a multiple of 1.

2 Every number is a multiple of itself.

3 0 is a multiple of every number.

4 Every (non-zero) multiple of a whole number is either greater than or equal to that number.

1 From the numbers given below mark the numbers which are divisible and also those which are not divisible by the numbers given on the left column.

Divisible by	Numbers						
	99	184	7065	12480	27534	23343	12210
3	✓	×	✓				
4							
5							
6							
9							
11							
12							
15							

2 What is the smallest number which should be (i) subtracted from and (ii) added to:

(a) 3646 to get a number divisible by 3   (i) _____   (ii) _____

(b) 12642 to get a number divisible by 4   _____   _____

(c) 5213 to get a number divisible by 5   _____   _____

(d) 7427 to get a number divisible by 6   _____   _____

(e) 9466 to get a number divisible by 9   _____   _____

(f) 26,303 to get a number divisible by 11   _____   _____

3 Find out if the first number is a factor of the second number. Say yes or no.

(a) 8 ; 1008 _____ (b) 7 ; 658 _____ (c) 9 ; 3145 _____ (d) 11 ; 3644 _____

(e) 19 ; 626 _____ (f) 17 ; 398 _____ (g) 13; 4164556 _____ (h) 12 ; 780 _____

(i) 14; 464 _____ (j) 15 ; 1785 _____ (k) 13 ; 4103 _____ (l) 16 ; 1936 _____

4 List the factors of the following:

(a) 48 _____   (b) 63 _____

(c) 84 _____   (d) 108 _____

(e) 32 _____   (f) 169 _____

(g) 343 _____   (h) 150 _____

5 (a) Find the first six multiples of 9. _____

   (b) Find the seventh multiple of 16. _____

   (c) Find the fifth multiple of 15. _____

   (d) Find the ninth multiple of 16. _____

   (e) Find the multiples of 11 greater than 55 but less than 180. _____

   (f) Find the multiples of 15 greater than 120 but less than 225. _____

6 Write down the prime numbers between

   (a) 50 to 65   _____

   (b) 80 to 100   _____

   (c) 110 to 125 _____

7 Write down the composite numbers between

   (a) 70 to 80   _____

   (b) 100 to 110 _____

   (c) 40 to 50   _____

8 Is 1 a prime number? _____

9 What is the smallest composite number? _____

10 Write the prime number which is even. _____

11 Find the prime factors of the following numbers:

   27, 35, 63, 91, 100, 77, 54, and 143

_____

_____

_____

8.6 GREATEST COMMON FACTOR OR HIGHEST COMMON FACTOR

The Greatest Common Factor (G.C.F.) or the Highest Common Factor (H.C.F.) of two or more whole numbers is the greatest whole number that is a factor of both the numbers.

EXAMPLE 1   Find the H.C.F. of 18 and 24.

Solution :   **Method 1 :** Listing method

Factors of 18 are 1, 2, 3, 6, 9 and 18
and factors of 24 are 1, 2, 3, 4, 6, 8, 12 and 24.
∴ The common factors of 18 and 24 are 1, 2, 3 and 6.
But the highest common factor is 6.
∴ H.C.F. = 6

Method 2 : Prime factor method

```
2 | 18          2 | 24
3 | 9           2 | 12
3 | 3           2 | 6
    1           3 | 3
                    1
```

$18 = \underline{2} \times \underline{3} \times 3$

$24 = \underline{2} \times 2 \times 2 \times \underline{3}$

Common factors of 18 and 24 are 2 and 3 (underlined).

∴ H.C.F. of 18 and 24 is $2 \times 3 = 6$ (Product of all common prime factors)

We can do the same problem by the following method also.

```
2 | 18, 24
3 | 9, 12
    3,  4
```

Start dividing by the least common factor and stop when there is no common factor. Generally we do the problems by this method since it is simple and fast.

H.C.F. $= 2 \times 3 = 6$

EXAMPLE 2   Find the H.C.F. of 48, 72 and 84.

Solution:

```
2 | 48      2 | 72      2 | 84
2 | 24      2 | 36      2 | 42
2 | 12      2 | 18      3 | 21
2 | 6       3 | 9       7 | 7
3 | 3       3 | 3           1
    1           1
```

$2 \times 2 \times 3$ are the common factors of each number

∴ H.C.F. $= 2 \times 2 \times 3 = 12$

Or we can solve the problem like this

```
2 | 48, 72, 84
2 | 24, 36, 42
3 | 12, 18, 21
    4,  6,  7
```

∴ H.C.F. $= 2 \times 2 \times 3 = 12$

H.C.F. by division method

Whenever we are asked to find out the H.C.F. of large numbers, we always use the division method.

EXAMPLE 1   Find the H.C.F. of 300 and 888.

Solution:

```
        2
300 | 888
    - 600      1
    -----
     288 | 300
         - 288      24
         -----
          12 | 288
             - 24
             ----
              48
             - 48
             ----
               0
```

Step 1 : Take the smaller number (i.e.) 300 as the divisor. Divide the greater number by the smaller number (i.e.) 888 by 300. 288 is the remainder.

Step 2 : The remainder then becomes the divisor and the first divisor becomes the dividend. In this case, 300 becomes the dividend and 288 becomes the divisor. 12 is the remainder.

Step 3 : The same process is repeated until the remainder becomes 0. The last divisor is the H.C.F. In this case it is 12.

∴ H.C.F. = **12**

EXAMPLE 2   Find the H.C.F. of 912, 1216 and 2400.

When we are asked to find out the H.C.F. of more than two numbers, we first find out the H.C.F. of the largest and the second largest number. Then we find the H.C.F. of this H.C.F. of two numbers and the third number. The last divisor is the required H.C.F.

Solution: First find the H.C.F. of 2400 and 1216.

```
           1
1216 | 2400
     - 1216        1
     ------
      1184 | 1216
           - 1184      37
           ------
             32 | 1184
                - 96
                ----
                 224
                - 224
                -----
                   0
```

H.C.F. of 2400 and 1216 is 32.

Now find the H.C.F. of 32 and 912.

```
         28
32 | 912
   - 64
   ----
    272
   - 256       2
   -----
     16 | 32
        - 32
        ----
          0
```

∴ H.C.F of 912, 1216 and 2400 is 16

<div align="center">

EXERCISE 8(B)

</div>

1 Find the H.C.F. of 27 and 36.

2 Find the H.C.F. of 82 and 104.

3 Find the common factors of 20, 35 and 40. Find the H.C.F. of 20, 35 and 40.

4 Find the common factors of 45, 60 and 75. Find the H.C.F. of 45, 60 and 75.

5 Find the common factors of 18, 28, 46 and 58. Find the H.C.F. of 18, 28, 46 and 58

6 Find the H.C.F. of the following numbers by prime factor method :

(a) 75 and 125　　　　　　　(b) 24, 54 and 60　　　　　　(c) 63, 70 and 98

(d) 112, 210 and 252　　　　(e) 27, 99 and 144　　　　　　(f) 175, 250 and 300

(g) 144, 256 and 216　　　　(h) 104, 128 and 176　　　　　(i) 160, 180 and 2000

7 Find the H.C.F. of the following numbers by the division method.

(a) 112 and 189　　　　　　(b) 34, 51 and 85　　　　　　　(c) 95, 152 and 190

(d) 650, 900 and 1000　　　(e) 690, 966 and 1150　　　　　(f) 738, 1080 and 1332

(g) 1350, 1530 and 1650　　(h) 441, 630 and 945

8.7 LEAST COMMON MULTIPLES (L.C.M.)

We know that the least common multiple of two or more numbers is the least number that is a multiple of each of the numbers.

EXAMPLES　　The common multiples of 3 and 2 are 6, 12, 18 ....

But the **least** common multiple of 3 and 2 is 6

∴ L.C.M. of 3 and 2 is 6

Similarly, the common multiples of 4 and 5 are 20, 40, ...

∴ L.C.M. of 4 and 5 is 20

Properties of L.C.M.

1 The L.C.M. of two prime numbers is their product.

(e.g.)　L.C.M. of 3 and 2 = 6;　L.C.M. of 7 and 2 = 14

2 If a number is a factor of another number, then their L.C.M. is the greater number itself.

(e.g.)　L.C.M. of 3 and 9 is 9;　L.C.M. of 8 and 24 is 24

3 The L.C.M. of two or more numbers cannot be less than either of them.

4 The L.C.M. of two consecutive numbers is the product of the numbers.

L.C.M. by prime factor method :

EXAMPLE　　Find the L.C.M. of 12, 15, 24.

Solution:　　　$12 = 2 \times 6 = 2 \times 2 \times 3$

　　　　　　　　$15 = 3 \times 5$

　　　　　　　　$24 = 2 \times 12 = 2 \times 2 \times 2 \times 3$

　　　　　　　　The prime factors are 2, 3, 5

> The L.C.M. should contain each prime factor that is occuring maximum number of times in any number.

In the above prime factorisation of numbers, the digit 2 occurs thrice and the digits 3 and 5 occur only once.

$$\therefore \text{L.C.M.} = 2 \times 2 \times 2 \times 3 \times 5$$
$$= 120$$
$$\therefore \text{L.C.M. of 12, 15 and 24} = 120$$

L.C.M. by Common Division Method

EXAMPLE   Find the L.C.M. of 20, 25, 30 and 36 by division method.

Solution:

2	20, 25, 30, 36
2	10, 25, 15, 18
3	5, 25, 15, 9
3	5, 25, 5, 3
5	5, 25, 5, 1
5	1, 5, 1, 1
	1, 1, 1, 1

$$\therefore \text{L.C.M.} = 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 900$$

Ans. 900

EXERCISE 8(C)

1 Write the prime factors of each number and find the L.C.M.

(a) 36 and 63   (b) 11 and 55   (c) 25 and 100   (d) 9, 36, 45

(e) 12, 15, 18, 36   (f) 20, 50, 60, 100   (g) 3, 5, 15, 25   (h) 22, 55, 66, 88

2 Find the L.C.M. of the following sets of numbers using division method.

(a) 22, 44, 66   (b) 9, 12, 18, 24   (c) 8, 40, 54, 135   (d) 21, 33, 42, 44

(e) 15, 30, 60, 90   (f) 25, 50, 55, 110   (g) 26, 39, 65, 52   (h) 12, 15, 18, 21

8.8 RELATION BETWEEN H.C.F., L.C.M. AND THE NUMBERS

For any two numbers:

L.C.M. × H.C.F. = Product of the two numbers.

Consider 6 and 8.

L.C.M. of 6 and 8 = 24

H.C.F. of 6 and 8 = 2

L.C.M. × H.C.F. = 24 × 2 = 48

The product of 8 and 6 = 48

$\therefore$ L.C.M. × H.C.F. = Product of the two numbers.

(i)   L.C.M. of two numbers = $\dfrac{\text{Their product}}{\text{Their H.C.F.}}$

(ii) H.C.F. of two numbers = $\dfrac{\text{Their product}}{\text{Their L.C.M.}}$

and (iii) $\dfrac{\text{L.C.M.} \times \text{H.C.F.}}{\text{One number}}$ = The other number

EXAMPLE 1

The HCF of two numbers is 28 and their LCM is 336. If one number is 112, find the other number.

Solution:

$$\frac{L.C.M. \times H.C.F.}{One\,number} = The\,other\,number$$

$$\Rightarrow The\,other\,number = \frac{28 \times 336}{112} = 28 \times 3 = 84 \textbf{ Ans.}$$

EXAMPLE 2

Find the smallest number of four digits which when divided by 6, 8, 12 and 20 leaves no remainder

Solution:

The smallest number, which can be divided by each of the given numbers with no remainder is the LCM of the given numbers. So we find the LCM of the numbers.

```
2 | 6, 8, 12, 20
2 | 3, 4,  6, 10
3 | 3, 2,  3,  5
  | 1, 2,  1,  5
```

LCM = $2 \times 2 \times 3 \times 1 \times 2 \times 1 \times 5$
    = 120.

∴ 120 is the smallest number that can be divided by 6, 8, 12 and 20 with no remainder.

We have to find the smallest multiple of 120 which is of four digits.

The smallest four-digit number = 1000

Let us check whether 120 divides 1000 exactly.

```
          8
120 | 1000
      - 960
        40
```

So the eighth multiple of 120 is less than 1000 as it leaves 40 as remainder. But the ninth multiple of 120 will be more than 1000.

∴ The smallest four-digit number divisible by 120

= nineth multiple of 120
= 9 × 120 = 1080.

Alternatively, the required number can also be found like this:

1000 − 40 + 120 = 1080.

Ans. The smallest four-digit number divisible by each of 6, 8, 12 and 20 = 1080

EXAMPLE 3 Find the greatest number of 4 digits which when divided by 7, 10, 15, 21 and 28 leaves no remainder.

Solution: First we find the L.C.M. of 7, 10, 15, 21 and 28.

2	7, 10, 15, 21, 28
3	7, 5, 15, 21, 14
5	7, 5, 5, 7, 14
7	7, 1, 1, 7, 14
	1, 1, 1, 1, 2

∴ L.C.M. of 7, 10, 15, 21 and 28 = 2 × 3 × 5 × 7 × 2 = 420

The greatest number of 4 digits = 9999

Let us check whether this number is divisible by the L.C.M. (420) exactly.

$$
\begin{array}{r}
23 \\
420\overline{)9999} \\
-840 \\
\hline
1599 \\
-1260 \\
\hline
339
\end{array}
$$

The remainder is 339

∴ 9999 in not exactly divisible by 420

Hence, subtract the remainder from the number i.e. 9999 − 339 = 9660.

∴ The greatest number of 4 digits exactly divisible by 420 = 9999 − 339 = 9660

The number 9660 is exactly divisible by 420

Ans. The greatest four-digit number divisible by each of the numbers 7, 10, 15, 21 and 28 = 9660

EXERCISE 8(D)

1. Find the H.C.F. and L.C.M. of the following numbers :

   (a) 576 and 1440   (b) 496 and 1116

   (c) 270 and 450   (d) 465 and 1116

   (e) 408 and 1530   (f) 603 and 1608

2. The L.C.M. and H.C.F. of two numbers are 720 and 5 respectively. If one of the two numbers is 45 find the other number.

3. The L.C.M. of 576 and 128 is 1152. Find the H.C.F.

4 Complete the following table :

Number	Product	H.C.F.	L.C.M	Product of L.C.M. & H.C.F.
12 and 15				
18 and 24				
27 and 36				
24 and 32				
35 and 42				

5 The greatest number which divides 1155 and 3080 exactly is 385. Find the least number which is divisible by 1155 and 3080.

6 Find the greatest number that can divide 663 and 975 exactly.

7 What is the greatest 3-digit number which is exactly divisible by 9 and 21?

8 Find the greatest number of 4-digits which is exactly divisible by 12, 32 and 48.

9 Find the smallest number which when divided by 12, 16 and 20 leaves no remainder.

10 Rohit distributes toffees to his friends on his birthday. If he gives 5, 10 or 12 to each, he is left with no toffees. What is the least number of toffees he should buy ?

FRACTIONS

9.1 REVISION

A. Fraction

$\dfrac{3}{5}, \dfrac{2}{7}, \dfrac{5}{9}$ are all fractions.

> Equal parts of a whole are called fractions.

$\dfrac{3}{5}$ indicates that 3 parts out of 5 parts of a whole are taken.

In $\dfrac{3}{5}$, 3 is called the numerator and 5 is called the denominator.

B. Types of fractions

(a) Like fractions : Fractions which have the same denominator are called like fractions, e.g. $\dfrac{3}{7}, \dfrac{4}{7}, \dfrac{6}{7}$.

(b) Unlike fractions : Fractions which are not like fractions (having different denominators) are called unlike fractions, e.g. $\dfrac{3}{5}, \dfrac{8}{9}, \dfrac{3}{4}$, etc.

(c) Proper fraction : A fraction whose numerator is less than the denominator is known as a proper fraction. The value of a proper fraction is always less than 1, e.g. $\dfrac{1}{5}, \dfrac{2}{3}, \dfrac{5}{9}$, etc.

(d) Improper fraction : A fraction whose numerator is greater than or equal to the denominator is known as an improper fraction. The value of an improper fraction is always greater than 1 or equal to 1 (e.g.) $\dfrac{6}{5}, \dfrac{5}{4}, \dfrac{13}{5}, \dfrac{11}{11}$, etc.

(e) Mixed number : A mixed number contains a whole number and a proper fraction, e.g. $5\dfrac{1}{3}, 6\dfrac{3}{4}, 7\dfrac{4}{5}$, etc.

(f) Equivalent fractions : Two or more fractions representing the same part of the whole are known as equivalent fractions, e.g. $\dfrac{1}{2}, \dfrac{2}{4}, \dfrac{3}{6}$

$$\frac{1}{2} \qquad\qquad \frac{2}{4} \qquad\qquad \frac{3}{6}$$

It is clear from the above diagrams that $\dfrac{1}{2} = \dfrac{2}{4} = \dfrac{3}{6}$.

We get equivalent fractions of a given fraction by multiplying both the numerator and the denominator by the same number (except 0). For example

The equivalent fractions of $\frac{1}{4}$ are $\frac{2}{8} = \frac{1 \times 2}{4 \times 2}$, $\frac{3}{12} = \frac{1 \times 3}{4 \times 3}$, $\frac{4}{16} = \frac{1 \times 4}{4 \times 4}$, and so on.

Hence $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16} = \frac{6}{24}$ are all equivalent fractions.

Similarly, if we divide the numerator and denominator by the same number (except 0), we get equivalent fractions. $\frac{6}{12} = \frac{3}{6} = \frac{1}{2} \left(\frac{6}{12} \div \frac{2}{2} = \frac{3}{6} \div \frac{3}{3} = \frac{1}{2} \right)$

In equivalent fractions, the numerator of the first multiplied by the denominator of the second is equal to the numerator of the second multiplied by the denominator of the first.

e.g. $\frac{3}{5} = \frac{9}{15}$; $\frac{3}{5} \times \frac{9}{15}$. $3 \times 15 = 45$ and also $9 \times 5 = 45$

(g) Reciprocal fractions : When the product of two fractions is equal to one, they are

called reciprocal fractions, e.g. $\frac{3}{5}$ and $\frac{5}{3}$, $\frac{6}{7}$ and $\frac{7}{6}$ etc. ($\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{5}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{3}}} = 1$)

C. Reducing to the lowest term :

To reduce a given fraction to its lowest term we divide the numerator and denominator of the given fraction by their H.C.F.

EXAMPLE 1   Reduce $\frac{16}{24}$ to its lowest term.

Solution: The H.C.F. of 16 and 24 is 8. Now divide the numerator and denominator

by H.C.F. 8 i.e. $\frac{16}{8} = 2$; and $\frac{24}{8} = 3$ $\therefore \frac{16}{24} = \frac{2}{3}$ $\left[\frac{16 \div 8}{24 \div 8} = \frac{2}{3} \right]$

Alternatively : We can divide 16 and 24 by their common factors.

Factors of 16 are 2, 4, 8, 16 and factors of 24 are 2, 3, 4, 8, 12, 24

Common factors of 16 and 24 are 2, 4, 8 [8 is the H.C.F.]

Let us divide the numerator and denominator by their common factors. Here we start with 2.

$\frac{\cancel{16}^{8}}{\cancel{24}_{12}} = \frac{\cancel{8}^{4}}{\cancel{12}_{6}} = \frac{2}{3}$ (2 and 4 are common factors of 16 and 24)

EXAMPLE 2 Reduce $\dfrac{150}{750}$ to its lowest term.

$$\dfrac{\overset{\overset{\overset{5}{25}}{\overset{75}{150}}}{\underset{\underset{375}{750}}{}}}{} = \dfrac{\overset{25}{75}}{\underset{125}{375}} = \dfrac{\overset{5}{25}}{\underset{25}{125}} = \dfrac{5}{25} = \dfrac{1}{5}$$ (2, 3 and 5 are the common factors of 150 and 750)

$$\therefore \quad \dfrac{150}{750} = \dfrac{1}{5}$$

D. Conversion of improper fractions to mixed numbers :

Divide the numerator by the denominator. The quotient gives the whole number part of the mixed number while the remainder gives the numerator part of the fraction.

EXAMPLES $\dfrac{45}{8} = \dfrac{5 \times 8 + 5}{8} = 5\dfrac{5}{8}$; $\dfrac{37}{9} = \dfrac{4 \times 9 + 1}{9} = 4\dfrac{1}{9}$; $\dfrac{115}{12} = \dfrac{9 \times 12 + 7}{12} = 9\dfrac{7}{12}$, etc.

E. Conversion of mixed numbers into improper fractions.

Multiply the whole number by the denominator and add the numerator to the product.

EXAMPLE $5\dfrac{3}{7} = \dfrac{(5 \times 7 + 3)}{7} = \dfrac{35 + 3}{7} = \dfrac{38}{7}$

Note : Conversion of mixed numbers into improper fractions is just the reverse of conversion of improper fractions to mixed number fractions.

9.2 COMPARISON OF FRACTIONS

(a) **Like denominators and unlike numerators :** If two fractions have the same denominator, the fraction with greater numerator is greater than the fraction with the smaller numerator.

EXAMPLE 1 In fractions $\dfrac{3}{5}$ and $\dfrac{2}{5}$, $\dfrac{3}{5} > \dfrac{2}{5}$

(b) **Like numerators and unlike denominators :** If two fractions have the same numerator but different denominators, the fraction having the smaller denominator is greater than the other.

EXAMPLE 2 In $\dfrac{3}{5}$ and $\dfrac{3}{8}$; $\dfrac{3}{5} > \dfrac{3}{8}$ Similarly, in $\dfrac{11}{15}$ and $\dfrac{11}{13}$, $\dfrac{11}{13} > \dfrac{11}{15}$

(c) **Unlike numerators and unlike denominators :** First change all the given fractions into like fractions (same denominator) by taking the L.C.M. of the denominators and then compare.

EXAMPLE 3   Which is greater $\frac{3}{8}$ or $\frac{5}{6}$?

Solution: First find the L.C.M. of the denominators i.e. 8 and 6

$8 = 2 \times 2 \times 2$; $6 = 2 \times 3$

$\therefore$ L.C.M. $= 2 \times 2 \times 2 \times 3 = 8 \times 3 = 24$

Now $\frac{3}{8} = \frac{3 \times 3}{8 \times 3} = \frac{9}{24}$

and $\frac{5}{6} = \frac{5 \times 4}{6 \times 4} = \frac{20}{24}$

To compare fractions or to arrange fractions in ascending or descending order, always find the L.C.M. of the denominators.

Form equivalent fractions such that the denominators are equal to the L.C.M.

$\therefore \frac{20}{24} > \frac{9}{24}$ (as 20 > 9)

Hence $\frac{5}{6} > \frac{3}{8}$ **Ans.** $\frac{5}{6}$ is greater

EXAMPLE 4   Which is smaller $\frac{7}{9}$ or $\frac{5}{8}$?

Solution: First find the L.C.M. of the denominators

$9 = 3 \times 3$ and $8 = 2 \times 2 \times 2$

$\therefore$ L.C.M. of 9 and 8 $= 2 \times 2 \times 2 \times 3 \times 3 = 72$

$\frac{7}{9} = \frac{56}{72}$ and $\frac{5}{8} = \frac{45}{72}$ (Change the denominators and make them equal to the L.C.M. of the two).

Obviously $\frac{45}{72} < \frac{56}{72}$ $\therefore \frac{5}{8} < \frac{7}{9}$ **Ans.** $\frac{5}{8}$ is smaller.

EXAMPLE 5   Arrange the following fractions in ascending order : $\frac{5}{6}$, $\frac{7}{8}$, $\frac{5}{9}$

Solution: First find the L.C.M. of 6, 8 and 9

$6 = 2 \times 3$; $8 = 2 \times 2 \times 2$; $9 = 3 \times 3$

$\therefore$ L.C.M. $= 2 \times 2 \times 2 \times 3 \times 3 = 72$

$\frac{5}{6} = \frac{60}{72}$; $\frac{7}{8} = \frac{63}{72}$ and $\frac{5}{9} = \frac{40}{72}$ (Change the denominators and make them equal to the L.C.M. of all).

Obviously, $\frac{40}{72} < \frac{60}{72} < \frac{63}{72}$ **Ans.** $\frac{5}{9} < \frac{5}{6} < \frac{7}{8}$

1 Write four fractions equivalent to each of the following :

(a) $\dfrac{1}{3}$ _____

(b) $\dfrac{4}{5}$ _____

(c) $\dfrac{1}{6}$ _____

(d) $\dfrac{2}{11}$ _____

(e) $\dfrac{4}{15}$ _____

2 Fill in the blanks.

(a) $\dfrac{1}{5} = \dfrac{\square}{20}$

(b) $\dfrac{3}{4} = \dfrac{\square}{24}$

(c) $\dfrac{2}{3} = \dfrac{\square}{24}$

(d) $\dfrac{\square}{14} = \dfrac{1}{7}$

(e) $\dfrac{\square}{7} = \dfrac{24}{28}$

(f) $\dfrac{18}{\square} = \dfrac{9}{27}$

(g) $\dfrac{20}{31} = \dfrac{\square}{93}$

(h) $\dfrac{11}{\square} = \dfrac{33}{39}$

(i) $\dfrac{\square}{40} = \dfrac{7}{8}$

(j) $\dfrac{11}{15} = \dfrac{44}{\square}$

(k) $\dfrac{35}{50} = \dfrac{7}{\square}$

(l) $\dfrac{16}{64} = \dfrac{\square}{4}$

(m) $\dfrac{7}{11} = \dfrac{42}{\square}$

(n) $\dfrac{\square}{12} = \dfrac{55}{60}$

(o) $\dfrac{14}{15} = \dfrac{\square}{105}$

3 Reduce the following fractions to their lowest form:

(a) $\dfrac{68}{136}$

(b) $\dfrac{102}{119}$

(c) $\dfrac{153}{204}$

(d) $\dfrac{129}{243}$

(e) $\dfrac{154}{238}$

(f) $\dfrac{198}{297}$

(g) $\dfrac{117}{189}$

(h) $\dfrac{304}{368}$

(i) $\dfrac{115}{345}$

(j) $\dfrac{160}{720}$

4 Tick (✓) the fractions which are proper fractions:

(a) $\dfrac{13}{16}$

(b) $\dfrac{8}{7}$

(c) $\dfrac{17}{8}$

(d) $\dfrac{23}{25}$

(e) $\dfrac{38}{4}$

(f) $\dfrac{48}{50}$

(g) $\dfrac{25}{21}$

(h) $\dfrac{1}{7}$

(i) $\dfrac{45}{9}$

(j) $\dfrac{63}{65}$

5 Convert the following improper fractions into mixed numbers:

(a) $\dfrac{21}{6}$

(b) $\dfrac{112}{6}$

(c) $\dfrac{123}{6}$

(d) $\dfrac{98}{16}$

(e) $\dfrac{105}{14}$

(f) $\dfrac{223}{18}$

(g) $\dfrac{445}{15}$

(h) $\dfrac{614}{24}$

(i) $\dfrac{305}{85}$

(j) $\dfrac{1148}{32}$

6 Convert the following mixed numbers into improper fractions:

(a) $14\dfrac{3}{4}$

(b) $8\dfrac{6}{7}$

(c) $24\dfrac{5}{7}$

(d) $25\dfrac{4}{5}$

(e) $48\dfrac{5}{8}$

(f) $17\dfrac{7}{9}$

(g) $28\dfrac{5}{6}$

(h) $71\dfrac{1}{8}$

(i) $100\dfrac{3}{4}$

(j) $33\dfrac{2}{3}$

7 Write 5 improper fractions with 12 as the denominator.

8 Write 5 fractions which are equal to 1.

9 Fill in the blanks using > or < to make correct statements:

(a) $\dfrac{5}{14}$ ☐ $\dfrac{5}{8}$
(b) $\dfrac{11}{16}$ ☐ $\dfrac{11}{12}$
(c) $\dfrac{15}{19}$ ☐ $\dfrac{15}{23}$
(d) $\dfrac{33}{40}$ ☐ $\dfrac{27}{40}$

(e) $\dfrac{45}{70}$ ☐ $\dfrac{45}{85}$
(f) $\dfrac{37}{85}$ ☐ $\dfrac{37}{90}$
(g) $\dfrac{67}{79}$ ☐ $\dfrac{72}{79}$
(h) $\dfrac{32}{39}$ ☐ $\dfrac{27}{39}$

10 Which is the greater of the two given fractions in each case? Write your answer using the sign '>' or '<' .

(a) $\dfrac{3}{4}$ ☐ $\dfrac{6}{7}$
(b) $\dfrac{8}{9}$ ☐ $\dfrac{5}{6}$
(c) $\dfrac{3}{10}$ ☐ $\dfrac{5}{8}$
(d) $\dfrac{11}{12}$ ☐ $\dfrac{8}{9}$

(e) $6\dfrac{6}{7}$ ☐ $\dfrac{49}{8}$
(f) $5\dfrac{2}{7}$ ☐ $\dfrac{41}{8}$
(g) $1\dfrac{11}{12}$ ☐ $1\dfrac{12}{15}$
(h) $16\dfrac{3}{5}$ ☐ $16\dfrac{4}{7}$

11 Arrange the following fractions in ascending order (use the sign <).

(a) $\dfrac{11}{13}, \dfrac{11}{17}, \dfrac{11}{15}$
(b) $\dfrac{8}{9}, \dfrac{8}{15}, \dfrac{8}{11}$
(c) $\dfrac{8}{17}, \dfrac{16}{17}, \dfrac{15}{17}$
(d) $\dfrac{3}{4}, \dfrac{5}{6}, \dfrac{7}{18}$

(e) $\dfrac{8}{9}, \dfrac{7}{9}, \dfrac{2}{3}$
(f) $\dfrac{7}{12}, \dfrac{5}{6}, \dfrac{2}{3}$
(g) $\dfrac{7}{10}, \dfrac{2}{3}, \dfrac{11}{24}$
(h) $\dfrac{11}{21}, \dfrac{5}{7}, \dfrac{1}{2}$

12 Arrange the following fractions in descending order (use the sign >).

(a) $\dfrac{1}{4}, \dfrac{7}{8}, \dfrac{5}{12}$
(b) $\dfrac{5}{8}, \dfrac{3}{16}, \dfrac{3}{4}$
(c) $\dfrac{5}{8}, \dfrac{3}{4}, \dfrac{5}{14}$
(d) $\dfrac{5}{14}, \dfrac{7}{9}, \dfrac{2}{3}$

(e) $\dfrac{7}{16}, \dfrac{3}{8}, \dfrac{5}{12}$
(f) $\dfrac{25}{27}, \dfrac{8}{9}, \dfrac{15}{18}$
(g) $\dfrac{11}{20}, \dfrac{4}{5}, \dfrac{17}{40}$
(h) $\dfrac{11}{17}, \dfrac{1}{4}, \dfrac{1}{2}$

9.3 ADDITION AND SUBTRACTION OF FRACTIONS

When adding or subtracting two or more fractions, first change all the fractions to their equivalent fractions with common denominator (which is the L.C.M. of the denominators of the fractions) and then add or subtract.

EXAMPLE 1 Add $\dfrac{5}{8} + \dfrac{7}{12} + \dfrac{3}{4}$

Solution: L.C.M. of the denominators 8, 12, 4 = 2 × 2 × 2 × 3 = 24

2	8, 12, 4
2	4, 6, 2
2	2, 3, 1
3	1, 3, 1
	1, 1, 1

$$\dfrac{5}{8} + \dfrac{7}{12} + \dfrac{3}{4} = \left(\dfrac{5}{8} \times \dfrac{3}{3}\right) + \left(\dfrac{7}{12} \times \dfrac{2}{2}\right) + \left(\dfrac{3}{4} \times \dfrac{6}{6}\right)$$

$$= \dfrac{15 + 14 + 18}{24} = \dfrac{47}{24} = 1\dfrac{23}{24} \quad \textbf{Ans.} \ 1\dfrac{23}{24}$$

[If the answer is an improper fraction, convert it into a mixed number. Leave the answer in its simplest form].

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EXAMPLE 2 Add $3\dfrac{3}{5} + 8\dfrac{2}{3} + \dfrac{7}{10}$.

Solution: **Method 1** : First convert the mixed numbers into improper fractions

$$3\dfrac{3}{5} + 8\dfrac{2}{3} + \dfrac{7}{10} = \dfrac{18}{5} + \dfrac{26}{3} + \dfrac{7}{10}$$

L.C.M. of 5, 3, 10 = $5 \times 3 \times 2 = 30$

$$\dfrac{18}{5} + \dfrac{26}{3} + \dfrac{7}{10} = \dfrac{108 + 260 + 21}{30} = \dfrac{389}{30} = 12\dfrac{29}{30}$$

5	5, 3, 10
2	1, 3, 2
3	1, 3, 1
	1, 1, 1

$$\begin{array}{r} 12 \\ 30\overline{)\,389} \\ -30 \\ \hline 89 \\ -60 \\ \hline 29 \end{array}$$

Ans. $12\dfrac{29}{30}$

Method 2 : First add the whole numbers and then add the fractions

$$3\dfrac{3}{5} + 8\dfrac{2}{3} + \dfrac{7}{10} = 3 + 8 + \left(\dfrac{3}{5} + \dfrac{2}{3} + \dfrac{7}{10}\right)$$

$$= 11 + \dfrac{18 + 20 + 21}{30}$$

$$= 11 + \dfrac{59}{30} = 11 + 1\dfrac{29}{30} = 12\dfrac{29}{30}$$

Ans. $12\dfrac{29}{30}$

EXAMPLE 3 Subtract $6\dfrac{7}{9}$ from $9\dfrac{3}{7}$.

Solution: First convert the mixed fractions into improper fractions, then subtract.

$$9\dfrac{3}{7} - 6\dfrac{7}{9} = \dfrac{66}{7} - \dfrac{61}{9}$$

$$= \dfrac{594 - 427}{63} = \dfrac{167}{63} = 2\dfrac{41}{63} \quad \text{(L.C.M. of 7 and 9 = 63)}$$

Ans. $2\dfrac{41}{63}$

EXAMPLE 4 Simplify $\frac{4}{9} + \frac{5}{6} - \frac{2}{3}$.

Solution: L.C.M. of 9, 6 and 3 = 18

$$\frac{4}{9} + \frac{5}{6} - \frac{2}{3} = \frac{8+15-12}{18}$$

> First arrange fractions with '+' sign together and then fractions with '−' sign together. If there are mixed fractions, convert them into improper fractions.

$$= \frac{23-12}{18} = \frac{11}{18} \textbf{ Ans.}$$

EXAMPLE 5 Simplify $3\frac{3}{5} - 4\frac{1}{4} - 6\frac{1}{2} + 8$

Solution:

$$3\frac{3}{5} + 8 - 4\frac{1}{4} - 6\frac{1}{2} = \frac{18}{5} + \frac{8}{1} - \frac{17}{4} - \frac{13}{2}$$

$$= \frac{72+160-85-130}{20} \quad \text{[L.C.M. of 5, 4 and 2 is 20]}$$

$$= \frac{232-215}{20} = \frac{17}{20} \textbf{ Ans.}$$

EXERCISE 9(B)

1 Add

(a) $\frac{5}{6} + \frac{7}{12}$

(b) $\frac{4}{5} + \frac{3}{10} + \frac{1}{2}$

(c) $\frac{5}{6} + \frac{7}{12} + \frac{5}{24}$

(d) $\frac{2}{7} + \frac{3}{5} + \frac{1}{2}$

(e) $\frac{5}{16} + \frac{7}{10} + \frac{2}{5}$

(f) $\frac{16}{25} + \frac{9}{10} + \frac{3}{8}$

(g) $1\frac{1}{4} + 3\frac{3}{8}$

(h) $3\frac{1}{3} + 7\frac{5}{6} + 5\frac{1}{2}$

(i) $6\frac{5}{14} + 20 + 7\frac{3}{7} + 8\frac{7}{12}$

2 Subtract the following fractions :

(a) $\frac{8}{15} - \frac{4}{9}$

(b) $\frac{11}{13} - \frac{5}{7}$

(c) $\frac{13}{17} - \frac{7}{10}$

(d) $\frac{15}{19} - \frac{9}{13}$

(e) $\frac{7}{9} - \frac{4}{15}$

(f) $\frac{16}{27} - \frac{7}{18}$

(g) $13\frac{7}{9} - 8\frac{5}{12}$

(h) $6\frac{3}{17} - 4$

(i) $30\frac{3}{4} - 25$

(j) $20\frac{7}{12} - 15$

(k) $12\frac{7}{8} - 11\frac{1}{2}$

(l) $100\frac{1}{4} - 99$

3 Simplify :

(a) $\dfrac{7}{12} + \dfrac{9}{12} - \dfrac{5}{12}$

(b) $\dfrac{9}{10} - \dfrac{3}{5} + \dfrac{7}{8}$

(c) $\dfrac{5}{12} - \dfrac{2}{3} - \dfrac{1}{2} + 7$

(d) $\dfrac{1}{2} + \dfrac{3}{4} - \dfrac{5}{8} - \dfrac{1}{16}$

(e) $8\dfrac{3}{4} + 7\dfrac{1}{2} - 3\dfrac{1}{4} - 2\dfrac{1}{2}$

(f) $10\dfrac{5}{6} - 7\dfrac{2}{3} + 8\dfrac{1}{3} - 5\dfrac{1}{2}$

(g) $5\dfrac{5}{12} - 6 + 8 - 5\dfrac{3}{5}$

(h) $10\dfrac{1}{4} + 6\dfrac{3}{8} - 15 + 1\dfrac{1}{2}$

(i) $25 - 20\dfrac{1}{2} + 15\dfrac{3}{5} - 5$

(j) $\dfrac{9}{14} - 1\dfrac{2}{7} + 4\dfrac{3}{7} - 1\dfrac{2}{21}$

9.4 MULTIPLICATION OF FRACTIONS

A. Multiplication of a Fractional Number by a Whole Number

$$\text{Fraction} \times \text{whole number} = \dfrac{\text{Numerator of the fraction} \times \text{whole number}}{\text{denominator of the fraction}}$$

EXAMPLES Multiply $\dfrac{4}{25}$ by 3.

Solution: $\dfrac{4}{25} \times 3 = \dfrac{4 \times 3}{25} = \dfrac{\mathbf{12}}{\mathbf{25}}$

> For every whole number, 1 is taken as the denominator e.g. $3 = \dfrac{3}{1}$, or, $14 = \dfrac{14}{1}$.

Similarly, $\dfrac{7}{9} \times 3 = \dfrac{7 \times 3^{1}}{9_{3}} = \dfrac{7}{3} = \mathbf{2\dfrac{1}{3}}$

$\dfrac{9}{20} \times 25 = \dfrac{9 \times 25^{5}}{20_{4}} = \dfrac{45}{4} = \mathbf{11\dfrac{1}{4}}$

> Divide the numerator and the denominator by the common factors.

B. Multiplication of a Fractional Number by another Fractional Number

Let us consider the following example :

(i)

$\dfrac{1}{4}$
$\dfrac{1}{4}$
$\dfrac{1}{4}$
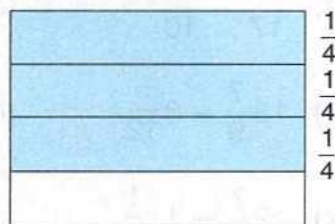
(ii)
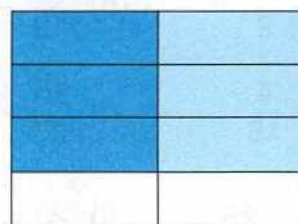
The shaded portion in Fig. (i) represents $\frac{3}{4}$. If we take half of this shaded portion, it is $\frac{3}{8}$ as is evident from Fig (ii).

Therefore half of $\frac{3}{4} = \frac{3}{8}$ or $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$.

Hence, the product of two fractional numbers is a fractional number whose numerator is the product of their numerators and whose denominator is the product of their denominators.

$$\text{Product of two fractions} = \frac{\text{Numerator (1}^{st}\text{ fraction)} \times \text{Numerator (2}^{nd}\text{ fraction)}}{\text{Denominator (1}^{st}\text{ fraction)} \times \text{Denominator (2}^{nd}\text{ fraction)}}$$

EXAMPLES   Find the product of the following fractions :

(a) $\frac{8}{15} \times \frac{2}{3}$ (b) $\frac{9}{16} \times \frac{8}{27}$ (c) $3\frac{5}{7} \times 2\frac{4}{5}$

Solution :

(a) $\frac{8}{15} \times \frac{2}{3} = \frac{8 \times 2}{15 \times 3} = \frac{16}{45}$ **Ans.**

(b) $\frac{\overset{1}{\cancel{9}}}{\underset{2}{\cancel{16}}} \times \frac{\overset{1}{\cancel{8}}}{\cancel{27}_3} = \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$ **Ans.**

(c) $3\frac{5}{7} \times 2\frac{4}{5} = \frac{26}{\cancel{7}_1} \times \frac{\cancel{14}^2}{5} = \frac{52}{5} = 10\frac{2}{5}$ **Ans.**

C.   Multiplication of more than two fractional numbers

We can multiply two or more fractional numbers by first finding out the product of two of them, then multiplying this product by the third, and so on.

EXAMPLE   Find the product of $\frac{3}{4} \times \frac{5}{7} \times \frac{9}{11}$

Solution : $\frac{3}{4} \times \frac{5}{7} \times \frac{9}{11} = \left(\frac{3}{4} \times \frac{5}{7}\right) \times \frac{9}{11} = \frac{15}{28} \times \frac{9}{11} = \frac{135}{308}$ **Ans.**

Alternatively, multiply the numerators and the denominators of the given fractional numbers to get the numerator and the denominator of the product.

$$\text{Product of two or more fractions} = \frac{\text{Product of all the numerators of the fractions}}{\text{Product of all the denominators of the fractions}}$$

$$\frac{3}{4} \times \frac{5}{7} \times \frac{9}{11} = \frac{3 \times 5 \times 9}{4 \times 7 \times 11} = \frac{135}{308} \text{ \textbf{Ans.}}$$

EXAMPLE   Find the Products

(a) $3\frac{3}{7} \times \frac{5}{8} \times 1\frac{10}{11}$ (b) $\frac{8}{35} \times 6\frac{2}{3} \times 5\frac{1}{4} \times 8$

Solution :   (a) $3\frac{3}{7} \times \frac{5}{8} \times 1\frac{10}{11} = \frac{\cancel{24}^3}{\cancel{7}} \times \frac{5}{\cancel{8}} \times \frac{\cancel{21}^3}{11}$

$$= \frac{3 \times 5 \times 3}{1 \times 1 \times 11}$$

$$= \frac{45}{11} = 4\frac{1}{11} \textbf{ Ans.}$$

> First divide the numerators and the denominators by the common factors to get the result in simplified form.

(b) $\frac{8}{35} \times 6\frac{2}{3} \times 5\frac{1}{4} \times 8 = \frac{^2\cancel{8}}{_1{}_5\cancel{35}} \times \frac{^4\cancel{20}}{\cancel{3}_1} \times \frac{^1\cancel{7}\cancel{21}}{\cancel{4}} \times \frac{8}{1}$

$$= \frac{2 \times 4 \times 1 \times 8}{1 \times 1 \times 1 \times 1} = \frac{64}{1} = \textbf{64 Ans.}$$

9.5 PROPERTIES OF MULTIPLICATION

1 Changing the order of fractional numbers $\left(\frac{1}{2} \times \frac{3}{7} \times \frac{5}{9} \text{ or } \frac{3}{7} \times \frac{5}{9} \times \frac{1}{2}\right)$ does not change the product.

2 The product of a fraction and 1 is the fraction itself, e.g. $\frac{5}{6} \times 1 = \frac{5}{6}$.

3 The product of a fraction and 0 is 0, e.g. $\frac{5}{6} \times 0 = 0$.

EXERCISE 9(C)

Multiply

(a) $\frac{5}{28} \times 7$

(b) $\frac{20}{21} \times \frac{7}{10} \times \frac{1}{2}$

(c) $\frac{4}{5} \times \frac{11}{16} \times \frac{5}{8}$

(d) $\frac{17}{24} \times \frac{3}{34} \times \frac{6}{7}$

(e) $\frac{5}{9} \times \frac{5}{12} \times \frac{24}{25}$

(f) $\frac{4}{5} \times 1\frac{6}{7} \times 0$

(g) $\frac{1}{4} \times 2\frac{1}{2} \times \frac{4}{5} \times 3\frac{1}{2} \times \frac{4}{5}$

9.6 DIVISION OF FRACTIONS

We follow the following rules for division of fractions :

1 Replace the divisor by its reciprocal.

2 Change the division sign (÷) to multiplication sign (×).

3 Simplify.

EXAMPLE 1 Divide $\frac{1}{3}$ by 2.

Step 1: Reciprocal of 2 is $\frac{1}{2}$.

Step 2: Change sign $\frac{1}{3} \div 2 = \frac{1}{3} \times \frac{1}{2}$.

Step 3: Simplify, $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$ **Ans.**

> Denominator of a whole number is always 1, e.g. $2 = \frac{2}{1}$

EXAMPLE 2 Divide $\frac{11}{15}$ by $\frac{2}{3}$.

Step 1: Replace the divisor $\frac{2}{3}$ by its reciprocal, *i.e.* $\frac{3}{2}$.

Step 2: Change sign $\dfrac{11}{15} \div \dfrac{2}{3} = \dfrac{11}{15} \times \dfrac{3}{2}$.

Step 3: Simplify, $\dfrac{11}{\cancel{15}_5} \times \dfrac{\cancel{3}^1}{2} = \dfrac{11}{10} = 1\dfrac{1}{10}$ **Ans.**

EXAMPLE 3 Divide $2\dfrac{19}{26}$ by $16\dfrac{5}{13}$.

Step 1: Simplify the fractions.

$$2\dfrac{19}{26} = \dfrac{71}{26}, \quad 16\dfrac{5}{13} = \dfrac{213}{13}$$

First convert mixed fraction to improper fraction

Step 2: Multiply by the reciprocal.

$$\dfrac{71}{26} \div \dfrac{213}{13} = \dfrac{\cancel{71}^1}{\cancel{26}_2} \times \dfrac{\cancel{13}^1}{\cancel{213}_3} = \dfrac{1}{2} \times \dfrac{1}{3} = \dfrac{1}{6} \text{ \textbf{Ans.}}$$

EXAMPLE 4 Write the quotient in its simplest form.

(a) $\dfrac{\dfrac{6}{7}}{\dfrac{18}{35}}$ 　　(b) $\dfrac{\dfrac{3}{8}}{9}$ 　　(c) $\dfrac{9}{\dfrac{18}{35}}$

Solution : (a) $\dfrac{\dfrac{6}{7}}{\dfrac{18}{35}}$ Here, divisor is $\dfrac{18}{35}$, reciprocal of $\dfrac{18}{35}$ is $\dfrac{35}{18}$.

$$\therefore \dfrac{6}{7} \div \dfrac{18}{35} = \dfrac{\cancel{6}}{\cancel{7}} \times \dfrac{\cancel{35}^5}{\cancel{18}_3} = \dfrac{5}{3} = 1\dfrac{2}{3} \text{ \textbf{Ans.}}$$

(b) $\dfrac{\dfrac{3}{8}}{9} = \dfrac{3}{8} \div 9$ 　Divisor is 9, reciprocal of 9 is $\dfrac{1}{9}$.

$$\therefore \dfrac{3}{8} \div 9 = \dfrac{\cancel{3}}{8} \times \dfrac{1}{\cancel{9}_3} = \dfrac{1}{24} \text{ \textbf{Ans.}}$$

(c) $\dfrac{9}{\dfrac{18}{35}} = 9 \div \dfrac{18}{35}$ 　Divisor is $\dfrac{18}{35}$, reciprocal is $\dfrac{35}{18}$.

$$\therefore 9 \div \dfrac{18}{35} = \cancel{9} \times \dfrac{35}{\cancel{18}_2} = \dfrac{35}{2} = 17\dfrac{1}{2} \text{ \textbf{Ans.}}$$

EXERCISE 9(D)

1 Divide :

(a) $\dfrac{35}{44} \div 70$ 　　(b) $\dfrac{12}{13} \div 15$ 　　(c) $\dfrac{8}{13} \div \dfrac{2}{13}$

(d) $\dfrac{5}{12} \div \dfrac{10}{21}$ 　　(e) $\dfrac{22}{25} \div \dfrac{11}{15}$ 　　(f) $\dfrac{26}{27} \div \dfrac{13}{15}$

(g) $45 \div \dfrac{3}{8}$ (h) $91 \div \dfrac{26}{27}$ (i) $12\dfrac{4}{15} \div 2\dfrac{1}{27}$

(j) $\dfrac{3}{4} \div \dfrac{1}{2} \div \dfrac{6}{7}$ (k) $2\dfrac{1}{4} \div 1\dfrac{3}{10} \div \dfrac{3}{13}$ (l) $4\dfrac{2}{3} \div 1\dfrac{1}{2} \div 1\dfrac{2}{3}$

2 Find the quotient in its simplest form:

(a) $\dfrac{\frac{3}{5}}{\frac{7}{10}}$ (b) $\dfrac{\frac{5}{16}}{\frac{9}{14}}$ (c) $\dfrac{\frac{8}{15}}{\frac{35}{36}}$ (d) $\dfrac{\frac{12}{17}}{5}$

(e) $\dfrac{\frac{8}{6}}{7}$ (f) $\dfrac{\frac{2}{19}}{4}$ (g) $\dfrac{\frac{7}{9}}{28}$ (h) $\dfrac{\frac{5}{3}}{10}$

(i) $\dfrac{\frac{20}{7}}{15}$ (j) $\dfrac{\frac{10}{2}}{1\frac{2}{3}}$ (k) $\dfrac{24}{3\frac{1}{3}}$ (l) $\dfrac{3\frac{3}{4}}{1\frac{1}{2}}$

WORD PROBLEMS

3 A train covered $36\dfrac{3}{4}$ km in the first hour, $40\dfrac{2}{5}$ km in the second hour and 38 km in third hour. Find the total distance travelled by the train in 3 hours.

4 Rakesh spent $1\dfrac{1}{4}$ hours to finish his Maths home work, $1\dfrac{3}{4}$ hours to do his science home work and $\dfrac{3}{4}$ hours to do his English home work. How long did he take to complete his home work ?

5 The distance between two places is 100 km. Anil travelled first $33\dfrac{2}{3}$ km by bus and the remaining distance by train. Find the distance Anil travelled by train.

6 Sachin Tendulkar batted for a total of $2\dfrac{3}{5}$ hours. First he batted with Ganguly for $1\dfrac{1}{3}$ hours and then with Rahul Dravid for the rest of the period. How long did he bat with Rahul Dravid?

7 Find the distance covered by a bus in $4\dfrac{1}{2}$ hours if the speed of the bus is $30\dfrac{6}{7}$ km per hour.

8 A man won Rs 21,00,000 in a game show. For $\dfrac{3}{7}$th of the prize money, he bought a house, for $\dfrac{3}{14}$th of the money, he bought a car and the remaining money he deposited in the bank. How much money did he deposit in the bank?

9 If $54\dfrac{1}{2}$ kg of rice is distributed among 66 poor people, find how much rice each one gets ?

10 DECIMAL FRACTIONS

REVISION

A. Decimal Fractions

A decimal fraction is a fraction whose denominator is 10 or multiples of 10 (*i.e.* 10 or 100 or 1000, etc.). $\frac{7}{10}$, $\frac{18}{100}$, $\frac{127}{1000}$, $5\frac{9}{10}$, $16\frac{27}{100}$, etc. are decimal fractions.

The digits after the decimal point are read one by one.

$\frac{8}{100}$ is expressed as 0.08; and is read as zero point zero eight.

$\frac{127}{1000}$ is expressed as 0.127; and is read as zero point one two seven.

> The number of digits after the decimal point is equal to the number of zeroes in the denominator of the fraction.

$16\frac{27}{100}$ is expressed as 16.27; and is read as sixteen point two seven and <u>not</u> as sixteen point twenty seven.

> A decimal point separates a whole number from a decimal fraction.

B. Place value :

In **3129.275**, 3129 is the *integral part (whole number)* and 275 is the *decimal part*. The number of digits after the decimal point in it is three. So we say that the decimal fraction has three decimal places.

The place-value chart for a decimal fraction, say 3129.275, is as follows:

THOUSANDS (TH) 1,000	HUNDREDS (H) 100	TENS (T) 10	ONES (O) 1	TENTHS (t) $\frac{1}{10}$	HUNDREDTHS (h) $\frac{1}{100}$	THOUSANDTHS (th) $\frac{1}{1000}$
3	1	2	9	2	7	5

> **Note** the difference between tens and tenths; hundreds and hundredths and so on.

The decimal fraction 3129.275 consists of 3 thousands, one hundred, 2 tens, 9 ones, 2 tenths, 7 hundredths and 5 thousandths.

C. Expanded Form

Consider 468·356. We know the place value of each digit in 468.356.

So, we can write 468.356 in the expanded form as indicated below:

468.356 = 4 hundreds + 6 tens + 8 ones + 3 tenths + 5 hundredths + 6 thousandths

$= 400 + 60 + 8 + 0.3 + 0.05 + 0.006 = 400 + 60 + 8 + \frac{3}{10} + \frac{5}{100} + \frac{6}{1000}$

Similarly, the number 48.378 can be expressed in the expanded form as

$$40 + 8 + 0.3 + 0.07 + 0.008 = 40 + 8 + \frac{3}{10} + \frac{7}{100} + \frac{8}{1000}$$

D. Types of Decimal Fractions

Like decimal fractions. If two decimal fractions have equal number of decimal places, they are called like decimal fractions.

e.g. 0.<u>03</u>, 1.<u>32</u>, 15.<u>19</u>, 150.<u>30</u> are like decimal fractions having two decimal places.

Unlike decimal fractions. Two decimal fractions are unlike if they have unequal number of decimal places.

e.g. 0.<u>10</u>, 3.<u>5</u>, 0.<u>351</u>, are unlike decimal fractions.

Equivalent decimal fractions. Take the decimal fractions 0.5, 0.50, 0.500. They are equal in value, each being equal to $\frac{5}{10}$. Such decimal fractions are called equivalent decimal fractions.

.400 = 0.40 = 0.4
.0700 = 0.070 = 0.07
6.00800 = 6.0080 = 6.008

> Adding any number of zeroes at the extreme right in the decimal part does not change the value of the decimal fraction.

10.1 COMPARISON OF DECIMAL FRACTIONS

When we compare two decimal fractions, first we compare the whole number part of the fractions. Obviously the decimal fraction with the greater whole number is greater.

In both the decimal fractions, if the whole number part is same or 0, then we compare the decimal fractions by their tenths. If they have the same digits in the tenths place, then we compare them by their hundredths digits and so on.

EXAMPLE 1 Compare 12.23 and 14.78

Solution : 14.78 > 12.23 as 14 > 12.

EXAMPLE 2 Which is greater 0.58 or 0.09 ?

Solution : 5 tenths > 0 tenths, so 0.58 > 0.09

EXAMPLE 3 Arrange the following decimal fractions in ascending order.
0.38, 1.65, 0.048

Solution : 0.048, 0.38, 1.65 (Since 0.048 < 0.38 < 1.65)

10.2 CONVERSION OF A DECIMAL FRACTION INTO A COMMON FRACTION

To change a decimal fraction into a common fraction, first remove the decimal point. The number thus obtained becomes the numerator whose denominator is 10, 100 or 1000, etc. as per the place value of the decimals.

EXAMPLE Express 2.04, 14.235 and 25.409 into common fractions in the lowest terms.

Solution :

$$2.04 = \frac{204}{100} = \frac{51}{25} = 2\frac{1}{25}$$

$$14.235 = \frac{14235}{1000} = \frac{2847}{200} = 14\frac{47}{200}$$

$$25.409 = \frac{25409}{1000} = 25\frac{409}{1000}$$

Alternatively :

$$2.04 = 2 + \frac{4}{100} = 2 + \frac{1}{25} = 2\frac{1}{25}$$

$$14.235 = 14 + \frac{235}{1000} = 14 + \frac{47}{200} = 14\frac{47}{200}$$

$$25.409 = 25 + \frac{409}{1000} = 25\frac{409}{1000}$$

10.3 CONVERSION OF A COMMON FRACTION INTO A DECIMAL FRACTION

To change a common fraction into a decimal fraction, first we change the given common fraction into an equivalent common fraction whose denominator is 10 or a multiple of 10. After that we change it into a decimal fraction.

(i) $\dfrac{3}{8} = \dfrac{3 \times 125}{8 \times 125} = \dfrac{375}{1000} = 0.375$ (ii) $\dfrac{23}{4} = \dfrac{23 \times 25}{4 \times 25} = \dfrac{575}{100} = 5.75$

We can also adopt the following division method to change a common fraction into a decimal fraction.

Use the following steps:

1 We divide the numerator by the denominator.

2 When a non-zero remainder is left, we insert a decimal point in the dividend and the quotient and put a zero on the right of the decimal point in the dividend and the remainder. Divide again.

3 We continue the division process just as in the case of whole numbers till the remainder is zero.

(i)
```
        .375
   8 |  3.000     Since 3 does not go by 8,
      -24         put (.) in the dividend and
      ----        the quotient. Add zeroes.
        60        Now, take the first two
      -56         digits i.e. 30 and divide like
      ----        regular numbers.
        40
      -40
      ----
         0
```
Ans : $\dfrac{3}{8} = 0.375$

(ii)
```
        5.75
   4 | 23.00
      -20
      ----
        30
      -28
      ----
        20
      -20
      ----
         0
```
Ans : $\dfrac{23}{4} = 5.75$

Note: Conversion of some fractions like $\dfrac{2}{3}, \dfrac{3}{7}, \dfrac{5}{11}$, etc. for which the process of division never ends, will be dealt with later.

10.4 ROUNDING OFF DECIMALS

A. Rounding off to the nearest ones.

As we rounded off the numbers to the nearest tens, hundreds, thousands, we round off the decimal fractions to the nearest ones, tenths, hundredths and so on. The method is the same as we discussed before. For rounding off to the ones, we see the digit in the tenths place. If it is less than 5 (1, 2, 3, 4), the digit in the

ones place remains the same, and the digit in the tenths place is replaced by 0. If the digit in the tenths place is 5 or more than 5 [5, 6, 7, 8, 9], we add 1 to the digit in the ones place and replace the digit in the tenths place by zero.

EXAMPLE   Round off 9.6 to the nearest ones.

Solution :   Digit in the tenths place is 6 which is greater than 5. So add 1 to 9 which is the digit in ones place and replace the tenths digit by 0.

∴   9.6 to the nearest ones = 10·0 = 10

B. Rounding off to the nearest tenths (one decimal place)

See the digit in the hundredths place. If it is 5 or more than 5, add 1 to the tenths place digit and replace the digit in the hundredths place by 0. If it is less than 5, the digit in the tenths place remains the same and the digit in the hundredths place is replaced by 0.

EXAMPLE   Round off 9.76 to the nearest tenths.

Solution :   Digit in the hundredths place is 6 so add 1 to 7 (the digit in the tenths place), and replace 6 (the digit in the hundredths place) by zero.

∴   9.76 = 9.80 = 9·8   (Because 6 > 5)
Similarly, 15.72 = 15.70 = 15.7   (Because 2 < 5)
          108.25 = 108.30 = 108·3   (Because hundredths digits is 5)

C. Rounding off to the nearest hundredth (Two decimal places)

EXAMPLES   Round off the following numbers to the nearest hundredth.
(a) 9.567   (b) 54.485   (c) 73.318   (d) 225.562 (e) 88.063

Solution: 9.567 = 9.57   [thousandths digit 7 > 5]
               54.485 = 54.49   [thousandths digit is 5]
               73.318 = 73.32   [as 8 > 5]
             225.562 = 225.56   [as 2 < 5]
               88.063 = 88.06   [as 3 < 5]

D. Rounding off a decimal fraction to the nearest whole number

EXAMPLE   Round off (i) 88.4582 and (ii) 719.806 to the nearest whole number.

Solution: Look at the digit in the tenths place (*i.e.* immediately after the decimal).
(i) 88.4582 : Since 4 < 5, the   (ii) 719.806 : Since 8 > 5, the
     nearest whole number to   nearest whole number to
     88.4582 will be **88**.   719.806 will be **720**.

EXERCISE 10(A)

1 Write the following decimal fractions in words :
(a) 0.9   (b) 0.07   (c) 0.083   (d) 0.014   (e) 0.005
(f) 0.038   (g) 0.0036   (h) 27.075

2 Write the following (a) in fraction form and (b) in decimal form.

(a) Two tenths

(b) Four and five tenths

(c) Five-hundredths

(d) Eleven and three hundredths

(e) Seventy two hundredths

(f) Sixteen and twenty seven hundredths

(g) Five thousandths

(h) Twenty eight thousandths

3 Express the following fractions as decimal fractions:

(a) $\dfrac{12}{100}$ (b) $\dfrac{37}{100}$ (c) $\dfrac{1}{1000}$ (d) $\dfrac{35}{1000}$ (e) $\dfrac{112}{1000}$ (f) $21\dfrac{76}{100}$ (g) $112\dfrac{9}{10}$

4 Write the following as a fraction or mixed number. Give the answer in simplified form.

(a) 0.45 (b) 0.124 (c) 0.049 (d) 0.055 (e) 9.05 (f) 30.09 (g) 100.225

5 Give the place value of the underlined digit:

(a) 0.6̲7 (b) 0.1̲63 (c) 0.27̲9 (d) 4.1̲6 (e) 3.7̲84 (f) 15.7̲5 (g) 1̲6.12

6 Write each decimal in the expanded form:

(a) 0.48 (b) 0.714 (c) 1.75 (d) 23.345

(e) 9.062 (f) 52.005 (g) 5.015 (h) 815.426

7 Write '>' or '<'.

(a) 0.46 _____ 0.5 (b) 0.008 _____ 0.1 (c) 0.76 _____ 0.09

(d) 0.48 _____ 0.7 (e) 0.125 _____ 0.307 (f) 0.009 _____ 0.04

8 Arrange the following in ascending order using the sign '<'.

(a) 0.6, 0.43, 0.7 (b) 0.014, 0.8, 0.006 (c) 0.123, 0.321, 0.103

(d) 0.9, 0.83, 0.8 (e) 3.46, 1.95, 1.99 (f) 11.21, 11.211, 11.112

9 Arrange the following in descending order using the sign '>'.

(a) 0.76, 0.62, 0.67 (b) 0.25, 0.56, 0.53 (c) 3.41, 6.83, 1.94

(d) 0.81, 0.77, 1.05 (e) 1.16, 6.11, 1.61 (f) 0.246, 0.426, 0.024

10 Convert the following common fractions into decimal fractions:

(a) $\dfrac{3}{4}$ (b) $\dfrac{7}{8}$ (c) $15\dfrac{1}{4}$ (d) $20\dfrac{3}{5}$ (e) $17\dfrac{3}{16}$ (f) $8\dfrac{21}{40}$ (g) $58\dfrac{5}{64}$

11 Convert the following decimal fractions into common fractions:

(a) 0.02 (b) 0.175 (c) 7.60 (d) 7.625 (e) 6.125 (f) 3.75 (g) 9.55

12 Round off each of the following to the nearest ones :

(a) 5.7 _____ (b) 38.7 _____ (c) 12.3 _____

(d) 189.5 _____ (e) 642.3 _____ (f) 304.5 _____

13 Round off each of the following to the nearest tenths.

(a) 12.38 _____   (b) 48.43 _____   (c) 98.69 _____

(d) 378.45 _____   (e) 940.08 _____   (f) 505.55 _____

14 Round off each of the following to the nearest hundredth.

(a) 5.583 _____   (b) 33.366 _____   (c) 180.762 _____

(d) 786.103 _____   (e) 388.008 _____   (f) 136.165 _____

15 Round off the following numbers first to the nearest hundredth, then round the numbers obtained to the nearest tenth and then round the numbers obtained to the nearest whole number.

(a) 9.382   (b) 51.175   (c) 100.125   (d) 499.862   (e) 616.069

16 Round off the following as instructed:

(a) To the nearest metre

4.56 m	19.67 m	21.23 m	89.56m	87.24 m

(b) To the nearest litre

3.467 *l*	36.8 *l*	56.398 *l*	5.34 *l*	9.741 *l*

(c) To the nearest kg.

4.576 kg	64.362 kg	87.560 kg	78.340 kg	89.56 kg

10.5 ADDITION AND SUBTRACTION OF DECIMAL FRACTIONS

To add or subtract decimal fractions, follow the rules given below:

(1) Write the numbers in column form.

(2) Decimal points should come in one column.

(3) There should be the same number of digits after the decimal point in each number. [If required put zeroes at the extreme right of the decimal point as it does not change the value of the number.]

EXAMPLE 1 Add 12.27, 13.09 and 15.87   **EXAMPLE 2** Subtract 189.76 from 500

Solution:

```
   12.27
   13.09
 + 15.87
 ───────
   41.23    Ans : 41.23
```

Solution:

```
   500.00   [500 = 500.00]
 − 189.76
 ───────
   310.24
```
Ans : 310.24

EXAMPLE 3 | Simplify 14.8 – 75.72 + 80 – 5.275

Solution: 14.8 + 80 – 75.72 – 5.275

(Step : 1)
```
  14.80
+ 80.00
  94.80
```

(Step : 2)
```
  75.720
+  5.275
  80.995
```

(Step : 3)
```
  94.800
– 80.995
  13.805
```
Ans.

EXERCISE 10(B)

1 Add the following :

(a) 3.5, 16.08, 125.073

(b) 20.25, 0.2025, 2.025, 202.5

(c) 44.6, 80.6, 96.0, 0.75

(d) 6.0648,   0.648, 6.48

(e) 56.0204, 16.0748, 25.5

(f) 9.09, 99.9, 999.9, 9.9099

(g) 10.1, 100.01, 1.1011, 1000

(h) 3.24, 20.076, 6.793, 526.3

2 Subtract the following:

(a) 0.36 – 0.2431

(b) 0.705 – 0.598

(c) 0.02 – 0.002

(d) 0.75 – 0.6735

(e) 0.7148 – 0.43

(f) 11.0061 – 9.7

(g) 100 – 75.0336

(h) 0.3568 – 0.1709

3 Take away 36.83 from 100.

4 Take away 112.5168 from 150.

5 Find the difference between 89.02 and 9.8924.

6 Find the difference between 0.9 and 0.0945.

7 How much should be added to 642.57 to get 900?

8 How much should be subtracted from 1500 to get 1125.15?

9 By how much does 94.8 exceed 64.025 ?

10 Find the sum of 0.9483 and 10.07 and then subtract 5.3156 from it.

11 Simplify

(a) 3.26 + 5.4 – 6.8

(b) 8.8 – 3.65 – 15.008 + 30.625

(c) 141.6 – 100 – 80.38 + 65.358

(d) 50 – 18.11 + 24.9 – 40.88

(e) 37.3 – 18.46 + 50.2 – 2.36 – 20.7156

(f) 2000 – 155.984 – 529.85 + 0.7078

10.6 MULTIPLICATION OF DECIMAL FRACTIONS

A. Multiplication by 10, 100, 1000, etc. (multiples of 10)

To multiply a decimal fraction by 10, 100, 1000, etc. move the decimal point in the multiplicand by as many places **to the right** as there are zeroes in the multiplier.

e.g. $0.375 \times 10 = 3.75$ (the decimal point is moved one place to the right)

$0.375 \times 100 = 37.5$ (the decimal point is moved two places to the right)

$0.375 \times 1000 = 375$ (the decimal point is moved three places to the right)

$0.375 \times 10000 = 3750$ (the decimal point is moved four places to the right)

EXERCISE 10(C)

1 Multiply the following decimal fractions by (a) 10; (b) 100; (c) 1000

(a) 0.487   (b) 0.5671   (c) 6.063   (d) 2.4861   (e) 51.835

(f) 123.6   (g) 0.0009   (h) 15.002

2 Find the values of the following :

(a) 0.4837×1000 (b) 0.389×10000 (c) 123.8×100 (d) 3.208×10

(e) 0.0007×100 (f) 3.017×10 (g) 1008.2×100 (h) 0.0309×1000

B. Multiplication by a whole number :

Multiply the multiplicand with the multiplier as in common multiplication. But it is important to know where to put the decimal point.

EXAMPLES (a) Multiply 17.25 by 15

Solution:

```
  17.25    Two decimal places.
  × 15

  8625
+ 1725×    The product should have the same number
           of decimal places as the multiplicand. Here
 258.75    the multiplicand has 2 decimal places.
```
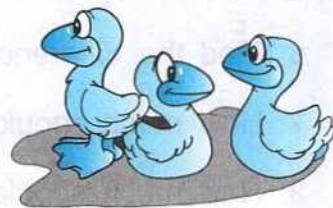
(b) Multiply 56.235 by 32

$56.235 \times 32 = 56.235$ Three decimal places.

```
            × 32

          112470
       + 168705    The product should have the same number
                   of decimal places as the multiplicand. Here
         1799.520  the multiplicand has 3 decimal places.
```

C. Multiplication of a decimal fraction by a decimal fraction:

Let us find the product of 0.45 × 0.3

We can write $0.45 \times 0.3 = \frac{45}{100} \times \frac{3}{10} = \frac{135}{1000} = 0.135$

We see that there are two decimal places in the multiplicand (0.45), one decimal place in the multiplier (0.3) and three decimal places in the product. Let us take one more example.

Multiply 8.63 by 0.14

$8.63 \times 0.14 = \frac{863}{100} \times \frac{14}{100} = \frac{12082}{10000} = 1.2082$

There are two decimal places in the multiplicand (8.63), two decimal places in the multiplier (0.14) and 4 decimal places in the product.

From the above examples we see that two decimal fractions are multiplied in the common way, but the number of decimal places in the product is equal to the total number of decimal places in the multiplicand and the multiplier together.

EXAMPLE   Multiply 0.765 by 0.9

Solution: $0.765 \times .9 =$

0.765	Three decimal places
× 0.9	One decimal place
0.6885	Four decimal places

Ans : 0.6885

EXERCISE 10(D)

1 Find the product :

(a) 1.88 × 16   (b) 16.32 × 8   (c) 41.08 × 32   (d) 4.032 × 85

(e) 0.47 × 375   (f) 2.008 × 150   (g) 0.4262 × 11   (h) 0.487 × 240

(i) 50.05 × 50   (j) 100.01 × 200

2 Find the product :

(a) 18.4 × 0.12   (b) 0.3146 × 0.05   (c) 1.32 × 0.0008   (d) 0.004 × 0.064

(e) 1.18 × 0.46 × 0.07 (f) 0.1 × 1 × 0.1   (g) 3.48 × 16 × 0.5   (h) 0.03 × 0.03 × 0.03

3 If 324 × 12 = 3888, then find the product of each of the following without actually performing the multiplication.

(a) 3.24 × 12   (b) 32.4 × 12   (c) 0.324 × 12   (d) 0.00324 × 12

4 If 614.6 × 9 = 5531.4, then find the product of each of the following without actually doing the multiplication.

(a) 61.46 × 9   (b) 0.6146 × 9   (c) 6146 × 9   (d) 6.146 × 9   (e) 0.06146 × 9

5 If 2.48 × 6 = 14.88 then find out the product without actually doing the multiplication when 2.48 is multiplied by

(a) 60   (b) 600   (c) 0.6   (d) 0.06   (e) 6000

6 If 56.2 × 7 = 393.4 then find the product of each of the following without actually doing the multiplication.

(a) 0.562 × 7   (b) 562 × 7   (c) 0.0562 × 7   (d) 5.62 × 7

10.7 DIVISION OF DECIMAL FRACTIONS

A.   Division by 10, 100, 1000 etc. (multiples of 10)

To divide a decimal fraction by 10, 100, 1000, etc. move the decimal point in the dividend by as many places **to the left** as there are zeroes in the divisor.

EXAMPLES   (a) 4.83 ÷ 10   (b) 4.83 ÷ 100   (c) 4.83 ÷ 1000

Solution: (a) $4.83 \div 10 = \dfrac{483}{100} \div 10$

$$= \dfrac{483}{100} \times \dfrac{1}{10}$$

$$= \dfrac{483}{1000} = 0.483 \qquad \text{[the decimal point is moved 1 place to the left]}$$

(b) $4.83 \div 100 = \dfrac{483}{100} \times \dfrac{1}{100}$

$$= \dfrac{483}{10000} = 0.0483 \qquad \text{[the decimal point is moved 2 places to the left]}$$

(c) $4.83 \div 1000 = \dfrac{483}{100} \times \dfrac{1}{1000}$

$$= \dfrac{483}{100000}$$

$$= 0.00483 \qquad \text{[the decimal point is moved 3 places to the left]}$$

EXERCISE 10(E)

1 Divide the following by   (a) 10 ;   (b) 100 ;   (c) 1000 :

(a) 12   (b) 75   (c) 1767   (d) 89.76   (e) 201.2

(f) 0.89   (g) 0.08   (h) 0.0076

2 Write down the values of :

(a) 64.83 ÷ 100   (b) 328 ÷ 1000

(c) 17.48 ÷ 10   (d) 217.4 ÷ 100

(e) 4648 ÷ 1000   (f) 547.8 ÷ 1000

(g) 3.6 ÷ 10000   (h) 47.6 ÷ 10000

B. Division of a decimal fraction by a whole number :

EXAMPLE 1 Divide 0.96 by 8

$$0.96 = \frac{96}{100}$$

$$0.96 \div 8 = \frac{\cancel{96}^{12}}{100} \times \frac{1}{\cancel{8}}$$

$$= \frac{12}{100}$$

$$= 0.12 \quad \textbf{Ans.}$$

EXAMPLE 2 Divide 82.25 by 5

$$82.25 = \frac{8225}{100}$$

$$82.25 \div 5 = \frac{\overset{1645}{\cancel{8225}}}{100} \times \frac{1}{\cancel{5}}$$

$$= \frac{1645}{100}$$

$$= 16.45 \quad \textbf{Ans.}$$

Generally we solve division problems by the following alternative method.

EXAMPLE 3 Divide 231.36 by 15

Solution:

```
          15.424
    15 │ 231.360
        -15
        ─────
         81
        -75
        ─────
         63
        -60
        ─────
         36
        -30
        ─────
         60
        -60
        ─────
          0
```

Insert as many zeroes as are necessary to continue the division process and then divide like regular numbers.

Here (.) appears in the dividend so put (.) in the quotient also. Since 6 < 15 (quotient), so bring down 3 after the decimal (.) and divide.

Bring down the zero

Ans : 15.424

EXAMPLE 4   Divide 98.37 by 12

Solution:

$$
\begin{array}{r}
8.1975 \\
12\overline{)98.3700} \\
-96 \\
\hline
23 \\
-12 \\
\hline
117 \\
-108 \\
\hline
90 \\
-84 \\
\hline
60 \\
-60 \\
\hline
0
\end{array}
$$

When division with the whole number in the dividend is over, put a decimal point in the quotient.

Insert zero in the dividend.

Put another zero in the dividend to complete the division.

Ans : 8.1975

C. Division of a decimal by a decimal :

To divide a decimal number by a decimal number, first change the divisor into a whole number by multiplying the denominator by 10, 100, 1000 etc. (multiples of 10) as required. Multiply the dividend (numerator) also by the same number so that the value of the given number remains the same.

Let us understand the steps involved by taking some examples.

EXAMPLE 1   Divide 0.81 by 0.3

Solution: Since there is one digit in the decimal part of 0.3, multiply it by 10 to change it to a whole number. Multiply the numerator also by 10.

$$0.81 \div 0.3 = \frac{0.81}{0.3} = \frac{0.81 \times 10}{0.3 \times 10} = \frac{8.1}{3}$$

[Next divide 8.1 by 3]

$$
\begin{array}{r}
2.7 \\
3\overline{)8.1} \\
-6 \\
\hline
21 \\
-21 \\
\hline
0
\end{array}
$$

Ans. 2.7

EXAMPLE 2   Divide 0.352 by 0.16

$$0.352 \div 0.16 = \frac{0.352}{0.16} = \frac{0.352 \times 100}{0.16 \times 100} = \frac{35.2}{16}$$

[As there are two digits in the decimal part of 0.16, multiply both the numerator and denominator by 100]

Now divide 35.2 by 16

$$
\begin{array}{r}
2.2 \\
16\,\overline{\smash{\big)}\,35.2} \\
-\,32 \\
\hline
32 \\
-\,32 \\
\hline
0
\end{array}
$$ **Ans.** 2.2

D. Division of a whole number by a decimal

To divide a whole number by a decimal, convert the divisor into a whole number by multiplying the dividend and the divisor by 10 or 100 or 1000, depending upon the number of decimal places in the divisor, and then divide the new dividend (product of the given dividend and 10 or 100 or 1000) by the whole number divisor.

EXAMPLES   (a) $15 \div 0.3$ (b) $34 \div 4.25$

Solution: (a) $15 \div 0.3 = \dfrac{15}{0.3} = \dfrac{15}{0.3} \times \dfrac{10}{10}$ | (b) $34 \div 4.25 = \dfrac{34}{4.25} = \dfrac{34}{4.25} \times \dfrac{100}{100}$

$= \dfrac{150}{3} = 50$ | $= \dfrac{3400}{425} = 8$

Ans. 50 | **Ans.** 8

EXERCISE 10(F)

Divide

(1) 0.406 by 29   (2) 24.9 by 300   (3) 147.2 by 230

(4) 650.3 by 7000   (5) 17.4 by 2000   (6) 108.8 by 8000

(7) 0.8432 by 0.8   (8) 316.96 by 0.028

10.8 OPERATIONS IN DECIMAL NOTATION — MONEY

We know that one rupee = 100 paise.
We can express 50 paise in decimal notation as ₹ 0.50

Similarly, Ten paise = ₹ 0.10
      One paisa = ₹ 0.01

EXAMPLE 1   A pair of shoes costs ₹ 1846.60, a pair of trousers costs ₹ 1208.75 and a shirt costs ₹ 675.25. Find the total cost of all the three articles.

Solution:

Cost of the shoes	=	₹ 1846.60
Cost of the trousers	=	₹ 1208.75
Cost of the shirt	=	+ ₹ 675.25
Total cost	=	₹ 3730.60

Ans. ₹ 3730.60

EXAMPLE 2   Ramesh had ₹ 1,200 with him. He went to the market and bought grocery for ₹ 665.75, vegetables for ₹ 75.80, sweets for ₹ 112.20 and spent ₹ 25.00 on conveyance. How much money was left with him?

Solution: Amount spent = ₹ 665.75 + ₹ 75.80 + ₹ 112.20 + ₹ 25.00 =

$$\begin{array}{r}
₹ \ \text{p.} \\
665.75 \\
75.80 \\
112.20 \\
+ \ 25.00 \\
\hline
₹ \ 878.75
\end{array}$$

Amount left

$$\begin{array}{r}
₹ \ 1200.00 \\
- \ 878.75 \\
\hline
₹ \ 321.25
\end{array}$$

Ans : ₹ 321.25

EXAMPLE 3   A bicycle costs ₹ 885.75. Find the cost of 15 such bicycles.

Solution: Cost of one bicycle   =   ₹ 885.75
∴ Cost of 15 bicycles =   ₹ 885.75

$$\begin{array}{r}
₹ \ 885.75 \\
\times \ 15 \\
\hline
= \ ₹ \ 13,286.25
\end{array}$$

Ans : ₹ 13,286.25

EXAMPLE 4   I bought a dozen note books for ₹ 219.00. What is the price of one note book?

Solution: Price of 1 dozen (12) note books   = ₹ 219.00

∴ price of 1 note book   = ₹ 219 ÷ 12

$$\begin{array}{r}
18.25 \\
12 \ \overline{)219.00} \\
-12 \ \ \ \ \\
\hline
99 \ \ \ \\
-96 \ \ \ \\
\hline
30 \ \\
-24 \ \\
\hline
60 \\
-60 \\
\hline
0
\end{array}$$

Ans : ₹ 18.25

1. A man bought a refrigerator for ₹ 10,450, a steel almirah for ₹ 755.75 and a table TV for ₹ 5850.65. How much money did he spend in all?

2. Aman's monthly income is ₹ 28,000. He has to pay a monthly rent of ₹ 12,000, ₹ 7,500 for food, ₹ 1,200 for transport and ₹ 1,775 as school fees for his son. How much money does he save every month ?

3. Mrs. Mathur had ₹ 1275.75 in her purse. She bought a saree for ₹ 465.65 and a hand bag for ₹ 175.85. How much money was left with her?

4. Radha bought the following things from a grocery shop

   (i) Rice for ₹ 275.80 (ii) Wheat for ₹ 418.85 (iii) Spices for ₹ 208.25. She gave ₹ 1000 to the shopkeeper. How much money would the shopkeeper return?

5. A rice bag costs ₹ 135.50 and a bag of wheat costs ₹ 95.75. What is the total cost of 9 rice bags and 12 wheat bags?

6. Sudhir bought 6 pens costing ₹ 18.25 each and 10 pencils costing ₹ 4.75 each. How much will he get back if he pays the shopkeeper ₹ 200?

7. If the cost of 9 fans is ₹ 8370, find the cost of 14 fans.

8. Subtract the difference of ₹ 415.75 and ₹ 282.90 from ₹ 500.00.

9. A pair of shoes costs ₹ 1190.90, a pair of socks costs ₹ 30.15 and a T-shirt costs ₹ 495.50. Mr. Gopal bought 2 pairs of shoes, 4 pairs of socks and 6 T-shirts. How much money did he spend in all?

10. The cost of a motorcycle is ₹ 67,889 while the cost of a scooter is ₹ 39,465. Find the difference in their prices.

11.1 INTRODUCTION

Mrs. Xavier, class teacher of class V A is working on her class report cards. Here are the marks of four of her class students.

Debjani Dutta		Neha Chawla	
Subject	**Max. Marks 100**	**Subject**	**Max. Marks 100**
English	76	English	78
Maths	80	Maths	72
Science	65	Science	65
History	72	History	78
Geography	68	Geography	80
Hindi	59	Hindi	65
Radha Mohan		**Mary Joseph**	
Subject	**Max. Marks 100**	**Subject**	**Max. Marks 100**
English	80	English	85
Maths	85	Maths	70
Science	70	Science	75
History	66	History	70
Geography	58	Geography	76
Hindi	58	Hindi	50

Mrs. Xavier wants to find out which of these students had done the best work. First she finds the total marks secured by each student.

Debjani Dutta gets 76 + 80 + 65 + 72 + 68 + 59 = 420

Neha Chawla gets 78 + 72 + 65 + 78 + 80 + 65 = 438

Radha Mohan gets 80 + 85 + 70 + 66 + 58 + 58 = 417

Mary Joseph gets 85 + 70 + 75 + 70 + 76 + 50 = 426

From this Mrs. Xavier sees that Neha Chawla has got the highest total marks.

Now she wants to find out the average marks scored by each student. She divides the total marks of each student by the total number of subjects.

Debjani's average marks $= \dfrac{420}{6} = 70$

Neha's average marks $= \dfrac{438}{6} = 73$

Radha's average marks $= \dfrac{417}{6} = 69.5$

Mary's average marks $= \dfrac{426}{6} = 71$

Let us take one more example : The runs scored by Sachin Tendulkar in 6 one-day matches are 37, 66, 92, 15, 102 and 24. What is his average run rate?

Total runs scored by him in 6 matches = 37 + 66 + 92 + 15 + 102 + 24 = 336

Average runs scored in a match by Sachin Tendulkar $= \dfrac{336}{6} = 56$

From the above examples what do we understand by average?

We notice that in none of the matches Sachin Tendulkar scored 56 runs. When we say that average runs scored in a match is 56, we mean that if he scores 56 runs in each match, the total runs scored in 6 matches would be the same as it is now. Similarly, in the first example, Debjani Dutta's average marks in 6 subjects are 70, it does not mean she got 70 marks in every subject. It just means that if we take her total marks for 6 subjects and divide it by 6, we get 70.

$$\text{So, Average} = \dfrac{\text{The sum of the given quantities}}{\text{The number of quantities}}$$

Thus average is a number which is roughly between the smallest and the largest number/quantity.

The average gives us an idea of the general value of a group. The average is the arithmetical mean value of the number of given values/quantities.

EXAMPLE 1   The weight of 10 children are 32, 36, 30, 35, 38, 34, 30, 32, 37 and 39 kg respectively. What is their average weight?

Solution: The weight of 10 children

= 32 + 36 + 30 + 35 + 38 + 34 + 30 + 32 + 37 + 39 = 343 kg

∴ Average weight of a child $= \dfrac{343}{10} = 34.3$ kg **Ans.**

EXAMPLE 2   The heights of 7 children aged 10 years are 136 cm, 140 cm, 142 cm, 138 cm, 142 cm, 141 cm and 148 cm. Find their average height.

Solution: The total heights of 7 children

= 136 + 140 + 142 + 138 + 142 + 141 + 148 = 987 cm

∴ Average height of a child $= \dfrac{987}{7} = 141$ cm **Ans.**

EXAMPLE 3 Find the average of $5\dfrac{1}{2}$, $3\dfrac{3}{4}$, $\dfrac{1}{8}$, $\dfrac{9}{16}$, $2\dfrac{1}{4}$.

Solution: The sum of the given quantities

$$= 5\dfrac{1}{2} + 3\dfrac{3}{4} + \dfrac{1}{8} + \dfrac{9}{16} + 2\dfrac{1}{4}$$

$$= \dfrac{11}{2} + \dfrac{15}{4} + \dfrac{1}{8} + \dfrac{9}{16} + \dfrac{9}{4}$$

$$= \dfrac{88 + 60 + 2 + 9 + 36}{16} = \dfrac{195}{16}$$

The number of quantities given = 5

$$\therefore \text{Average} = \dfrac{195}{16} \div 5$$

$$= \dfrac{\overset{39}{\cancel{195}}}{16} \times \dfrac{1}{\cancel{5}} = \dfrac{39}{16} = 2\dfrac{7}{16} \textbf{ Ans.}$$

EXAMPLE 4 Find the average of 10.1, 12.5, 7.25, 14.8, 9.75, 8.08, 9, 7.96

Solution: Total of the given quantities

$$= 10.1 + 12.5 + 7.25 + 14.8 + 9.75 + 8.08 + 9 + 7.96 = 79.44$$

The number of quantities given = 8

$$\therefore \text{Average} = \dfrac{79.44}{8} = 9.93 \textbf{ Ans.}$$

EXAMPLE 5 Find the average of all the odd numbers between 2 and 22.

Solution: The odd numbers between 2 and 22 are 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

Sum of the given quantities

$$= 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 = 120$$

Number of quantities given = 10

$$\therefore \text{Average} = \dfrac{120}{10} = 12 \textbf{ Ans.}$$

We should remember that the average always lies somewhere between the highest and the lowest value/quantity. In the above example, 12 is the average. We say 3, 5, 7, 9, 11 are below the average and 13, 15, 17, 19 and 21 are above the average.

EXAMPLE 6 5 students of a class went for medical check up. The table below shows the record of their age, height and weight. Find the average (a) age (b) height and (c) weight of the students.

Name	Age	Height	Weight
Vishal	12 years 10 months	144cm	30kg
Namik	13 years 2 months	150cm	36kg
Saikat	11 years 11 months	130cm	32kg
Shyam	13 years	148cm	38kg
Sunder	12 years 5 months	138cm	33kg

Solution:

(a)

$$12 \times 12 + 10 = 154 \text{ months}$$

$$13 \times 12 + 2 = 158 \text{ months}$$

$$11 \times 12 + 11 = 143 \text{ months}$$

$$13 \times 12 = 156 \text{ months}$$

$$12 \times 12 + 5 = 149 \text{ months}$$

Total age of 5 students = 760 months

> When finding the average of numbers see that they have the same measure.

$$\therefore \text{ Average age} = \frac{760}{5} = 152 \text{ months}$$

$$= 12 \text{ years 8 months } \textbf{Ans.}$$

(b) Total height of 5 students = 144 + 150 + 130 + 148 + 138

$$= 710 \text{ cm}$$

$$\text{Average height} = \frac{710}{5} \text{ cm} = 142 \text{ cm } \textbf{Ans.}$$

(c) Total weight of 5 students = 30 + 36 + 32 + 38 + 33

$$= 169 \text{ kg}$$

$$\text{Average weight} = \frac{169}{5} = 33.8 \text{ kg } \textbf{Ans.}$$

11.2 TO FIND THE SUM OF THE QUANTITIES WHEN THE AVERAGE IS GIVEN

We know that Average = $\dfrac{\text{The sum of the given quantities}}{\text{No. of quantities}}$

So, the sum of the given quantities = Average × No. of quantities

e.g. If the average of 8 numbers is 12, then the sum of the quantities is 12 × 8 = 96

EXAMPLE 1 Daisy's father earns on an average ₹4300 a week. How much does he earn in a year of 52 weeks?

Solution: Average earning of Daisy's father in a week

$$= ₹ 4300$$

Total earning in a year $= ₹ 4300 \times 52$

$$= ₹ 2,23,600$$

Ans. ₹ 2,23,600

```
   4300
  × 52
 ─────
   8600
 21500 ×
 ─────
 2,23,600
```

EXAMPLE 2 Ramesh scored 36 runs on an average in 5 innings. The average of his first three innings is 40. He scored a duck in the fourth innings. How many runs did he score in his fifth innings?

Solution: Average runs scored by Ramesh in 5 innings = 36

∴ Total runs scored by him = 36 × 5 = 180 runs

Average runs scored in first three innings = 40

∴ Total runs scored in first three innings = 40 × 3 = 120 runs

Runs scored in the fourth innings = 0

∴ Total runs scored in 4 innings = 120

∴ Runs scored in the fifth innings = 180 – 120 = 60 runs

Ans. 60 runs

EXAMPLE 3 The average of 4 numbers is 16 and the average of another 4 numbers is 20. Find the average of the 8 numbers taken together.

Solution: The average of 4 numbers = 16

∴ Sum of 4 numbers = 16 × 4 = 64

The average of another 4 numbers = 20

∴ Sum of another 4 numbers = 20 × 4 = 80

Sum of 8 numbers = 64 + 80 = 144

∴ Average of 8 numbers = $\dfrac{144}{8}$ = 18

Ans. 18

1 Find the average of

(a) 50, 41, 47, 48, 40, 44

(b) 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

(c) 35, 42, 31, 53, 16, 34, 27

(d) 24, 21, 26, 25, 18, 20, 27, 23

(e) $\dfrac{3}{8}$, $1\dfrac{1}{4}$, $2\dfrac{5}{6}$, $4\dfrac{1}{2}$, $6\dfrac{4}{3}$

(f) $2\dfrac{3}{5}$, $3\dfrac{3}{10}$, $3\dfrac{1}{2}$, $\dfrac{2}{5}$, $\dfrac{9}{10}$, $1\dfrac{1}{2}$

(g) $\dfrac{7}{12}$, $2\dfrac{5}{6}$, $5\dfrac{3}{4}$, $\dfrac{1}{2}$, $\dfrac{5}{12}$, $\dfrac{1}{6}$

(h) $\dfrac{1}{4}$, $\dfrac{3}{4}$, $\dfrac{1}{2}$, $\dfrac{1}{6}$, $\dfrac{3}{8}$

2 The rainfall in Jamshedpur for 6 consecutive years was 28.5 cm, 30.25 cm, 32.4 cm, 31.6 cm, 24 cm and 30.25 cm. Find the average rainfall of Jamshedpur.

3 Find the average of all even numbers between 7 and 23.

4 Find the average of all odd numbers between 10 and 30.

5 The age, height and weight chart of 5 students is given below:

Name	Age	Height	Weight
Radha	8 years 3 months	121cm	25.5kg
Renu	9 years 1 month	130cm	28kg
Rakhi	8 years 8 months	128cm	27.8kg
Rani	10 years	131cm	30kg
Ranju	9 years 5 months	130cm	29.6kg

Find the average (a) age (b) height and (c) weight of the above students.

6 The marks of 20 students of a class in a mathematics test are given below :

34, 42, 54, 76, 82, 26, 78, 67, 62, 54, 17, 25, 39, 42, 66, 78, 80, 92, 26, 40

(a) Find the average marks scored by the students of the class.

(b) How many students scored marks more than the average marks?

(c) How many students scored marks less than the average marks?

(d) How many students scored marks equal to the average marks?

7 The daily attendance of classes VA, VB and VC on 5 days of a week are given below:

Class	Monday	Tuesday	Wednesday	Thursday	Friday
VA	48	50	52	46	44
VB	49	51	48	45	47
VC	50	47	45	48	50

(a) Which class had the best average attendance during the week and which class had the worst average attendance during the week?

(b) On which day the average attendance of the three classes was the (i) best (ii) worst

8 The marks of 6 students in 6 different subjects are given below :

Name	English	Hindi	Maths	Science	History	Geography
Amar	63	58	85	68	70	64
Balbir	50	37	41	40	50	46
Chander	82	48	91	88	74	73
Dilraj	60	58	62	60	65	67
Ela	48	51	47	50	51	47
Fatima	75	48	70	66	80	75

Read the above table and answer the following questions:

(a) Find the average marks in each subject.

(b) Find the average marks of each student.

(c) Which subject has the highest average marks?

(d) Which subject has the lowest average marks?

9 Srikanth's average marks in 6 subjects in an examination were 65. He scored 64 in English, 68 in Hindi, 58 in Maths, 55 in Science and 70 in History. How many marks did he get in Geography?

10 The average weight of a group of 8 children is 25.6 kg. The average weight of another group of 7 children is 26.2 kg. Find the average weight of the group of 15 children.

11 The average age of 10 children is 9 years 9 months. The average age of 9 children is 8 years 11 months. What is the age of the tenth child?

12 Find the average of 12 numbers if the average of the first nine numbers is 21 and the average of the last three is 17.

12 SIMPLIFICATION-BODMAS RULE

12.1 ORDER OF OPERATION

In the earlier chapters we have learnt how to add, subtract, multiply and divide whole numbers, fractions and decimals. So far we did only one operation at a time.

But sometimes we need to do two or more of the four fundamental operations at the same time to solve a problem.

Let us consider a problem. $16 - 8 \div 4 \times 2 + 8$

Here we need to carry out all the four operations to solve the problem. But in what order should we do them?

Suppose we do the problem in the way it is given, then

$16 - 8 \div 4 \times 2 + 8$	(We first subtract)
$8 \div 4 \times 2 + 8$	(then divide)
$\dfrac{\overset{2}{\cancel{8}}}{\cancel{4}_1} \times 2 + 8$	(then multiply)
$4 + 8 = 12$	(then add)

Working the answer we get is 12   (1st operation)

Suppose if we do the problem in the following way,

$16 - 8 \div 4 \times 2 + 8$	(We first subtract)
$8 \div 4 \times 2 + 8$	(then add)
$8 \div 4 \times 10$	(then multiply)
$8 \div 40$	(and then divide)
$\dfrac{8}{40} = \dfrac{1}{5}$	

The answer we get is $\dfrac{1}{5}$ (2nd operation)

We can do the same problem by the following method also.

$16 - 8 \div 4 \times 2 + 8$	(We first divide)
$16 - \dfrac{\overset{2}{\cancel{8}}}{\cancel{4}_1} \times 2 + 8$	
$16 - 2 \times 2 + 8$	(then multiply)
$16 - 4 + 8$	(then subtract)
$12 + 8 = 20$	(and then add)

The answer we get is 20   (3rd operation)

For the same problem we got three different answers. We do not know which answer is correct. This means we need to have some rules to tell us the order in

which we should do the operations. In mathematics, it has become the custom or convention to do the four operations in the following order.

First–Division   Second–Multiplication   Third–Addition   Fourth–Subtraction

DMAS in short

So what is the correct answer for the above problem?

$16 - 8 \div 4 \times 2 + 8 = 16 - 2 \times 2 + 8$

Start with division $= 16 - 4 + 8$ (Then multiplication)

$= 16 + 8 - 4$ (Addition)

$= 24 - 4$ (Subtraction)

Ans : 20

> This rule conventionally makes it easier for us to do sums involving more than one operation. We call it the simplification rule.

EXAMPLES   Using the simplification rule (DMAS) solve the following sums.

(a) $8 + 6 \div 2$ (b) $54 \times 3 + 5$ (c) $105 - 8 \times 3$

(d) $26 + 9 \times 7 - 15$ (e) $14 + 24 \div 8 \times 20 - 60$

Solution: (a) $8 + 6 \div 2$

$= 8 + \dfrac{{}^{3}\cancel{6}}{\cancel{2}_{1}}$ (First divide)

$= 8 + 3$ (Then add)

$= 11$

Ans : 11

(c) $105 - 8 \times 3$ (Multiply first)

$= 105 - 24$ (Subtract)

$= 81$

Ans : 81

(e) $14 + 24 \div 8 \times 20 - 60$

$= 14 + \dfrac{{}^{3}\cancel{24}}{\cancel{8}\,_{1}} \times 20 - 60$ (First divide)

$= 14 + 3 \times 20 - 60$ (Multiply)

$= 14 + 60 - 60$ (Then add)

$= 74 - 60$ (Then subtract)

$= 14$

Ans : 14

(b) $54 \times 3 + 5$ (First multiply

$= 162 + 5$ and then add)

$= 167$

Ans : 167

(d) $26 + 9 \times 7 - 15$ (Multiply first)

$= 26 + 63 - 15$ (Then add)

$= 89 - 15$ (Subtract)

$= 74$

Ans : 74

Simplify

(a) $48 \div 6 + 7$

(b) $72 \div 12 - 6 + 4$

(c) $18 \div 2 \times 14 + 15$

(d) $26 + 6 \times 56 \div 8$

(e) $112 \div 7 \times 5 - 35$

(f) $28 \times 6 \div 3 - 36$

(g) $64 + 7 + 26 \div 13 - 39$

(h) $76 \div 19 \times 5 - 10 + 30$

(i) $7 \times 50 + 72 \div 8 - 225$

12.2 MORE ABOUT SIMPLIFICATION OF NUMERICAL EXPRESSIONS

If an expression involves the use of 'of' which, as we know, means multiplication; this multiplication is carried out even before division.

For example

$$81 \div \frac{1}{3} \text{ of } 27 = 81 \div \frac{27}{3} = 81 \div 9 = \frac{81}{9} = 9 \text{ OR } 81 \div \frac{1}{\cancel{3}} \times \overset{9}{\cancel{27}} = 81 \div 9 = 9.$$

12.3 TYPES OF BRACKETS

If some expression is enclosed within a pair of brackets, it means that it has to be simplified before all the other operations.

For example, consider $3 + (8 - 6)$.

We have to simplify numbers given within brackets first, i.e. $8 - 6 = 2$ and then add. $3 + 2 = 5$

If it is given $(3 + 8) - 6$ then we have to add $3 + 8$ first, i.e. 11 and then subtract 6 from 11.

$11 - 6 = 5$

There are four types of brackets. They are :

[ ] Square bracket.

{ } Braces or curly bracket.

( ) Parentheses or common bracket.

——— Bar bracket

> Expression given within the bracket must be simplified first.

Now let us list the rules for simplification of numerical expressions when more than one operation is involved.

Rule 1 : First remove the brackets (B) by simplifying all the operations within it.

Rule 2 : Then, perform operations involving 'of' (O).

Rule 3 : Then perform the operation involving division (D).

Rule 4 : Then perform the operation involving multiplication (M).

Rule 5 : Then do the operations involving addition (A) and then subtraction (S).

In order to remember the order of the operations, we remember the acronym 'BODMAS' where

- B stands for brackets
- O stands for 'of'
- D stands for division
- M stands for multiplication
- A stands for addition
- S stands for subtraction

Always use BODMAS rule.

These rules are followed in simplification of all numerical expressions involving natural numbers, fractions and decimals.

B	O	D	M	A	S
Brackets	'Of' which means : X	Division	Multiplication	Addition	Subtraction

EXAMPLE 1 Simplify : $25 - (19 + 8) \div \frac{1}{3}$ of 18

Solution:

$= 25 - 27 \div \frac{1}{3}$ of 18 (Simplify the bracket first)

$= 25 - 27 \div 6$ (Next comes 'of', $\frac{1}{3}$ of $18 = 6$)

$= 25 - \frac{9}{2}$ (Then comes division $27 \div 6 = \frac{27}{6} = \frac{9}{2}$)

$= \frac{50 - 9}{2} = \frac{41}{2}$ (Subtraction)   **Ans : $20\frac{1}{2}$**

EXAMPLE 2 Simplify : $3\frac{1}{2} + (7\frac{3}{4} - 4) \div \frac{1}{4}$ of 16.

Solution:

$\frac{7}{2} + (\frac{31}{4} - 4) \div \frac{1}{4}$ of 16

Remember to change the mixed numbers into improper fractions.

$= \frac{7}{2} + (\frac{31 - 16}{4}) \div \frac{1}{4}$ of 16 (first bracket)

$= \frac{7}{2} + \frac{15}{4} \div \frac{1}{4}$ of $\overset{4}{\cancel{16}}$ ('of' operation)

$= \frac{7}{2} + \frac{15}{4} \div 4 = \frac{7}{2} + \frac{15}{4} \times \frac{1}{4}$ (division by 4)

$= \frac{7}{2} + \frac{15}{16} = \frac{56 + 15}{16} = \frac{71}{16} = 4\frac{7}{16}$ **Ans : $4\frac{7}{16}$**

12.4 We have already discussed the four types of brackets; square bracket, curly bracket, common bracket and bar bracket. We did problems involving common bracket in the previous exercise. Now we will do problems involving more than one bracket. Conventionally the brackets are solved in the following order: from the innermost to the outermost.

When we simplify an expression involving the use of more than one bracket, we remove them in the following order :

$\overline{}$ Bar first

(   )   Common Bracket second

{   }   Curly Bracket third and

[   ]   Square Bracket fourth

EXAMPLE 1   Simplify $36 \div (8 + \overline{6 - 2})$

Solution: $36 \div (8 + \overline{6 - 2})$

Remove the bar first. $(6 - 2) = 4$

$36 \div (8 + 4)$, remove the bracket and then solve.

$36 \div 12 = \dfrac{36}{12} = 3$ **Ans : 3.**

EXAMPLE 2   Simplify $15 + \{8 - (7 - \overline{8 - 5})\}$

Solution: First remove the bar $8 - 5 = 3$

$15 + \{8 - (7 - 3)\}$

Then remove the common bracket, $7 - 3 = 4$

$15 + \{8 - 4\}$

Then remove the curly bracket $8 - 4 = 4$

$15 + 4 = 19$ **Ans : 19**

EXAMPLE 3   Simplify $92 \div [18 + 4\{6 + (12 - \overline{10 + 1})\}]$

Solution: First remove the bar $10 + 1 = 11$

$92 \div [18 + 4\{6 + (12 - 11)\}]$

Then remove the common bracket $12 - 11 = 1$

$92 \div [18 + 4\{6 + 1\}]$

Then remove the curly bracket $6 + 1 = 7$

$92 \div [18 + 4 \times 7]$

Then remove the square bracket $18 + 4 \times 7 = 18 + 28 = 46$

$92 \div 46 = \dfrac{92}{46} = 2$ **Ans. 2**

EXAMPLE 4   Simplify $3\frac{1}{2} + \{4\frac{1}{3} + \frac{1}{6}(3\frac{1}{4} - 1\overline{\frac{1}{2} - 1})\}$

Solution: Convert the mixed fractions into improper fractions.

$$\frac{7}{2} + \{\frac{13}{3} + \frac{1}{6}(\frac{13}{4} - \overline{\frac{3}{2} - 1})\}$$

$$\frac{3}{2} - 1 = \frac{3-2}{2} = \frac{1}{2} \text{ (Removing the bar first)}$$

$$= \frac{7}{2} + \{\frac{13}{3} + \frac{1}{6}(\frac{13-2}{4})\} \text{ (Removing the common bracket)}$$

$$= \frac{7}{2} + \{\frac{13}{3} + \frac{1}{6} \times \frac{11}{4}\} = \frac{7}{2} + \{\frac{13}{3} + \frac{11}{24}\}$$

$$= \frac{7}{2} + \{\frac{104+11}{24}\} \text{ (Removing the curly bracket)}$$

$$= \frac{7}{2} + \frac{115}{24} = \frac{84+115}{24}$$

$$= \frac{199}{24} = 8\frac{7}{24} \qquad \textbf{Ans : } 8\frac{7}{24}$$

EXAMPLE 5   Simplify $9 \div [8\frac{1}{5} - \{4\frac{1}{4} \div \frac{3}{4} + (6 - 3\overline{\frac{3}{5} + 1\frac{2}{3}})\}]$

Solution:
$$9 \div [\frac{41}{5} - \{\frac{17}{4} \div \frac{3}{4} + (6 - \overline{\frac{18}{5} + \frac{5}{3}})\}]$$

$$9 \div [\frac{41}{5} - \{\frac{17}{4} \div \frac{3}{4} + (6 - \frac{54+25}{15})\}]$$

$$9 \div [\frac{41}{5} - \{\frac{17}{4} \div \frac{3}{4} + (6 - \frac{79}{15})\}]$$

$$9 \div [\frac{41}{5} - \{\frac{17}{4} \div \frac{3}{4} + (\frac{90-79}{15})\}]$$

$$9 \div [\frac{41}{5} - \{\frac{17}{4} \times \frac{4}{3} + \frac{11}{15}\}]$$

$$9 \div [\frac{41}{5} - \{\frac{17}{3} + \frac{11}{15}\}]$$

$$9 \div [\frac{41}{5} - \{\frac{85+11}{15}\}]$$

$$9 \div [\frac{41}{5} - \frac{96}{15}]$$

$$9 \div [\frac{123 - 96}{15}]$$

$$9 \div [\frac{27}{15}]$$

$$9 \times \frac{15}{27} = 5 \qquad \textbf{Ans : 5}$$

EXAMPLE 6 Simplify $2.6 \div [9.4 - \{4.9 - (3.2 \div 1.6 - \overline{4.8 - 3.5})\}]$

Solution: $2.6 \div [9.4 - \{4.9 - (3.2 \div 1.6 - 1.3)\}]$

$$2.6 \div [9.4 - \{4.9 - (\frac{3.2}{1.6} - 1.3)\}]$$

$$2.6 \div [9.4 - \{4.9 - (2 - 1.3)\}]$$

$$2.6 \div [9.4 - \{4.9 - 0.7\}]$$

$$2.6 \div [9.4 - 4.2]$$

$$2.6 \div [5.2]$$

$$\frac{2.6}{5.2} = \frac{26}{52} = \frac{1}{2} = 0.5 \qquad \textbf{Ans : 0.5}$$

We can also do the above problem by first converting the decimals into fractions and then proceeding with the simplification of fractions.

<div align="center">EXERCISE 12(B)</div>

Simplify the following :

(1) $8\frac{3}{5} - (6\frac{1}{2} - \overline{4\frac{1}{4} - 3\frac{3}{4}})$

(2) $17\frac{1}{3} \div \{6\frac{2}{11} - (4 - \overline{2\frac{3}{11} - 1})\}$

(3) $3.2 \div \{1.8 + (3 \div 1.5 + \overline{0.6 - 0.4})\}$

(4) $8\frac{1}{4} + [4\frac{1}{2} + \{8\frac{1}{3} - (3\frac{1}{2} - \overline{6\frac{3}{4} - 5\frac{1}{2}})\}]$

(5) $5\frac{3}{8} - [3\frac{3}{5} - \{1\frac{3}{8} - (\frac{3}{4} - \overline{\frac{1}{2} - \frac{1}{4}})\}]$

(6) $4 - [5\frac{1}{2} - \{2\frac{1}{2} + (1 + \frac{1}{6} + \overline{1\frac{1}{4} - \frac{1}{12}})\}]$

(7) $7.2 + [0.2 \text{ of } 10 - \{0.6 \div 0.3 - \overline{0.8 - 0.6}\}]$

(8) $16 \div [0.1 + \{0.1 + (0.1 + \overline{0.2 - 0.1})\}]$

(9) $8.8 \div [0.5 \text{ of } 15 - \{6.2 \div 2 - (8.4 - 7.6)\}]$

(10) $0.4 \div [1.5 \div \{0.6 \div (0.3 - \overline{0.3 - 0.1})\}]$

13

13.1 INTRODUCTION

A fractional number with hundred as the denominator is known as percentage.

The word 'Percent' comes from the Latin word 'percenturi' meaning per hundred. 'Per, means out of or for every and 'cent' means hundred. So percent means out of every hundred.

For example Ravi got 80 percent marks means he got 80 marks out of 100 marks.

The symbol of percent is %.

Percentage : When a quantity is expressed in the percent form it is called percentage. But we generally do not differentiate between percent and percentage.

When the denominator of the fraction is 100, the numerator of the fraction is called percentage. e.g. $\frac{25}{100}$ is 25%; $\frac{75}{100}$ is 75%; $\frac{80}{100}$ is 80% and so on.

Some facts about percentage

1. Percentages are fractions whose denominators are 100.

2. A fraction can be expressed as a percentage by converting it into an equivalent fraction with 100 as the denominator.

3. We can convert a fraction to a percent by multiplying it by 100 and writing the % symbol.

4. A fraction with denominator 100 can be written as a percentage by writing the numerator with the % symbol.

5. To convert a percentage to a decimal, divide it with 100, i.e. move the decimal two places to the left.

6. To convert a percentage to a fraction, divide it by 100 and reduce it to the lowest term.

13.2 EXPRESSING A FRACTION AS A PERCENTAGE

To convert a fraction into percentage, multiply the fraction by 100 and put the symbol %.

EXAMPLE   Express 17 out of 40 as a percentage.

We know that 17 out of 40 means $\frac{17}{40}$.

$$\frac{17}{40} \times 100 = 42.5\%$$

Percentage means denominator is 100. So we convert the denominator to 100.

i.e. $\frac{17}{40} = \frac{17 \times 2.5}{40 \times 2.5} = \frac{42.5}{100} = 42.5\%$

> To convert a fraction into percentage, multiply it by 100 and write the symbol%.

Similarly, to express $\frac{3}{4}$ as a percentage, $\frac{3}{4} \times 100 = 75\%$

or $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$

13.3 EXPRESSING DECIMAL FRACTION AS A PERCENTAGE

To convert a decimal fraction into a percentage, multiply it by 100, as in the case of fractions.

EXAMPLES   Convert (a) 0.63, (b) 0.87 and (c) 0.745 into a percentage.

Solution: (a)   First convert 0.63 to a fraction

$$0.63 = \frac{63}{100} = 63\%$$

> Multiplying a decimal fraction by 100 means shifting the decimal point by two places to the right of the decimal fraction and writing the % symbol.

or Multiply $0.63 \times 100 = \frac{7563\%}{100}$

(b) $0.87 = \frac{87}{100} = 87\%$

or $0.87 \times 100 = 87\%$

(c) $0.745 = \frac{745}{1000} = \frac{74.5}{100} = 74.5\%$

or $\frac{745}{\underset{10}{1000}} \times \overset{1}{100} = \frac{745}{10} = 74.5\%$

13.4 EXPRESSING PERCENTAGE AS A FRACTION

To convert a percentage into a fraction, remove the % symbol and divide it by 100. Simplify the fraction to its lowest term.

EXAMPLES   Convert (a) 43% and (b) 65% as a fraction.

Solution: (a)   We know 43% is $\frac{43}{100}$

(b)   65% means $\frac{65}{100}$

$65\% = \frac{65}{100} = \frac{13}{20}$ [Simplify $\frac{65}{100}$ to its lowest term]

13.5 EXPRESSING PERCENTAGE AS A DECIMAL FRACTION

To convert the percentage into a decimal fraction, remove the % symbol and divide it by 100 as in the case of conversion of percentage into fraction.

We know that dividing by 100 means shifting to the left; so to convert a percentage into decimal fraction, remove the % symbol and shift the decimal point two places to the left.

EXAMPLES

$$23\% = \frac{23}{100} = 0.23$$

$$35\% = \frac{35}{100} = 0.35$$

$$66\% = \frac{66}{100} = 0.66$$

EXERCISE 13(A)

1 Express each of the following as percentage.

(a) $\frac{37}{100}$ (b) $\frac{18}{100}$ (c) $\frac{3}{100}$ (d) $\frac{85}{100}$ (e) $\frac{29}{100}$

2 Express each of the following as a fraction with 100 as the denominator.

(a) 41% (b) 56% (c) 62% (d) 69% (e) 93%

3 Express each of the following fractions as a percentage.

(a) $\frac{1}{4}$ (b) $\frac{9}{10}$ (c) $\frac{17}{20}$ (d) $4\frac{1}{2}$ (e) $\frac{17}{10}$

4 Express each of the following as a fraction in its lowest term.

(a) 38% (b) 47% (c) 78% (d) 82% (e) $67\frac{1}{3}\%$

(f) $112\frac{1}{2}\%$ (g) $16\frac{2}{3}\%$ (h) $1\frac{1}{2}\%$

5 Express each of the following as a decimal fraction.

(a) 13% (b) 24% (c) 69% (d) 81% (e) 105%

(f) 250% (g) 6.25% (h) 10.02%

6 Express each of the following decimal fractions into percentage.

(a) 0.58 (b) 0.483 (c) 2.76 (d) 9.243 (e) 6.025

(f) 3.96 (g) 4.20 (h) 8.75

7 Which of the following is equivalent to 5%?

(a) 0.5 (b) 0.05 (c) 5 (d) 0.005

8 Which of the following is equivalent to 12.5% ?

(a) 1.25 (b) 0.0125 (c) 125 (d) 0.125

9 Which of the following is equivalent to 7.5?

    (a) 75%   (b) 750%   (c) 0.75%   (d) 7.5%

10 Which of the following is equivalent to 6.08?

    (a) 60.8%   (b) 6.08%   (c) 608%   (d) .608%

13.6 TO FIND PERCENTAGE OF A GIVEN QUANTITY

To find the percentage of a given quantity, first express the given percent as a fraction and then multiply it by the given quantity. For example,

Find 25% of 16.

$$25\% \text{ of } 16 = \frac{\overset{1}{\cancel{25}}}{\underset{\cancel{4}_1}{\cancel{100}}} \times \overset{4}{\cancel{16}} = 4 \textbf{ Ans.}$$

EXAMPLE 1   Find 40% of 1000.

Solution: $\dfrac{40}{\underset{1}{\cancel{100}}} \times \overset{10}{\cancel{1000}} = 400$ **Ans.**

EXAMPLE 2   What is 20% of ₹ 800?

Solution: $20\% \text{ of } 800 = \dfrac{\overset{1}{\cancel{20}}}{\underset{\cancel{5}_1}{100}} \times \overset{160}{\cancel{800}} = ₹ 160$ **Ans.**

EXAMPLE 3   Find $12\frac{1}{2}$% of 250 metres.

Solution: $12\frac{1}{2}\% \text{ of } 250 = \dfrac{\overset{125}{\cancel{125}}}{\underset{1}{2 \times \cancel{100}_4}} \times \overset{125}{\cancel{250}}$

        $= \dfrac{125}{4} = 31\frac{1}{4}$ metres or 31.25 metres **Ans.**

To express a number as percentage of another, divide the number with the total number or quantity and then convert it into percentage by multiplying it by 100.

EXAMPLE 4   In a class of 50 students 30 are girls. What percent of the students are girls ?

Solution: Total number of students = 50

                No. of girls = 30

                Percentage of girls = $\dfrac{30}{\underset{1}{\cancel{50}}} \times \overset{2}{\cancel{100}} = 60\%$ **Ans.**

EXAMPLE 5   What percent is 3 cm of 3 m?

Solution: First convert 3 m into cm.

        3 m = 300 cm

        3 cm of 300 cm $= \dfrac{\overset{1}{\cancel{3}}}{\underset{\cancel{3}_1}{\cancel{300}}} \times \overset{1}{\cancel{100}} = 1\%$ **Ans.**

EXAMPLE 6

Express 45p as a percentage of ₹ 2.00

Solution:

First convert ₹ 2 into paise. ₹ 2 = 200p

Now express 45 p of 200 p as a percentage

$$\frac{45}{\underset{2}{200}} \times \overset{1}{100} = \frac{45}{2} = 22\frac{1}{2}\% \text{ or } 22.5\% \text{ Ans.}$$

1 Find

(a) 35% of 700

(b) 19% of 600

(c) 21% of ₹ 1800

(d) $16\frac{2}{3}\%$ of ₹ 3000

(e) 24% of 60 litres

(f) 45% of 900 metres

(g) 80% of 1200

(h) $37\frac{1}{2}\%$ of 140kg

(i) 140% of ₹ 1500

2 Express

(a) 15 paise as percentage of ₹ 1

(b) 20 as a percentage of 25

(c) 6 cm as a percentage of 1 m

(d) 5 cm as a percentage of 2 m

(e) 12 g as a percentage of 500 g

(f) 10 litres as a percentage of 15 litres

(g) 350 m as a percentage of 3.5 km

(h) 250 g as a percentage of 2 kg

(i) 75 p as a percentage of ₹ 4

(j) 24 cm as a percentage of 2.5 m

WORD PROBLEMS ON PERCENTAGE

3 In a class, 10% of the students failed in Maths. There are 50 students in the class. Find how many students failed in Maths. Also find the number of students who passed in Maths.

4 A basket contains two dozen mangoes. 25% of the mangoes are bad. Find the number of good mangoes.

5 In a quiz competition, Amrit answered 80% of questions correctly. If he was asked 35 questions how many questions he got correct ?

6 Abhishek got 684 marks out of 900 marks. Express this as a percentage.

7 Rakesh got 20 marks out of 25 in English, 31 out of 40 in Hindi and 65 out of 80 in Maths. In which subject his percentage of marks is best ?

8 Which is greater, 0.485 or $48\frac{1}{2}\%$?

9 For the school play, class V students sold 344 tickets out of 400 tickets and class VI students sold 582 tickets out of 600 tickets. In which class the sale percentage was higher ?

10 In a one-day international cricket match, India scored 400 runs. Of this, Sachin Tendulkar alone had scored 156 runs. Find the percentage of runs scored by (i) Sachin (ii) rest of the team members.

INTRODUCTION TO NEGATIVE NUMBERS

14.1 INTRODUCTION

The numbers which are used to count the objects found in nature are natural numbers.

$$N = \{1, 2, 3, 4, 5, 6, 7, ...\}$$

Zero is included to the natural numbers to give a new set of numbers called whole numbers.

$$W = \{0, 1, 2, 3, 4, 5, 6, ...\}$$

When a whole number is subtracted from another, the difference may or may not be a whole number.

Example : $6 - 4 = 2$.

But $4 - 6$ has no value in whole number system. Therefore we need to extend our whole number system.

Moreover, in our day-to-day life we need a symbol to represent opposites of natural numbers. Negative (–) is the sign to represent these opposites.

Example : Opposite of 2 is –2.

Opposite of 5 is –5.

In the following situations we use the concept of opposites.

(a) **Profit and loss :** As profit and loss are opposite situations, if profit is shown by a positive number, then loss is shown by a negative number.

(b) **Temperature :** We show the temperatures above 0°C by positive numbers and the temperatures below 0° by negative numbers.

(c) **Comparison of height from sea level :** Height and depth are also opposite situations. Height above the sea level is shown by positive numbers and depth below the sea level is shown by negative numbers.

A new set of numbers is obtained by combining whole numbers and negative numbers. This new set of numbers is called **integers**. Integers are denoted by the symbol Z or I.

$$Z = \{..., -4, -3, -2, -1, 0, 1, 2, 3, 4, ...\}$$

14.2 REPRESENTATION OF INTEGERS ON NUMBER LINE

In order to represent integers on number line, we draw a line and mark 0 in its

middle. Now, we mark equal distances on left as well as right side of 0. On the right side we mark these points as 1, 2, 3, 4, 5 etc. and on the left side we mark these points as –1, –2, –3, –4, –5, etc.
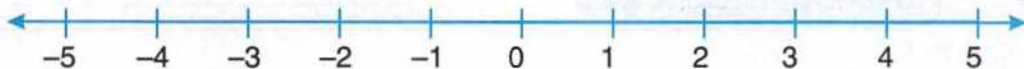
Every integer is represented by some point on the number line.

Since 1 and –1, 2 and –2 etc. are same in magnitude but opposite in direction, they are at equal distances from 0, but on the opposite sides of 0.

Ordering of integers : On the number line as we move towards the right side, value of the number increases. It means, any other number occurring on the right side of a given number will be greater than the given number which is on its left side.

EXAMPLE $4 > 3, 0 > -1, -2 > -3$

Note :   (i) Every integer has its successor and predecessor. [Think of a natural number which has no predecessor].

    (ii) Every positive integer is greater than every negative integer. For example : $1 > -8, 27 > -14$.

    (iii) Zero is less than every positive integer as zero lies towards the left side of all positive integers.

    (iv) Zero is bigger than every negative integer as zero lies towards the right side of all negative integers.

    (v) Greater the number, lesser is its opposite

         $6 > 4$ but $-6 < -4$

         $4 > -2$ but $-4 < 2$

         $-4 > -7$ but $4 < 7$

    (vi) A number farther from 0 on the right side has larger value.

    (vii) A number farther from 0 on the left side has smaller value.

EXAMPLE 1   Which number in each of the following pairs is bigger :

         (a) 4, –6   (b) 4, –4   (c) 0, –4   (d) –8, –6

Solution :
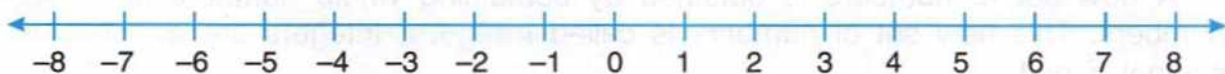
(a)   On the number line 4 is on the right of –6,   so 4 > –6.

(b)   On the number line 4 is on the right of –4,   so 4 > –4.

(c)   On the number line 0 is on the right of –4,   so 0 > –4.

(d)   On the number line –6 is on the right of –8,   so –6 > –8.

EXAMPLE 2 Use a number line to write the following integers in ascending order :

4, –3, 2, 0, –6, –1, 7 and –4.

Solution :

Mark the given integers on a number line.

Now, write these numbers from left to right.

–6 < –4 < –3 < –1 < 0 < 2 < 4 < 7

EXAMPLE 3 Use a number line to write the following integers in descending order :

5, –4, –1, 3, 7, 0, –7 and –5.

Solution :

Mark the given integers on a number line.

Now, write these numbers from right to left.

7 > 5 > 3 > 0 > –1 > –4 > –5 > –7.

EXAMPLE 4 Write the negative of each of the following numbers :

(a) 5   (b) –4   (c) –7   (d) 0   (e) 3.

Solution :

- Negative of a number means the same number with opposite sign.
- If before a number no sign in written, then it is positive.
- Zero is neither positive nor negative, so negative of zero is zero itself.

  (a) Negative of 5 = – 5   (b) Negative of –4 = 4

  (c) Negative of –7 = 7   (d) Negative of 0 = 0

  (e) Negative of 3 = – 3.

EXERCISE 14(A)

1 Which number in each of the following pairs is bigger ?

  (a) 2, –2   (b) 3, –5   (c) –4, 0   (d) –1, –4

  (e) –4, –8   (f) –15, –18   (g) 0, 7   (h) –6, 3

2 Which number in each of the folloiwng pairs is smaller ?

  (a) –4, 0   (b) 1, –2   (c) 16, –7   (d) 0, 5

  (e) –15, 4   (f) –10, –6   (g) 12, –13   (h) –20, –14

3 Use a number line to write the following integers in ascending order.

   (a) −6, 5, 0, −5, 4, −1, 2 and −7   (b) −4, 4, 3, −6, 0, 7, −5 and −9

   (c) −10, 9, 12, 0, 3, −2, 4 and 7

4 Use a number line to write the following integers in descending order.

   (a) 22, 16, 0, 5, 2, −7 and −12   (b) −5, −4, 8, 0, 16, −2, −1 and 3

   (c) 12, 10, −8, 0, −7, −6, 5 and 2

5 Write the negatives of the following numbers.

   (a) −12   (b) 6   (c) 0   (d) −7

   (e) −4   (f) −10   (g) 8   (h) 4

6 Mark the following integers on a number line.

   (a) −6   (b) 0   (c) −9   (d) −2

   (e) 12   (f) −15   (g) 6   (h) −4

7 How many integers are between the following ?

   (a) −5 and 2   (b) 4 and 11   (c) −3 and −10   (d) −5 and +5

   (e) 0 and −6   (f) −4 and +4

8 Write all integers between the following.

   (a) −2 and +7   (b) −4 and 4   (c) 0 and −5   (d) 2 and 9

   (e) −1 and 5   (f) 0 and 10

9 Indicate the following by using integers.

   (a) A loss of ₹ 90   (b) A profit of ₹ 48

   (c) 5 km above ground level   (d) 2 km below water level

   (e) 22° above zero   (f) 3° below zero

10 Find the opposite of each of the following.

   (a) A profit of ₹ 700   (b) −13

   (c) 27   (d) Going south

   (e) A loss of ₹ 500   (f) Decrease in population

   (g) Crediting money in bank.

14.3 ADDITION OF INTEGERS

We follow the rules given below, to add integers :

1. If both the numbers to be added have the same sign, then add the numbers (without sign) and put the sign of the number with greater numerical value.

EXAMPLE 1 $2 + 4 = 6$

Here, both the numbers are positive, so the numbers are added. 4 is the greater number, its sign is positive. Thus, the required sum is +6.

Here, both the numbers are negative, so the numbers are added. Out of 2 and 5, 5 is greater, thus minus sign is put as sign of 5 is minus.

2. If one of the numbers is positive and the other number is negative, then subtract the number with smaller numerical value from the number with greater numerical value (without sign) and put the sign of the number with greater numerical value.

EXAMPLE 1 $3 + (-7) = -4$.

Here, 3 is positive and 7 is negative so we will subtract 3 from 7. 7 is greater than 3 so its sign (minus) is put in the sum.

EXAMPLE 2 $-3 + 7 = 4$

Here, 3 is negative and 7 is positive so, we will subtract 3 from 7. 7 is greater than 3 so its sign (plus) is put in the sum.

Note : 1. If a positive number is added to an integer, then the sum is greater than the given integer.

2. If a negative number is added to an integer, then the sum is less than the given integer.

3. If two integers having the same magnitude but opposite signs are added then the result is zero. Such numbers are called additive inverse of each other.

$-5 + 5 = 0$, 5 and -5 are additive inverses of each other.

$7 + (-7) = 0$, -7 and 7 are additive inverses of each other.

EXERCISE 14(B)

1 Find the sum of the following :

   (a) $(+2)$ and $(+5)$ (b) (-3) and (-2) (c) (-5) and $(+6)$

   (d) (-5) and (-4) (e) (-2), $(+3)$ and (-4) (f) (-2), (-3) and (-4)

2 Add the following :

   (a) $125 + (-230)$ (b) $1075 + (-185)$ (c) $(-555) + (-76)$

   (d) $(-874) + (270)$ (e) $(-1075) + (-456)$ (f) $(-547) + (152)$

   (g) $(-931) + (951) + (-165)$

   (h) $(-20) + (-4) + (-6) + (+5)$

   (i) $(50) + (-80) + (-124) + (74)$

   (j) $(-546) + (128) + (-79) + (127)$

3 Find the successor and predecessor of the following :

   (a) (-14) (b) 36   (c) (-97) (d) (-174)

   (e) (-845) (f) -1094 (g) -999 (h) (-1000)

4 Using the number line find the integer which is :

    (a) 3 more than 4   (b) 5 more than −4   (c) 5 more than −8

    (d) 8 more than 0   (e) 4 less than −8   (f) 5 less than −5

5 Write the additive inverse of following :

    (a) −5   (b) 3   (c) −12   (d) 16

    (e) 25   (f) −54   (g) 8   (h) 4

14.4 SUBTRACTION OF INTEGERS

Rule : Change the sign of the number to be subtracted and add the two integers.

EXAMPLE 1 $3 - 4 = 3 + (-4) = -1$

    Here, 4 is to be subtracted from 3, so its sign is changed from plus to minus and −4 is added to 3.

EXAMPLE 2 $3 - (-4) = 3 + 4 = 7$

    Here, −4 is to be subtracted from 3, so its sign is changed from minus to plus and 4 is added to 3.

EXERCISE 14(C)

1 Subtract the following.

    (a) $(-5) - (-2)$ (b) $8 - (-3)$ (c) $(-3) - (4)$ (d) $7 - (3)$

    (e) $(-8) - (-3)$ (f) $5 - (-2)$ (g) $6 - (+2)$ (h) $-7 - 4$

    (i) $3 - (-2)$ (j) $-14 - (10)$ (k) $16 - (-1)$ (l) $-12 - (-2)$

2 Simplify.

    (a) $3 - 5 + 6 - 7$ (b) $15 - 20 + 5 - 8$

    (c) $(-5) - (2) - (8) + (7)$ (d) $(-8) - (-9) + 6 + (-10)$

    (e) $(4) - (5) + 2 - (-2)$ (f) $2 - (-1) + 5 - (4)$

    (g) $-1 + 2 - (-5) + 7 - 8$ (h) $-5 + (-8) + 9 - 1 + 6$

    (i) $-1 - 5 + 4 - (-9) + 1 - 6$

    (j) $-10 + 9 - 8 + 7 - 6 + 5 - 4 + 3 - 2 + 1$

    (k) $-3 + 3 - 3 + 3 - 3 + 3 - 3 + 3 - 3 + 3 - 3 + 3 - 3 + 3 - 3 + 3 - 3$ $+ 3 - 3 + 3$

3 Fill the blanks by (<, >, =).

    (a) -15 ☐ $- 8 - (3)$ (b) $-3 + (-4)$ ☐ 5

    (c) $(-5) + (5)$ ☐ $-2 - (-2)$ (d) $9 - (-2)$ ☐ $-7 + (-6)$

    (e) 10 ☐ $- 10 + (-4)$

15.1 REVISION

Let us recall some of the basic concepts of geometry such as a point, a line segment, a line, a ray and an angle which we have learnt in Std. IV.

Point : A point shows a definite position. It has no length, breadth and thickness. It has no shape and size. It is represented by a dot (.) and named by capital letters like A, B, X, Y, P, etc.

Line : A line has no breadth and thickness. A straight line can be extended to any length on both sides. To show this, arrow heads are drawn at the ends of a line. A straight line is the shortest distance between two given points (Fig. 1).

The symbol for a straight line is $\overleftrightarrow{XY}$ *i.e.* we can write either line XY or $\overleftrightarrow{XY}$.

Line segment : A part of a line is known as the line segment. Line segment has a fixed length. In Fig. 2, PQ is the line segment. Symbol for line segment is $\overline{PQ}$.

Ray : A ray is a straight line which has a definite starting point but goes on indefinitely in the other direction. MN is a ray with starting point M and extending indefinitely in the direction N (Fig. 3).

X   Fig. 1   Y   P   Fig. 2   Q   M   N   Fig. 3

Angle : Two rays starting from a common point form an angle. The two rays are called the arms of the angle. The common starting point is known as the vertex of the angle. An angle is denoted by the symbol $\angle$.

The angle shown in fig. 4 can be named as $\angle POQ$ or $\angle QOP$. It can also be named as $\angle O$. We generally name an angle by 3 capital letters. The letter at the vertex always comes in between the other two letters. Vertex O is always at the middle of P and Q. Angles are measured in degrees. The symbol for the degree is " ° ", e.g. 45°, 60°, etc.

Fig. 4
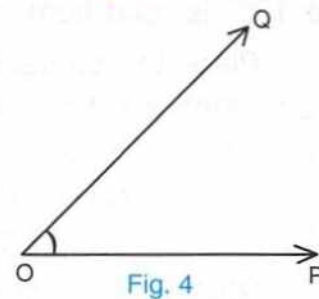
Angle formed by rotation :

The clock in Fig. 5 shows 9 o'clock. The minute hand is at 12. The clock in Fig. 6 shows 9:20. The minute hand has moved from 12 to 4.

The amount of turn the minute hand has made from its position as shown in Fig. 5 to its position in Fig. 6 is called an angle. Fig. 7 shows the amount of turn the minute hand has made from its position in Fig. 5 to its position in Fig. 6.

Fig. 5
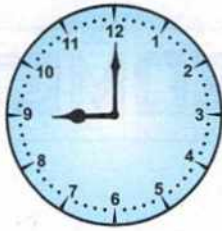
Fig. 6
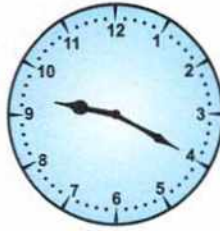
Fig. 7

So, an angle can be defined as the amount of turning or rotation from one (initial) position to another (final) position. When the minute hand comes back to its initial position (i.e. at 12) we say that the minute hand has completed one complete rotation.

Types of angles : Acute angle, right angle, obtuse angle and straight angle.

Acute angle is less than 90°.

Obtuse angle is more than 90°.
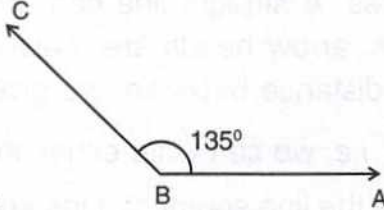
Right angle is equal to 90°.
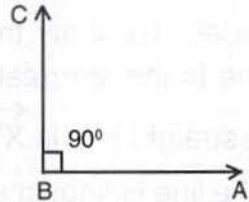
Straight angle is equal to 180°.

Fig. 8 : Acute angle

Fig. 9 : Obtuse angle
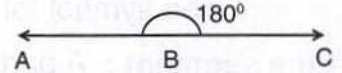
Fig. 10 : Right angle

Fig. 11 : Straight angle

When two lines intersect each other at 90°, they are called **perpendicular lines**.

Measuring Angles

A protractor has two sets of readings. The upper scale from 0 to 180° is read from left to right whereas the lower scale from 0 to 180° is read from right to left.

Place the protractor on the given angle such that the base line of the protractor coincides with OA and the centre of the protractor coincides with the point O (vertex of the angle). [The line joining the 0 of each scale is the base line] (Fig. 12).
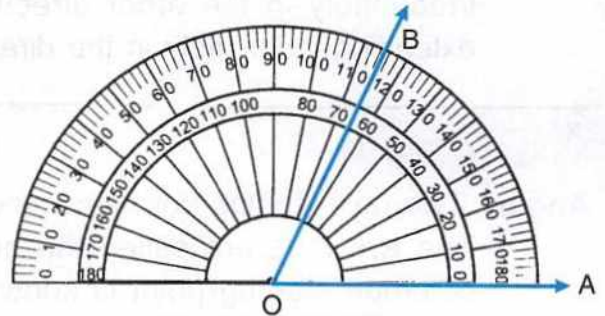
Fig. 12 A protractor

Starting with the mark 0 on lower scale move along the curved edge of the protractor and read the mark through which the other arm OB passes. In this case we find that it passes through the mark 65°. So we say that measure of ∠AOB is 65°.

Construction of an angle

Suppose we have to construct an angle of 75° at the point X of the straight line XY. We will place the protractor firmly on line XY, so that its centre is at the point X and its straight edge along XY (Fig. 13).

Fig. 13

112
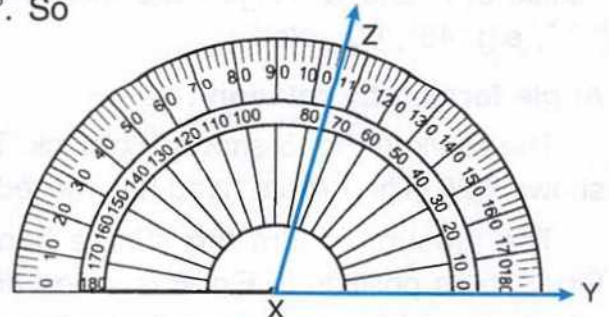
Now, hold the protractor in position and mark a point Z at the 75° division from zero on the lower scale. Remove the protractor and join X to Z and produce it. Thus $\angle YXZ = 75°$

EXERCISE 15(A)

1 Name the line segments in the following figures.

(a)

(b)

(c)

_____

_____

_____

_____

_____

_____
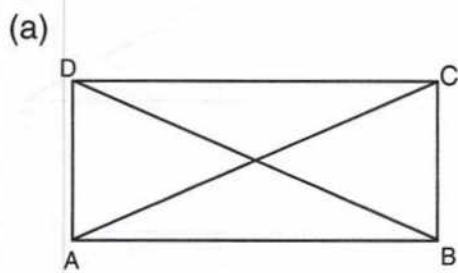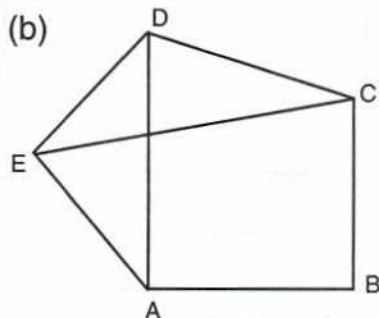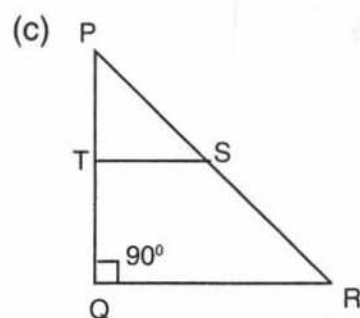
2 For each of the following angles name the vertex and the arms.

(a)

(b)

(c)

_____

_____

_____

_____

_____

_____

_____

_____
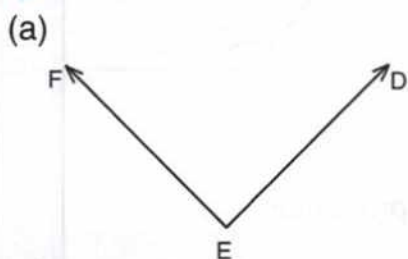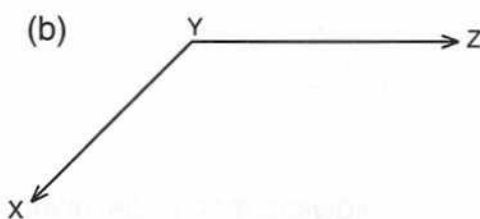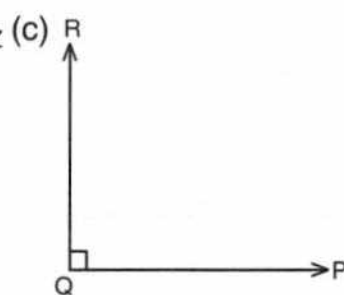
3 Write the names of the angles (acute, right, or obtuse).

(a)

(b)

(c)

(d)

_____

_____

_____

_____
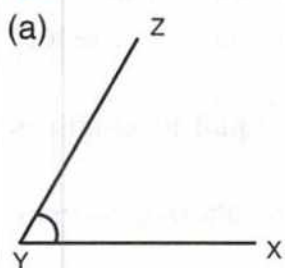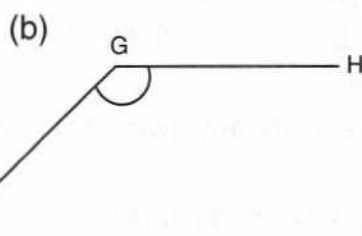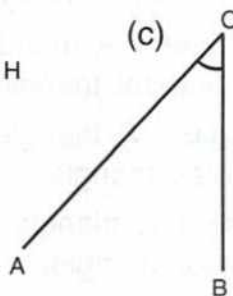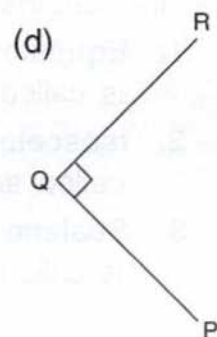
4 Find the lengths of the following line segments using a ruler.

(a) X ———————— Y _____ cm

(b) P —— Q _____ cm
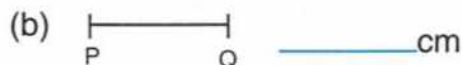
5 Draw line segments of the following lengths:

(a) 8 cm   (b) 2.8 cm   (c) 4.5 cm

6 Measure the lengths of the sides of (a) square (b) rectangle (c) triangle.

(a)

(b)

(c)

_____

_____

_____

_____

_____

_____
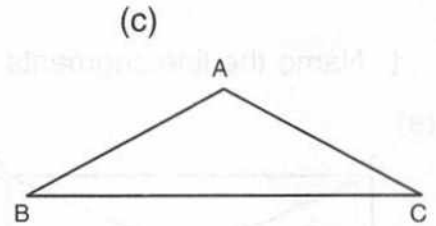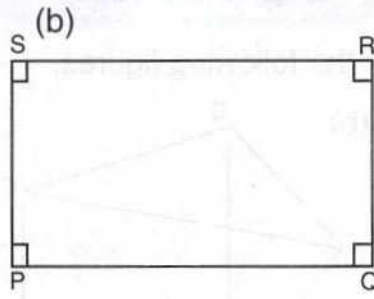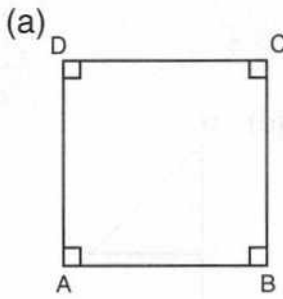
7 Measure each of the following angles:

(a)

(b)

(c)

_____

_____

_____
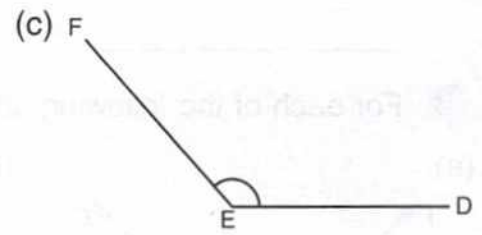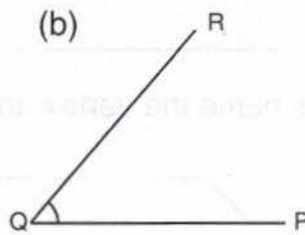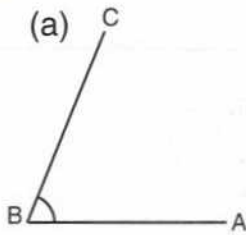
8 Construct angles of the following measures using a protractor:

(a) 45°   (b) 75°   (c) 90°

(d) 135°   (e) 150°   (f) 170°

15.2 TRIANGLES

We know that a triangle is a closed figure with three sides. But depending upon the lengths of these sides, triangles can be of the following three types :

1. **Equilateral triangle :** A triangle whose all three sides are equal in length is called an equilateral triangle.

2. **Isosceles triangle :** A triangle with any two of its sides equal in length is called an isosceles triangle.

3. **Scalene triangle :** A triangle whose all three sides have different lengths is called a scalene triangle.
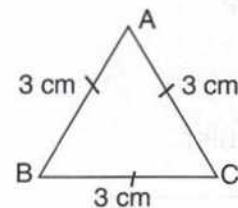
Equilateral triangle
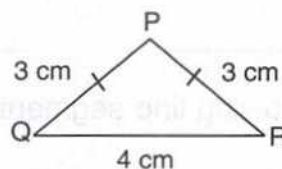
Isosceles triangle

Scalene triangle

114
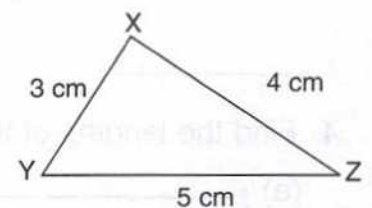
You have also learnt about angles. Let us now study different types of triangles based on their internal angles.

Note : The sum of all three angles in a triangle must be equal to 180°.

Acute triangle : A triangle with all its internal angles measuring less than 90° is called an acute triangle.

An equilateral triangle will always have all its internal angles equal to 60°

An isosceles triangle will always have two equal internal angles corresponding to the two equal sides.

A scalene triangle will have all three different internal angles.
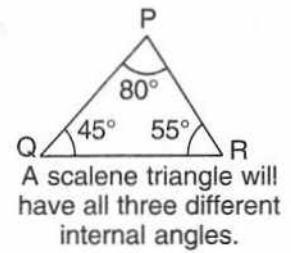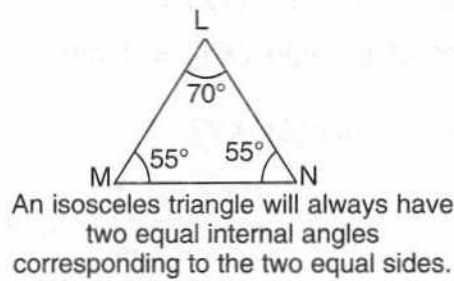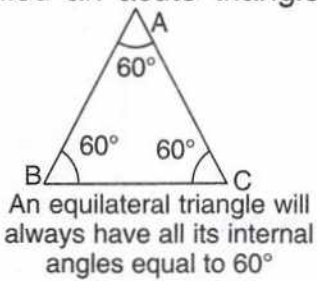
Right triangle : A triangle with one of its interior angles equal to 90° is called a right triangle.

$\angle B = 90°$ $\angle X = 90°$
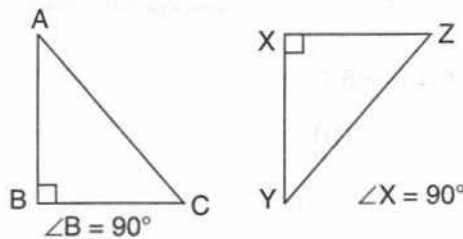
Obtuse triangle : A triangle with one of its interior angles more than 90° is called an obtuse triangle.
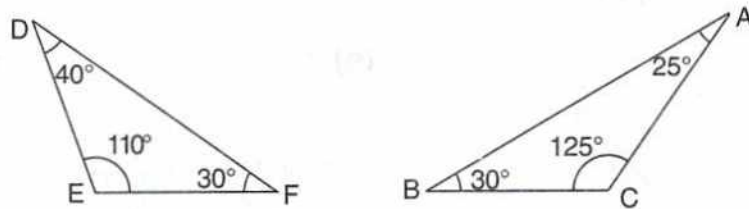
AREA OF TRIANGLES

Here, we will only learn how to find the area of a right triangle.

Area of a right triangle = $\dfrac{1}{2}$ × Base × Height
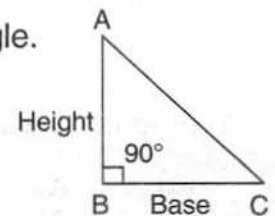
EXAMPLES   Find the area of the following :

(a)

12 cm   13 cm

B   5 cm   C

(b)

5 cm   4 cm

Z   3 cm   Y
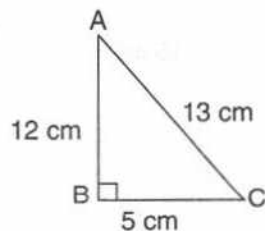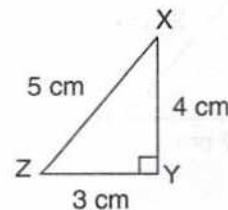
Solution :   (a)   Base of triangle (BC) = 5 cm

Height of triangle (AB) = 12 cm

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$$\therefore \quad \text{Area of triangle ABC} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 5 \times \overset{6}{\cancel{12}} = \textbf{30 cm}^2$$

(b) Base of triangle (YZ) = 3 cm

Height of triangle (XY) = 4 cm

$$\therefore \quad \text{Area of triangle XYZ} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 3 \times \overset{2}{\cancel{4}} = \textbf{6 cm}^2$$

EXERCISE 15(B)

1 Classify the following triangles :

(a)

6 cm, 6 cm, 6 cm — triangle ABC with A at top, B and C at base

(b)

P with 35°, Q with 65°, R with 80°

(c)

X at top, Y with 100°, X at right

(d)

L at top, M and N at base, right angle at N

(e)

D at top, 3 cm and 6 cm sides, E and F, 8 cm base

(f)

S with 130°, T, U
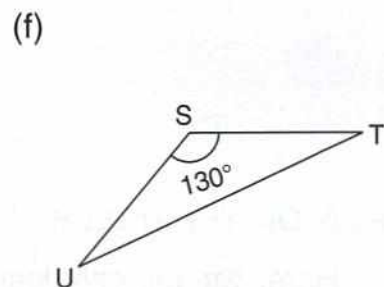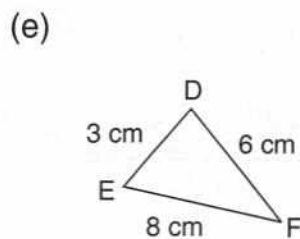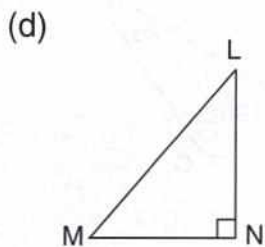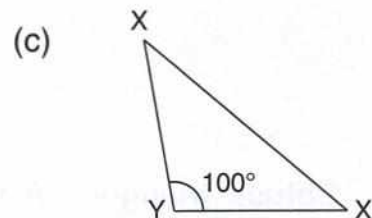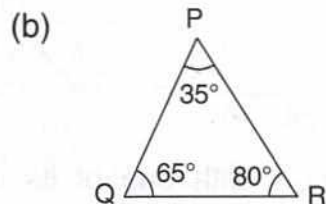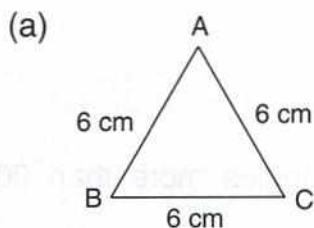
2 Find the area of the following right triangles.

(a)

A at top, 24 cm, 25 cm, right angle at B, 7 cm base, C

(b)

P, 8 cm, Q with right angle, 17 cm, 15 cm, R

(c)

D at top, 41 cm, 40 cm, B, 9 cm, right angle at C
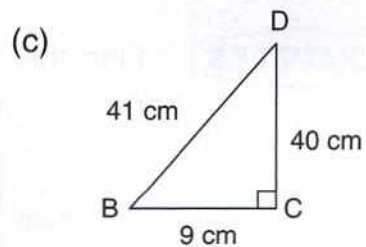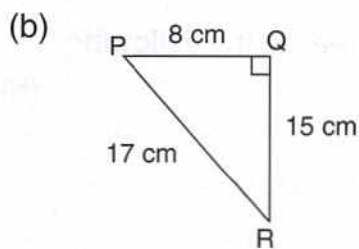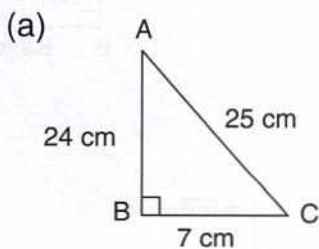
15.3 SYMMETRY

When a given figure is divided by a line and we get two figures that are exactly same in shape and size, we say that they are symmetrical.

We say that a figure has a line of symmetry if it can be divided by a line into two parts that are exactly the same, *i.e.* mirror images. The line of symmetry divides a figure into two identical halves.

> If we fold a figure about its line of symmetry, the two halves will exactly cover each other.

Some symmetric figures
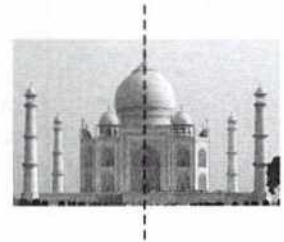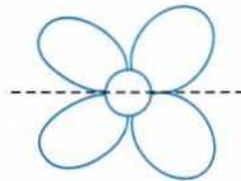
Letters which show symmetry.

Some figures have no line of symmetry. Figures which cannot be divided into two equal halves or which do not show any line of symmetry are known as **asymmetrical figures**.

Some asymmetrical figures

Letters which do not show symmetry.

1 Identify and tell which of the following are symmetrical.

(a)

(b)
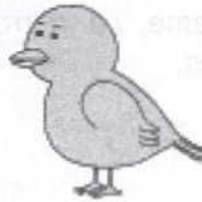
(c)

(d)
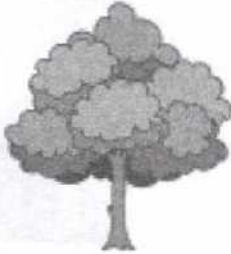
(e)

(f)

(g)

(h)

2 Draw a line of symmetry in the following, wherever possible.

(a)

(b)

(c)

(d)
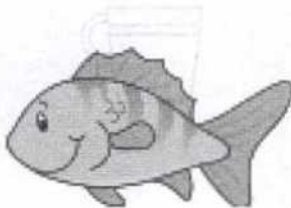
(e)
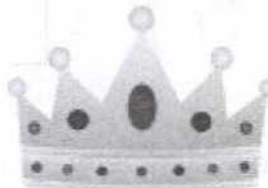
(f)
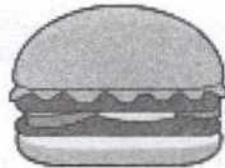
(g)
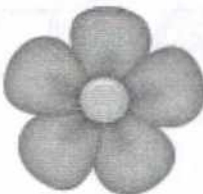
(h)

3 Draw a line of symmetry in letters between A to Z, wherever possible.

15.4 MORE THAN ONE LINES OF SYMMETRY

Some objects or figures have more than one line of symmetry. *For example*, A kite, an angle and an isosceles trapezium have one line of symmetry whereas a rhombus has two lines of symmetry and an equilateral triangle has three lines of symmetry.

There are few objects or figures which have two lines of symmetry, *i.e.* these objects can be divided into two equal halves in more than one way.

Consider the following figures.
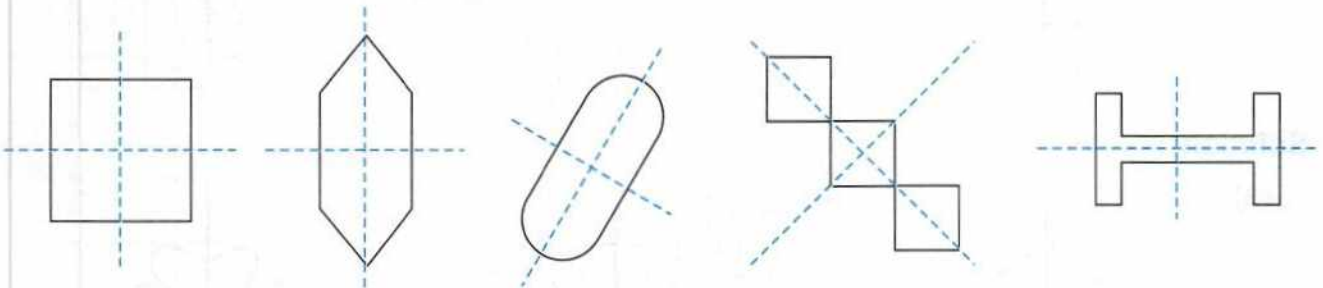
Letters which show two lines of symmetry
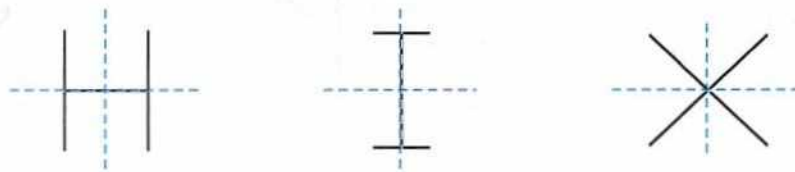
More than two lines of symmetry

Some figures/objects can have more than two lines of symmetry. Examples :
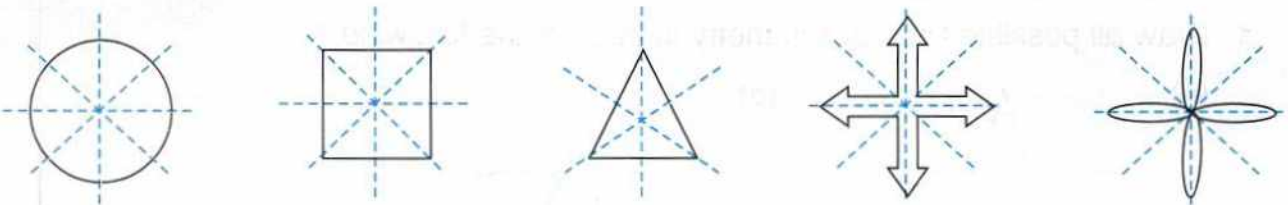
EXAMPLE 1 On a graph paper draw the following figures and their lines of symmetry :

(a) An equilateral triangle   (b) A semicircle   (c) A rectangle

Solution :

(a)

(b)

(c)
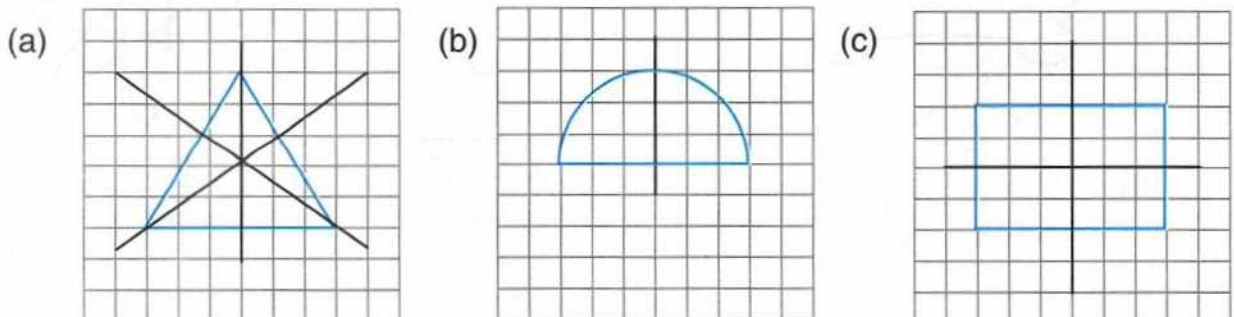
EXAMPLE 2

Complete the figures using graph paper along the lines of symmetry in each case.

(a)

(b)

(c)

Solution :

(a)

(b)

(c)
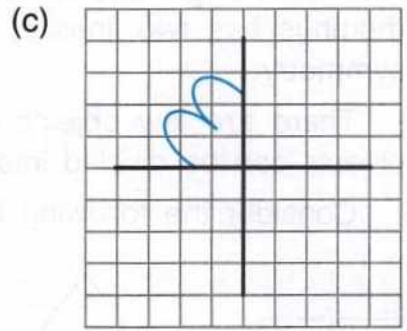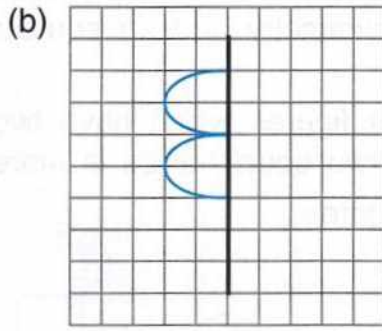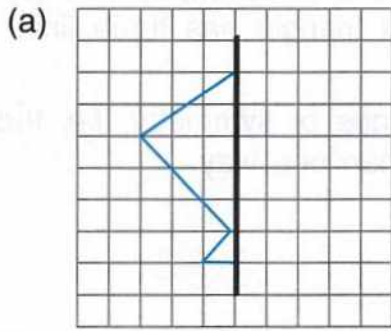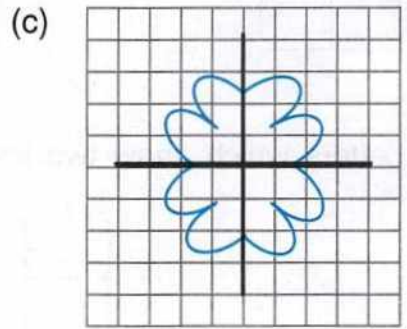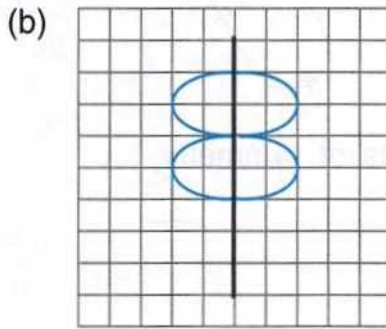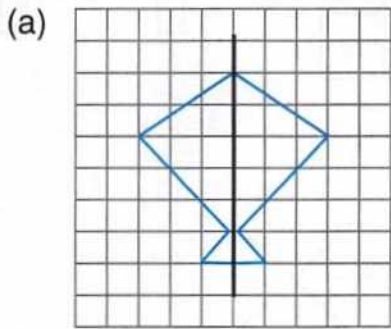
EXERCISE 15(D)

1 Draw all possible lines of symmetry in each of the following.

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)
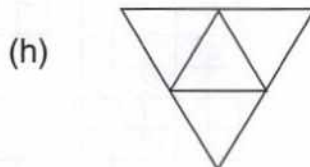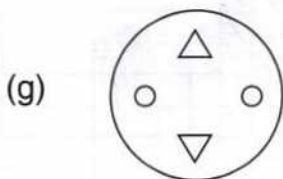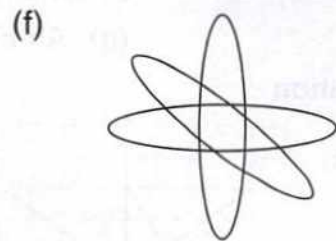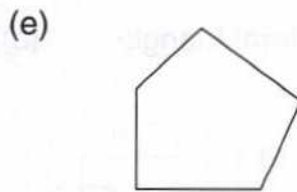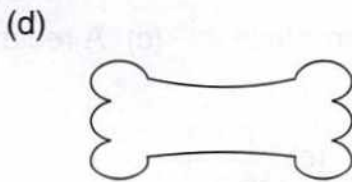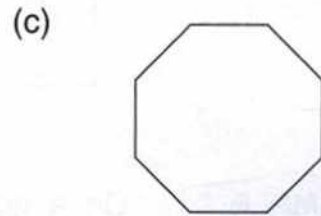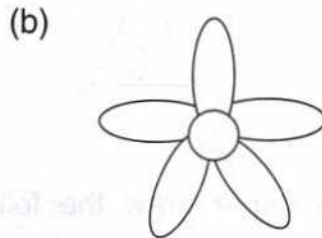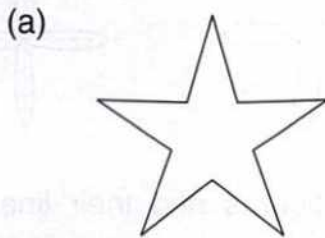
2 Draw the geometrical figure mentioned below and write the number of lines of symmetry possible for each.

(a) Rectangle   _____   (b) Equilateral triangle   _____

(c) Scalene triangle   _____   (d) Isosceles triangle   _____

(e) Trapezium   _____   (f) Square   _____

(g) Parallelogram   _____   (h) Semicircle   _____

3 Complete the following figures using graph paper.

(a)

(b)

(c)

(d)
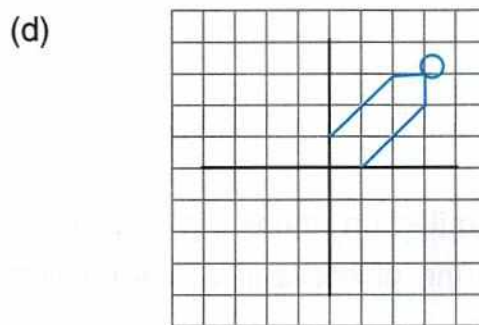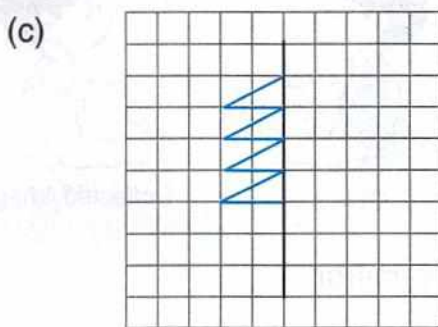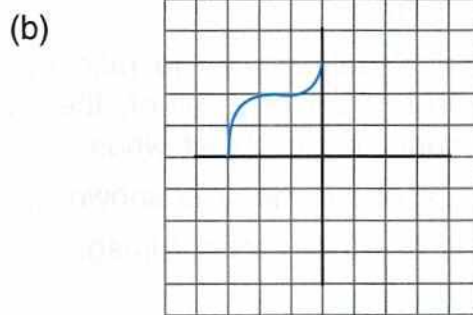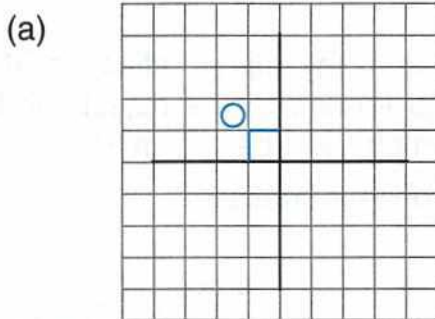
Let us now understand the symmetry of triangles.

The line of symmetry in a triangle is a line segment joining a vertex to the mid-point of the side opposite to that vertex. This line segment is called a **median** and it divides one side of the triangle in two equal parts. Let us consider the following triangle.

$\triangle ABC$ is an isosceles triangle.

$AB = AC$

AX is a line segment joining the vertex A to the mid-point of the side opposite to $\angle A$ i.e. BC

Since $BX = XC$, AX is the median of the triangle.
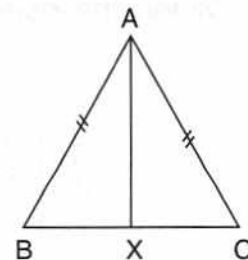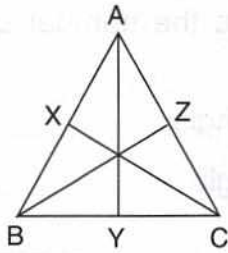
| An equilateral triangle has 3 medians *i.e.* 3 lines of symmetry. | An isosceles triangle can have only 1 line of symmetry. | A scalene triangle has no line of symmetry. |
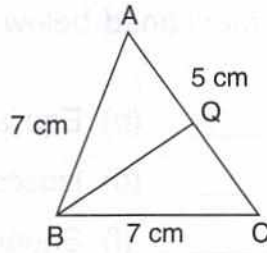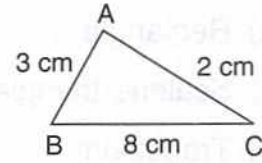
15.5 REFLECTION

Symmetry is closely related to reflection or we can say mirror reflection. If any object is placed in front of a mirror, then the image formed of the object will be a symmetrical image of the object where line of symmetry will be the mirror.
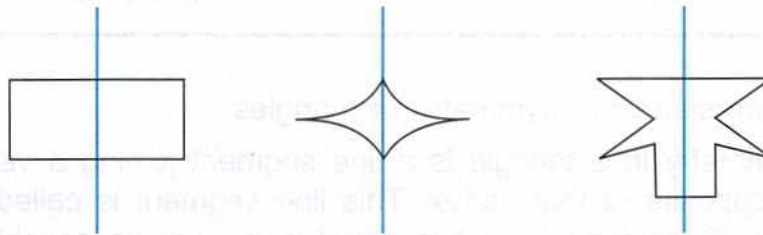
And this type of symmetry is known as **reflection symmetry**.

Reflection is basically a mirror image of any object.

Object   Reflected image
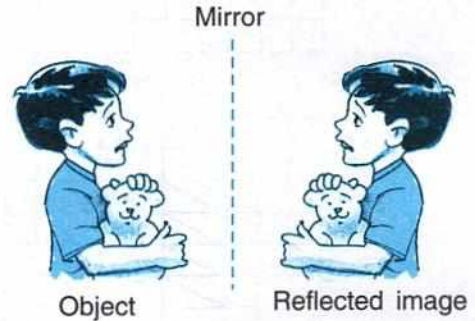
In mirror reflection, there are two possibilities.
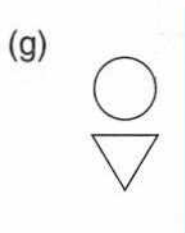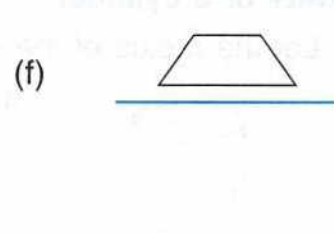
1. When the object is in actual contact with the mirror.

2. When the object is at some distance away from the mirror.
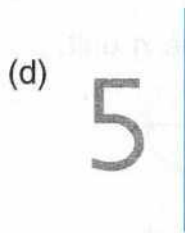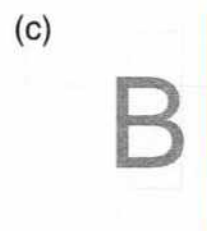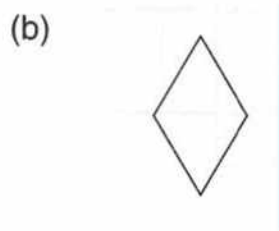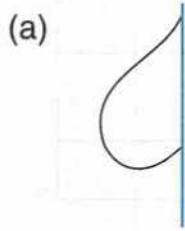

122
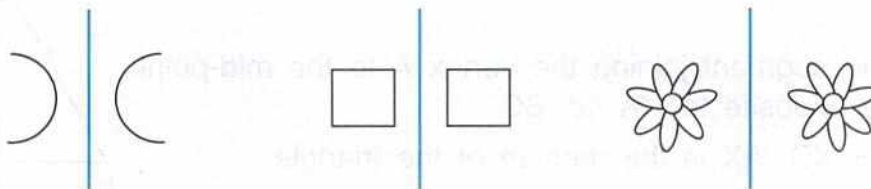
Complete the following figures using a graph paper.
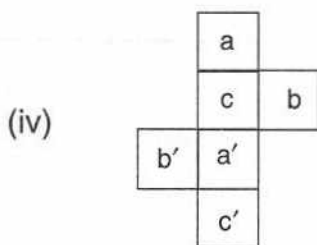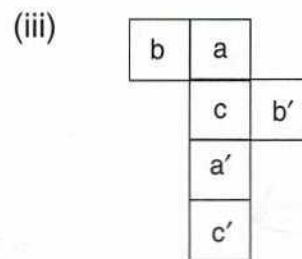
(a)

(b)

(c)

B

(d)

5

(e)

(f)

(g)
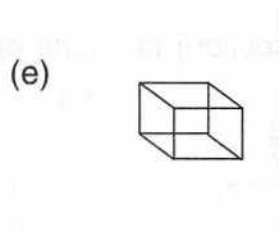
15.6 NETS OF 3D FIGURES (Representing 3-D figures into 2-D)
[For cube, cuboid, cylinder and cone]

A pattern, that can be cut and folded to make a model of a solid shape is called a **net**.

1. Nets of a cube :

Some of the nets of a cube are shown below :

(i)

	b		
c	a	c'	a'
	b'		

(ii)

a	b	a'
	c	
	b'	
	c'	

(iii)

b	a	
	c	b'
	a'	
	c'	

(iv)

	a	
	c	b
b'	a'	
	c'	
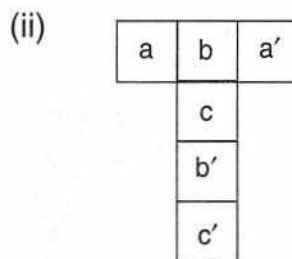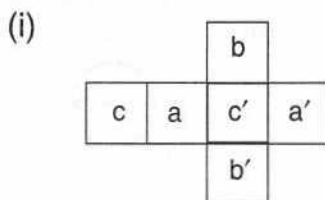
On folding, each of these patterns gives the model of a cube
    (i) face **a** comes opposite to face **a'**.
    (ii) face **b** comes opposite to face **b'**.
and (iii) face **c** comes opposite to face **c'**.

2. Nets of a cuboid :

Some of the nets of a cuboid are shown below :

(i)

(ii)

(iii)
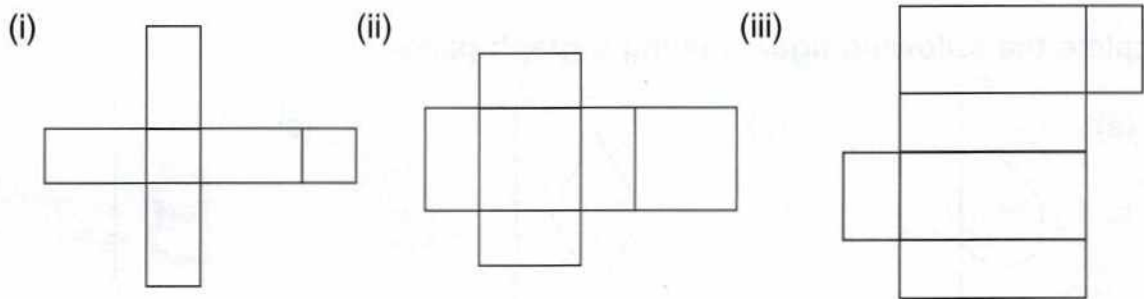
3. Nets of a cylinder :

Let the radius of the base (cross-section) be r unit and height be h unit.

(i)

(ii)

(iii)

(iv)

4. Nets of a cone :

(i)

(ii)

(iii)

Note : Figures given above are not drawn to scale.

16.1 INTRODUCTION

We use the metric system of measurement to measure length, mass and capacity. Standard units for measuring length, mass and capacity are as follows :

- **Length :** The standard unit is metre.　　　• **Mass :** The standard unit is gram.
- **Capacity (volume) :** The standard unit is litre.
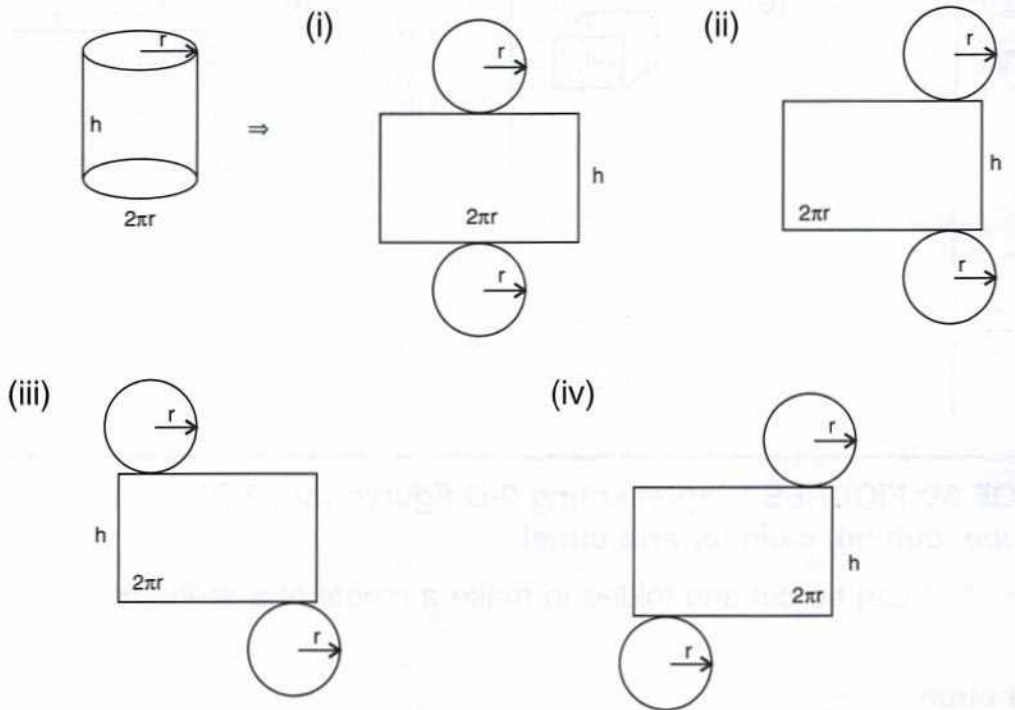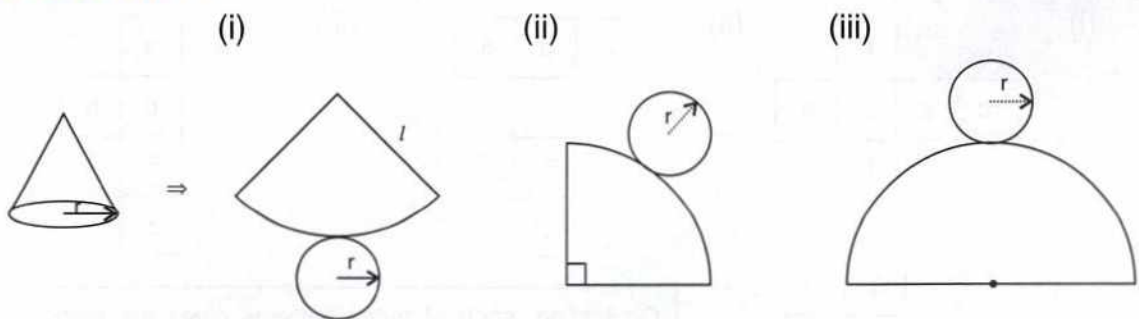
However, often we require to measure smaller or bigger quantities and the standard units are not suitable for measurement. In such cases, we use the multiples of these units or their sub-multiples. We use certain prefixes to indicate smaller and bigger units so formed.

The prefixes used : Kilo　Hecto　Deca　Deci　Centi　Milli

Their meaning : 　1000　100　10　$\dfrac{1}{10}$　$\dfrac{1}{100}$　$\dfrac{1}{1000}$

The following tables illustrate the prefixes and the units of length, mass and capacity.

Prefix	Meaning	Abb	Fraction	Prefix	Meaning	Abb	Multiple
Milli	Thousandth	m	$\dfrac{1}{1000}$	Deca	Ten	da	10
Centi	Hundredth	c	$\dfrac{1}{100}$	Hecto	Hundred	h	100
Deci	Tenth	d	$\dfrac{1}{10}$	Kilo	Thousand	k	1000

Units of Length		Units of mass		Units of capacity	
Millimetre (mm)	$\dfrac{1}{1000}$ of a metre	Milligram (mg)	$\dfrac{1}{1000}$ of a gram	Millilitre (mL)	$\dfrac{1}{1000}$ of a litre
Centimetre (cm)	$\dfrac{1}{100}$ of a metre	Centigram (cg)	$\dfrac{1}{100}$ of a gram	Centilitre (cL)	$\dfrac{1}{100}$ of a litre
Decimetre (dm)	$\dfrac{1}{10}$ of a metre	Decigram (dg)	$\dfrac{1}{10}$ of a gram	Decilitre (dL)	$\dfrac{1}{10}$ of a litre
A metre (m)	Standard unit	A gram (g)	Standard unit	A litre (L)	Standard unit
Decametre (dam)	10 metres	Decagram (dag)	10 grams	Decalitre (daL)	10 litres
Hectometre (hm)	100 metres	Hectogram (hg)	100 grams	Hectolitre (hL)	100 litres
Kilometre (km)	1000 metres	Kilogram (kg)	1000 grams	Kilolitre (kL)	1000 litres

16.2 MEASUREMENT OF LENGTH

Metre is the standard unit for measuring length. Kilometre is the commonly used unit for measuring larger lengths such as distance between two cities.

$$1 \text{ km} = 1000 \text{ m}$$

Centimetre is the commonly used unit for measuring small lengths such as length of a pencil.

$$1 \text{ m} = 100 \text{ cm}$$

Further, kilometre (km), hectometre (km) and decametre (dam) are other units of length bigger than metre.

$$1 \text{ dam} = 10 \text{ m}$$
$$1 \text{ hm} = 100 \text{ m}$$
$$1 \text{ km} = 1000 \text{ m}$$

Similarly, decimetre (dm), centimetre (cm) and millimetre (mm) are the units of length smaller than metre.

$$1 \text{ m} = 10 \text{ dm}$$
$$1 \text{ m} = 100 \text{ cm}$$
$$1 \text{ m} = 1000 \text{ mm}$$

16.3 MEASUREMENT OF MASS/WEIGHT

The standard unit for measuring mass is gram. Kilogram is the commonly used unit for measuring weights of heavy objects such as weight of a boy, table, etc.

$$1 \text{ kg} = 1000 \text{ g}$$

Milligram is the commonly used unit for measuring weights of very light objects such as an alpin, ornaments, etc.

$$1 \text{ g} = 1000 \text{ mg}$$

Kilogram (kg), hectogram (hg) and decagram (dag) are the units of weight bigger than gram.

$$1 \text{ kg} = 1000 \text{ g}$$
$$1 \text{ hg} = 100 \text{ g}$$
$$1 \text{ dag} = 10 \text{ g}$$

Decigram (dg), centigram (cg) and milligram (mg) are the units of weight smaller than gram.

$$1 \text{ g} = 10 \text{ dg}$$
$$1 \text{ g} = 100 \text{ cg}$$
$$1 \text{ g} = 1000 \text{ mg}$$

16.4 MEASUREMENT OF CAPACITY (VOLUME)

Capacity of a container is the amount of liquid which it can hold.

The standard unit of capacity is litre (L).

For measuring the capacity of a bigger container like a water tank or a swimming pool, we use bigger units of capacity called kilolitre (kL)

$$1 \text{ kL} = 1000 \text{ L}$$

To measure the capacity of very small containers such as an injection or syringe, we use smaller units of capacity called millilitre (mL).

$$1 \text{ L} = 1000 \text{ mL}$$

Kilolitre (kL), hectolitre (hL) and decalitre (daL) are the units of capacity bigger than litre.

$$1 \text{ daL} = 10 \text{ L}$$
$$1 \text{ hL} = 100 \text{ L}$$
$$1 \text{ kL} = 1000 \text{ L}$$

Decilitre (dL), centilitre (cL) and millilitre (mL) are the units of capacity smaller than litre.

$$1 \text{ L} = 10 \text{ dL}$$
$$1 \text{ L} = 100 \text{ cL}$$
$$1 \text{ L} = 1000 \text{ mL}$$

13.5 CONVERSION OF UNITS (METRIC SYSTEM)

To convert a lower unit into a **higher unit**, we **divide** by 10 or 100 or 1000 etc. and to convert a higher unit into a **lower unit**, we **multiply** by 10 or 100 or 1000, etc. We also know that division by 10, 100, 1000, etc. is done by shifting the decimal point to the left of the given number and multiplication by 10, 100, 1000, etc. is done by shifting the decimal point to the right of the given number. Let us take some examples.

EXAMPLE 1   Convert 560 cm into dm and m.

Solution: We know that 10 cm = 1 dm and 100 cm = 1 m

$$\text{So, } 560 \text{ cm} = \frac{560}{10} \text{ dm} = 56 \text{ dm}$$

$$560 \text{ cm} = \frac{560}{100} \text{ m} = 5.6 \text{ m}$$

Ans. 560 cm = 56 dm = 5.6 m

EXAMPLE 2   Convert 745m into dam, hm and km.

Solution: Since dam, hm and km are higher units than metre, we divide.

$$1 \text{ m} = \frac{1}{10} \text{ dam} = 0.1 \text{ dam}$$

$$\therefore \quad 745 \text{ m} = \frac{745}{10} \text{ dam} = 74.5 \text{ dam}$$

$$1 \text{ m} = \frac{1}{100} \text{ hm} = 0.01 \text{ hm}$$

$$\therefore \quad 745 \text{ m} = \frac{745}{100} \text{ hm} = 7.45 \text{ hm}$$

$$1 \text{ m} = \frac{1}{1000} \text{ km} = 0.001 \text{ km}$$

$$\therefore \quad 745 \text{ m} = \frac{745}{1000} \text{ km} = 0.745 \text{ km}$$

Ans. 745 m = 74.5 dam = 7.45 hm = 0.745 km

EXAMPLE 3   Convert 7285 g into dag, hg, and kg

Solution: Since dag, hg and kg are higher units than g, we divide.

$$1 \text{ g} = \frac{1}{10} \text{ dag} = 0.1 \text{ dag}$$

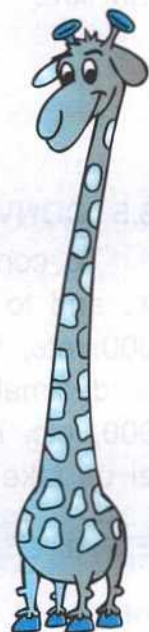$$\therefore \quad 7285 \text{ g} = \frac{7285}{10} \text{ dag} = 728.5 \text{ dag}$$

$$1 \text{ g} = \frac{1}{100} \text{ hg} = 0.01 \text{ hg}$$

$$\therefore \quad 7285 \text{ g} = \frac{7285}{100} \text{ hg} = 72.85 \text{ hg}$$

$$1 \text{ g} = \frac{1}{1000} \text{ kg} = 0.001 \text{ kg}$$

$$\therefore \quad 7285 \text{ g} = \frac{7285}{1000} \text{ kg} = 7.285 \text{ kg}$$

Ans. 7285 g = 728.5 dag = 72.85 hg = 7.285 kg

EXAMPLE 4   Convert 82415 mL into cL and L

Solution: 1 mL = $\frac{1}{10}$ cL $\therefore$ 82415 mL = $\frac{82415}{10}$ cL = 8241.5 cL

1 mL = $\frac{1}{1000}$ L   82415 mL = $\frac{82415}{1000}$ L = 82.415 L

Ans. 82415 mL = 8241.5 cL = 82.415 L

So far, we have converted smaller units into bigger units. Now let us see how to convert bigger units into smaller units.

Convert (a) 3.6 km (b) 6.358 g into smaller units.

(a)   1 km = 10 hm

So , 3.6 km = 3.6 × 10   = 36 hm

1 km = 100 dam

3.6 km = 3.6 × 100   = 360 dam

1 km = 1000 m

3.6 km = 3.6 × 1000 = 3600 m

(b)   1 g = 1000 mg

So , 6.358 g = 6358 mg

1 g = 100 cg

∴   6·358 g = 6·358 × 100 = 635·8 cg

1 g = 10 dg

∴   6.358 g = 6.358 × 10 = 63·58 dg

EXERCISE 16(A)

1 Express in m, dm, cm and mm :

(a) 8.425 m _____ (b) 7.75 m _____ (c) 27.078 m _____

(d) 52.064 m _____ (e) 0.6 m _____ (f) 0.009 m _____

(g) 1.050 m _____ (h) 75.08 m _____

2 Using decimal notation express in metres :

(a) 8 m 6 dm 5 cm 2 mm _____ (b) 10 m 8 dm 6 cm 5 mm _____

(c) 15 m 8 dm 1 cm 9 mm _____ (d) 1 m 3 dm 7 cm _____

(e) 7 dm 4 cm 3 mm _____ (f) 8 cm _____

(g) 9 mm _____ (h) 4 m 5 mm _____

3 Express in km, hm, dam and m :

(a) 2.355 km _____ (b) 8.162 km _____

(c) 30.750 km _____ (d) 35.250 km _____

(e) 48.878 km _____ (f) 7.075 km _____

(g) 1.005 km _____ (h) 9.003 km _____

4 Using decimal notation express in km :

(a) 1 km 1 hm 2 dam 9 m _____ (b) 7 km 8 hm 2 dam 2 m _____

(c) 50 km 8 dam 7 m _____ (d) 24 km 5 hm 6 m _____

(e) 6 hm 5 m _____ (f) 5 dam 2 m _____

(g) 1 km 5 m _____ (h) 2 km 8 dam _____

5 Express in kg, hg, dag and g :

(a) 3.127 kg _____ (b) 16.485 kg _____

(c) 0.758 kg _____ (d) 0.48 kg _____

(e) 6.5 kg _____ (f) 1.25 kg _____

(g) 250.04 kg _____ (h) 0.008 kg _____

6 Using the decimal notation express in kg :

(a) 2 kg 2 hg 7 dag 2 g _____ (b) 5 kg 5 hg 1 dag 5 g _____

(c) 7 kg 2 dag 7 g _____ (d) 5 hg 3 g _____

(e) 10 kg 6 hg 5 dag _____ (f) 6 hg 4 dag 2g _____

(g) 6 kg 5 g _____ (h) 9 kg 6 dag _____

7 Express in gm, dg, cg, mg :

(a) 3.164 g _____ (b) 5.750 g _____

(c) 0.5 g _____ (d) 0.185 g _____

(e) 17.06 g _____ (f) 0.75 g _____

(g) 9.009 g _____ (h) 0.008 g _____

8 Using decimal notation express in grams :

(a) 6 g 7 dg 2 mg _____ (b) 2 g 2 dg 7 cg 1 mg _____

(c) 5 dg 7 cg 2 mg _____ (d) 6 cg 6 mg _____

(e) 7 mg _____ (f) 9 mg _____

(g) 8 cg _____ (h) 5 dg _____

9 Express in L, dL, cL and mL :

(a) 6.452 L _____ (b) 8.616 L _____

(c) 0.5 L _____ (d) 0.25 L _____

(e) 0.125 L _____ (f) 6.05 L _____

10 Using decimal notation express in litres :

(a) 6 L 6 dL 7 cL 2 mL _____ (b) 20 L 8 dL _____

(c) 5 L 1 dL 5 cL 9 mL _____ (d) 2 cL 5 mL _____

(e) 6 dL _____ (f) 8 cL _____

(g) 1 L 5 mL _____ (h) 8 mL _____

11 Express in kL, hL, daL and L :

(a) 9.129 kL _____ (b) 0.775 kL _____

(c) 0.05 kL _____ (d) 1.1 kL _____

(e) 0.7 kL _____ (f) 0.225 kL _____

12 Using decimal notation expresss in kL :

(a) 3 kL 5 hL 3 daL 2 L _____ (b) 6 kL 7 L _____

(c) 8 kL 5 daL _____ (d) 15 kL 3 hL 7 daL 5 L _____

(e) 18 kL 6 hL _____ (f) 5 kL 8 L _____

13 Express in kg using decimal notation :

(a) 4153 g _____ (b) 3000 g _____

(c) 3856 g _____ (d) 31636 g _____

(e) 48416 g _____ (f) 850 g _____

(g) 500 g _____ (h) 75 g _____

14 Express in g :

(a) 4.3 kg _____ (b) 19.63 kg _____

(c) 35.365 kg _____ (d) 36.3 kg _____

(e) 0.015 kg _____ (f) 0.008 kg _____

(g) 0.22 kg _____ (h) 0.9 kg _____

15 Express in km using decimal notation :

(a) 365 m _____ (b) 660 m _____

(c) 99 m _____ (d) 588 m _____

(e) 1740 m _____ (f) 4030 m _____

(g) 2250 m _____ (h) 3666 m _____

16 Express in m :

(a) 1.5 km _____ (b) 2.25 km _____

(c) 5.75 km _____ (d) 0.8 km _____

(e) 0.75 km _____ (f) 6.06 km _____

(g) 100.025 km _____ (h) 60.025 km _____

17 Express in metres using decimal notation :

(a) 50 cm _____ (b) 100 cm _____

(c) 125 cm _____ (d) 500 cm _____

(e) 750 cm _____ (f) 220 cm _____

(g) 2110 cm _____ (h) 4004 cm _____

18 Express in cm :

(a) 0.15 m _____ (b) 0.05 m _____

(c) 2.75 m _____   (d) 3.25 m _____

(e) 8.55 m _____   (f) 0.006 m_____

(g) 8.008 m _____   (h) 1.115m _____

16.6 FUNDAMENTAL OPERATIONS IN METRIC MEASURES USING DECIMAL NOTATION

We already know how to do the four fundamental operations in metric measures. (By arranging the given units in their place value chart, putting the digits in their proper places, taking the vacant places as zero.) Now we learn how to do the four fundamental operations using decimal notation. The process is as follows:

Express the given measures in the same unit by using the decimal notation and then do the four operations (addition, subtraction, multiplication and division) as in the case of decimals.

EXAMPLE 1   Add 6 km 8 hm 7 dam 5 m; 15 km 9 hm 8 dam 5 m; 2 km 7 hm 5 m.

Solution: Express the given measures in km using decimal notation and then add.

$$6 \text{ km } 8 \text{ hm } 7 \text{ dam } 5 \text{ m} \quad = \quad 6.875 \text{ km}$$
$$15 \text{ km } 9 \text{ hm } 8 \text{ dam } 5 \text{ m} = \quad 15.985 \text{ km}$$
$$2 \text{ km } 7 \text{ hm } 5 \text{ m} \quad\quad = + \, 2.705 \text{ km} \quad [2 \text{ km } 7 \text{ hm } 0 \text{ dam } 5 \text{ m}]$$
$$\overline{\quad\quad\quad\quad 25.565 \text{ km}}$$

Ans : 25.565 km

EXAMPLE 2   Subtract 6kg 5hg 2dag 7g from 10kg 6g.

Solution: 10 kg 6 g   =   10.006 kg [10 kg 0 hg 0 dag 6 g = 10.006 kg]

6 kg 5 hg 2 dag 7 g =   − 6.527 kg
$$\overline{\quad\quad\quad 3.479 \text{ kg}}$$

Ans : 3.479 kg

EXAMPLE 3   Multiply 25.45 m by 34   **EXAMPLE 4**   Divide 523.138 kL by 86

Express your answer in cm.   Express your answer in litres.

Solution:

```
        25.45
       ×  34
      -------
       10180
        7635
      -------
       865.30
```

25.45 m × 34 = 865.30 m

Ans. 86530 cm

Solution:

```
              6.083
        86 | 523.138
             516
             -----
             713
             688
             -----
             258
             258
             -----
               0
```

6.083 kL = 6083 L

Ans. 6083 L

1 Express in decimal notation and then add :

(a) 2 km 6 hm 4 dam 2 m; 8 km 8 dam; 10 km 6 hm 2 dam 8 m

(b) 6 m 7 dm 2 cm 5 mm; 8 m 8 dm 6 cm 6 mm; 10 m 5 mm

(c) 6 kg 7 hg 5 dag 6 g; 8 hg 7 g; 4 kg 2 hg 2 g; 10 kg

(d) 5 L 6 dL 7 cL 4 mL; 8 L 8 dL 5 cL 1 mL; 7 L 4 dL 4 cL 6 mL

(e) 10 kL 8 L; 5 kL 4 hL 6 daL 5 L; 6 hL 2 daL 9 L

(f) 5 g 6 dg 8 cg 4 mg; 15 g 7 mg; 6 dg 5 mg; 8 g 7 cg 2 mg

2 Express in decimal notation and subtract:

(a) 25 km 625 m from 50 km 50 m   (b) 66 kg 725 g from 92 kg 6 hg 8 g

(c) 125 kL 615 L from 145 kL 220 L   (d) 58 L 6 dL 5 cL from 74 L 2 dL 4 cL

(e) 110 m 75 cm from 212 m 20 cm

3 Express in decimal notation and multiply:

(a) 7 km 2 hm 7 dam 5 m by 48   (b) 25 kg 620 g by 27

(c) 6 hm 4 dam 6 m by 72 [Answer in metre and km]

(d) 38 kg 516 g by 32   [Answer in kg, hg, dag and g]

4 Express in decimal notation and then divide:

(a) 591 kg 7 hg 3 dag 6 g by 68   (b) 49 m 4 dm 6 cm 4 mm by 54

(c) 936 kL 312 L by 39 [Answer in litres]   (d) 3831 m 24 cm by 84

(e) 35 km 5 hm 1 dam 1 m by 57   (f) 2 kL 6 hL 4 daL 9 L 9 dL 2 cL by 52

5 (a) Subtract 39.56kg from 100kg.

(b) By how much 25.36 m is more than 15.85 m?

(c) By how much is the sum of 27.35 kL and 50.83 kL less than the sum of 100 kL and 16.32 kL?

6 Multiply 925 g by 125. Give your answer in kg.

7 Divide 4.224 km by 96. Give your answer in metres.

8 Divide 0.175 L by 25. Give your answer in mL.

16.6 WORD PROBLEMS IN DECIMALS

EXAMPLE 1   4 bags contain rice weighing 50.675 kg; 100 kg; 78.5 kg and 80.75 kg respectively. How much rice is contained in the 4 bags?

Solution: Total quantity of rice in all the four bags

= 50.675 kg + 100 kg + 78.5 kg + 80.75 kg

$$50.675$$
$$100.000$$
$$78.500$$
$$+\ 80.750$$
$$\overline{309.925}$$

Ans: Total quantity of rice in 4 bags = 309.925 kg

EXAMPLE 2 Mr. Sen's monthly salary is ₹ 11,240.75. If his monthly expenses are ₹ 9048.50, how much does he save every month?

Solution:

Mr. Sen's monthly salary =	₹ 11240.75
His monthly expenses =	₹ 9048.50
His savings =	₹ 2192.25 (on subtracting)
∴ Mr. Sen's monthly savings =	₹ 2192.25 **Ans.**

EXAMPLE 3 2 m 25 cm cloth is needed to stitch a shirt. How much cloth is needed to stitch 176 such shirts?

Solution: Required length of cloth for a shirt = 2 m 25 cm = 2.25 m

Required length of cloth for 176 such shirts = 2.25 × 176

$$2.25$$
$$\times\ 176$$
$$\overline{1350}$$
$$1575$$
$$+\ 225$$
$$\overline{396.00}$$

Length of cloth required for 176 shirts = 396 m **Ans.**

EXAMPLE 4 If one container has a capacity of 85 litres of oil, how many containers are required to store 97.75 kL ?

Solution:

Capacity of one container =	85 litres
Quantity of oil to be stored =	97.75 kL = 97750 L
Total number of containers required =	97750 ÷ 85

```
        1150
   85 | 97750
       −85
       ─────
        127
        −85
       ─────
        425
       −425
       ─────
          0
```

No. of containers required = 1150 **Ans.**

1. Three drums can hold 16.62 kL, 25.25 kL and 75.68 kL of petrol respectively. How much petrol can they hold in all?

2. If 36 tins of oil weigh 567 kg, what is the weight of 1 tin? Also find the weight of 25 tins.

3. A long sleeved shirt requires 2 m 6 dm 5 cm of cloth. How much cloth will be required for 15 such shirts? Give your answer in metres.

4. A car in a journey requires 6.38 litres of petrol per hour. How many litres of petrol will be required for a journey of 7.25 hours?

5. Mr. Sohan requires 3.05 litres of petrol every day for his car. How many litres of petrol does he use in a month? If the petrol costs ₹ 67.90 per litre, how much does he spend on petrol every month?

6. A hotel needs 165 litres of milk every day. How many litres of milk does it require for a week? If the milk costs ₹ 31.50 per litre, how much does the hotel owner spend on milk every week?

7. A jar contains 5 litres of oil. 6 bottles each of capacity 8 dL are filled with oil from the jar. How much oil is left in the jar?

8. A rope is 15 m 60 cm long. How many pieces each measuring 25 cm long can be cut from it? Find the length of the remaining rope.

9. How many 0.20 litre cups can be filled up from a 5 litre jug of lemonade?

10. John gives ₹ 3565 for 50 litres of petrol. Find the cost of petrol per litre. Also find the cost of 30 litres of petrol.

17 PERIMETER AND AREA

17.1 PERIMETER : REVISION

The distance around a plane figure is called its perimeter.

Perimeter of a rectangle = 2 length + 2 breadth = 2 (l + b) units

Perimeter of a square = 4 × side of the square = 4s units (s means side of the square)

Perimeter of any irregular figure is the sum of the measure of all its sides.

EXERCISE 17(A)

1 Find the perimeter of the rectangle whose measures are:

	Length	Breadth	Perimeter		Length	Breadth	Perimeter
(a)	10 m	6 m		(b)	$6\frac{1}{2}$ cm	$5\frac{3}{4}$ cm	
(c)	15.8 cm	8.6 cm		(d)	1m 20 cm	60 cm	
(e)	12.5 m	5.5 cm		(f)	2m 12 cm	30 m	
(g)	23.3 cm	7 cm		(h)	5m 20 cm	42 cm	

2 Find the perimeter of a square whose side is:

(a) 7.6 cm (b) $18\frac{2}{3}$ m (c) 13 m 75 cm (d) 23.05 cm

3 Find the perimeter of a triangle whose sides are 6.3 cm, 5 cm and 4.7cm.

4 The length of a rectangular field is three times its breadth. If the breadth of the rectangle is $3\frac{1}{2}$m, find the perimeter of the rectangle.

5 The breadth of a rectangular garden is 6m less than its length. If the length of the garden is 30m, find the perimeter of the garden.

6 The length of a square field is 35m. What distance will a man walk in going around it 3 times ?

7 Sonu bought a table cloth 2.25 m long and 1.75m wide. She wanted to put lace around it. How many metres of lace would she have to buy? Also find how much would the lace cost if it costs ₹ 14.50 per metre ?

8 Akash covers a distance of 48m while going round a square field twice. Find the side of the square. How much wire will be needed for fencing around it once? Find the cost of the wire if 1 metre costs ₹ 1.75.
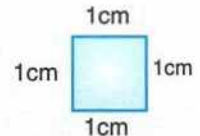
17.2 AREA

The amount of surface enclosed within the boundary of a figure is called its area.
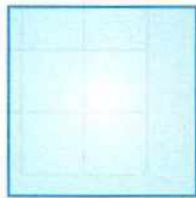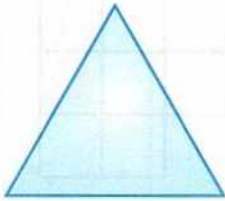
The shaded portion of the above figures denotes the area of the figures.

The standard units that are generally used for measuring areas are **square centimetres** and **square metres.**

The area of a **square of side 1cm long is one square centimetre.**

Similarly, the area of a square of side 1 metre long

is one square metre.

Square centimetre is written in short as cm^2 or sq.cm. Similarly, square metre is written in short as m^2 or sq.m.

Consider the floor of a room which is covered with 25 square tiles side 1 m long each. Then

Area of each square tile is 1 sq. m or 1 m^2.

Area of 25 square tiles is 25 sq.m or 25 m^2.

∴ Area of the floor = 25 m^2 **Ans.**

Area of an irregular plane figure can be found only approximately. For this purpose we use a 1cm square paper which we generally call a **graph paper**.
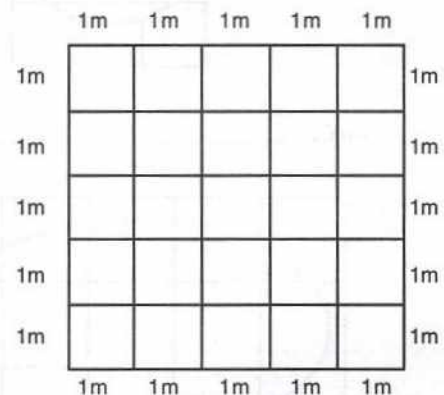
To find an approximate area of an irregular plane figure, we proceed as follows.

1 Count the complete squares.

2 Neglect the square(s) which is less than half of a full square.

3 Count the square(s) which is half or more than half of a full square as one full square.

4 Add the complete squares and the squares that are half or more than half. This sum gives the approximate area of the plane figure.

1 Find the area of each of the following. The unit used is a sq. cm.

(a)

(b)
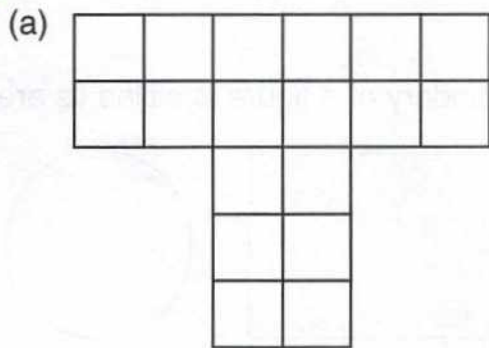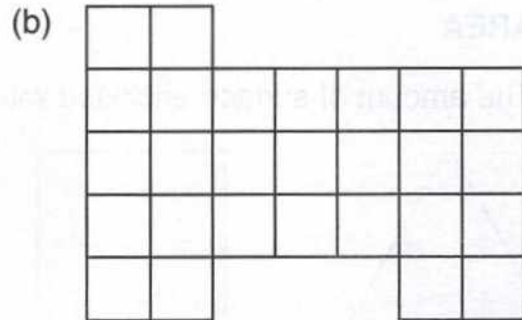
Area _____   Area _____

2 Find the approximate area of the following figures:

(a)

(b)

Area _____   Area _____

(c)

(d)
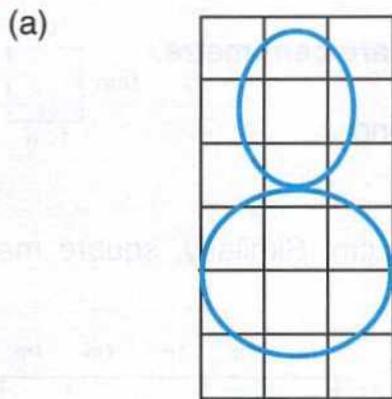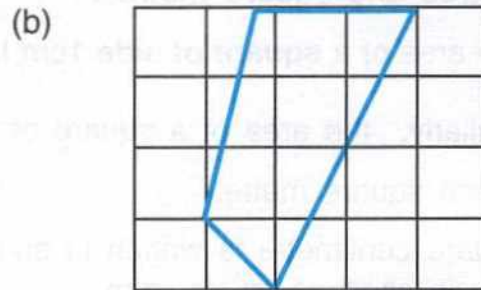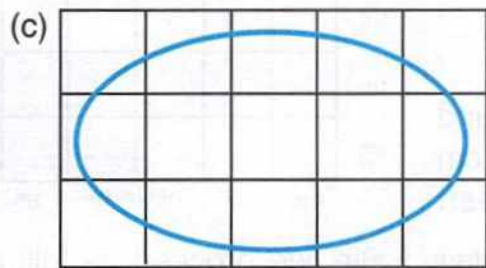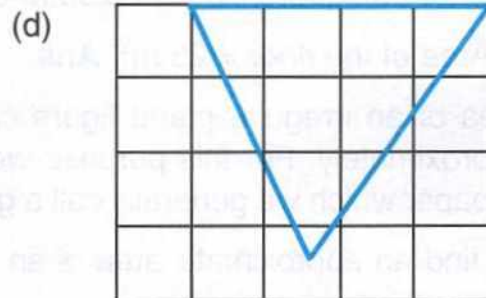
Area _____   Area _____

Area of a rectangle

Let us consider the rectangles PQSR and EFHG

What is the area of the rectangle PQSR ?

Count the number of squares. We have 12 squares.

Area of the rectangle PQSR = 12 sq. cm or 12 cm^2

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What is the area of the rectangle EFHG ?

Count the number of squares. 21 squares.

Area of the rectangle EFHG = 21cm^2

From the above examples, we see

length	breadth	area
2cm	6cm	12cm^2
7cm	3cm	21cm^2
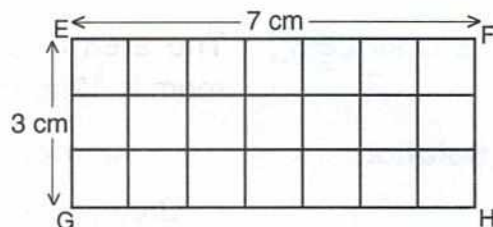
Area is always measured in square units

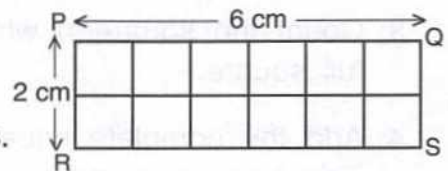∴ It is clear that area of a rectangle = length × breadth

If A = Area; L = Length; B = Breadth, then **A = L × B**

While finding the area of a rectangle by using the formula given above, it is necessary that we express both the length and the breadth in the same unit.

If the length and breadth are both expressed in centimetres, we get the area in square centimetres. If both length and breadth are expressed in metres, we get the area in square metres (m^2).

When the area and breadth of a rectangle are given, to find out the length, we use

$$L = \frac{A}{B} \text{ since } L \times B = A$$

Similarly to find out the breadth, when the area and length of a rectangle are given, we use :

$$B = \frac{A}{L} \text{ since } L \times B = A$$

Area of a square

We know that a square is a special kind of rectangle whose length and breadth are equal i.e. length = breadth = side

Area of a rectangle = length × breadth

From this we easily conclude that area of a square = (Side × Side) square units.

EXAMPLE 1 Find the area of a rectangular field whose length is 45m and breadth is 12m.

Solution: Length of the field = 45m
Breadth of the field = 12m
Area of the field = L × B = 45 × 12 = 540m^2 **Ans.**

EXAMPLE 2 Find the area of a square whose length is $7\frac{1}{2}$m.

Solution: Side of the square = $7\frac{1}{2}$ m = $\frac{15}{2}$ m

Area of the square = (side × side)

$$= \frac{15}{2}m \times \frac{15}{2}m = \frac{225}{4}m^2 = 56\frac{1}{4}m^2 \text{ **Ans.**}$$

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EXAMPLE 3 The area of a rectangular room is 180m². If the breadth of the room is 12m, find the length of the room.

Solution: Area of the room = 180m²

Breadth of the room = 12m

∴ Length of the room = $\dfrac{\text{Area}}{\text{Breadth}}$ = $\dfrac{A}{B}$ = $\dfrac{180}{12}$ = 15m **Ans.**

EXAMPLE 4 The length of a hall is 40m and its area is 1000m². Find the breadth of the hall.

Solution: Area of the hall = 1000m²

Length of the hall = 40m

Breadth of the hall = $\dfrac{A}{L}$ = $\dfrac{1000}{40}$ = 25m **Ans.**

EXAMPLE 5 A room is 12m long and 10m broad. Find the cost of carpeting its floor if 1sq. m of carpet costs ₹ 25.

Solution: Length of the room = 12m

Breadth of the room = 10m

∴ Area of the room = Area 10 = 120m²

Cost of 1sq. m carpet = ₹ 25.

∴ Cost of 120 sq. m. carpet = 120 × 25 = ₹ 3000

∴ The cost of carpeting the floor = ₹ 3000 **Ans.**

<div align="center">

EXERCISE 17(C)

</div>

1 Determine the area of rectangles whose lengths and breadths are given below :

	Length	Breadth	Area		Length	Breadth	Area
(a)	10m	7m		(b)	15cm	20cm	
(c)	25cm	16cm		(d)	18cm	12cm	
(e)	8dm	6dm		(f)	14dm	11dm	
(g)	12dm	9dm		(h)	5m	25cm	

2 Determine the area of a square whose one side is:

	Side	Area		Side	Area
(a)	1m 10 cm		(b)	5 m 25 cm	
(c)	2 cm 4 mm		(d)	4 cm 5 mm	
(e)	1 m 6 dm		(f)	3.5 m	

3 Study and complete the table.

	Length	Breadth	Area	Rough Calculation
(a)	50cm	—	$300cm^2$	
(b)	—	12m	$156m^2$	
(c)	—	21m	$504cm^2$	
(d)	4m	—	$12m^2$	
(e)	4m	—	$72m^2$	

WORD PROBLEMS

4 Mr. Seth has a beautiful lawn in his garden. Its area is 98 m^2 and its length is 14 m. What is its breadth ?

5 The size of a square field is 35m long. Find the area of the field. Find also the cost of levelling the field at the rate of ₹ 5 per sq. metre.

6 A swimming pool is 15m long and covers an area of 135 m^2. Find its breadth. Also find its perimeter.

7 A rectangular field is 48m long and 40m broad. Find the cost of levelling the field at the rate of ₹ 3 per sq. metre.

8 The area of a hall is 1620 m^2. The breadth of the hall is 36 m. Find the length of the hall. Also find the perimeter of the hall.

9 The perimeter of a classroom is 42m. If the length of the classroom is 12m, find the breadth of the classroom and hence find the area of the classroom.

10 The perimeter of a square cardboard is 1m. Find its area in cm^2.

11 Find the areas of the following figures by dividing them into rectangles, measurements are given in centimetres.

(a)

1 cm

6 cm

$6 \times 1 = 6 \, cm^2$
$(8-1) \times 1 = 7 \, cm^2$
Total area = 13 cm²

1 cm

8 cm

(b)

1 cm

4 cm   1 cm   3 cm   4 cm

(c)

6 cm

2.5 cm

1.5 cm

3 cm

(d)

3.5 cm

4 cm

2 cm

11.5 cm
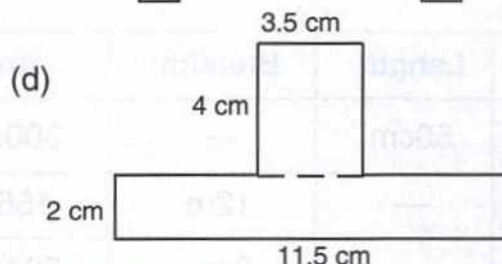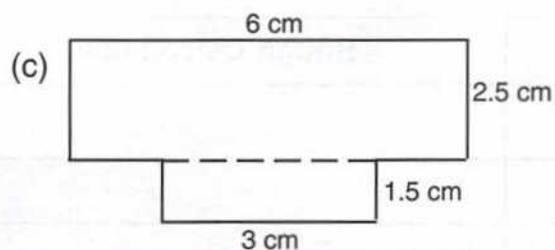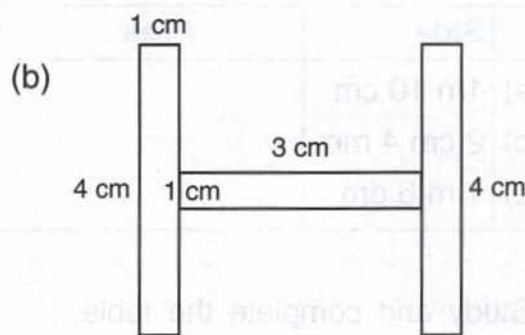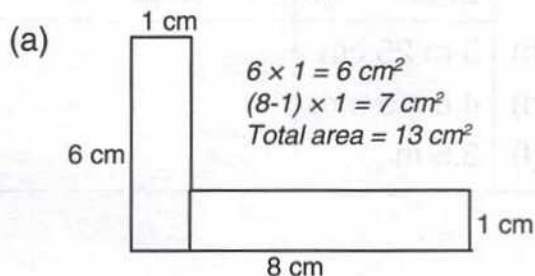
17.3 PAVING THE FLOORS

EXAMPLE 1   The dimensions of the floor of a room are 12m 50cm by 8m 50cm. How many square tiles will be required to cover the floor if the side of each tile is 25cm?

Solution:

Length of the floor = 12m 50cm = 1250 cm

Breadth of the floor = 8m 50cm = 850 cm

∴ Area of the floor = 1250 × 850 cm²

Side of a square tile = 25 cm

Area of a square tile = 625cm²

∴ No. of square tiles required $= \dfrac{\text{Area of the floor}}{\text{Area of a square tile}} = \dfrac{1250 \times 850}{625}$

$= \dfrac{10,62,500}{625} = 1700$ **Ans.**

EXAMPLE 2   750 tiles each 10 cm long and 6 cm wide are used to pave the corridor. Find the area of the corridor.

Solution:

Area of one tile = 10 × 6

= 60 cm²

∴ Area of 750 tiles = 60 × 750

= 45,000 cm²

But the area occupied by 750 tiles is the area of the corridor.

∴ Area of the corridor = 45,000 cm² **Ans.**

17.4 AREA OF PATH, VERANDAHS AND BORDERS

EXAMPLE 1   A garden 15m by 12m is surrounded by a path 1 m wide. Find the area of the path.

Method   First draw a rough diagram of the garden.

Shaded portion denotes the area of the path.

Width of the path is 1m.

We see from the figure that there are two rectangles where the length of the outer rectangle is 2m more than the length of the inner rectangle [it is extended by 1m on both the ends].

Similarly, breadth of the outer rectangle is also 2m more than the breadth of the inner rectangle.

Outer rectangle includes area of the inner rectangle + the area of the path.

So, we can say, area of the path = outer rectangle's area – inner rectangle's area

Length of the outer rectangle = 15 + 2 = 17m

Breadth of the outer rectangle = 12 + 2 = 14m

Area of the outer rectangle = 17 × 14

i.e. [Area of the garden + path] = 238 m²

Area of the inner rectangle = 15 × 12 = 180m²

i.e. [Area of the garden] = 180 m²

∴ Area of the path = Outer area – Inner area

= 238 – 180 = 58m² **Ans :**
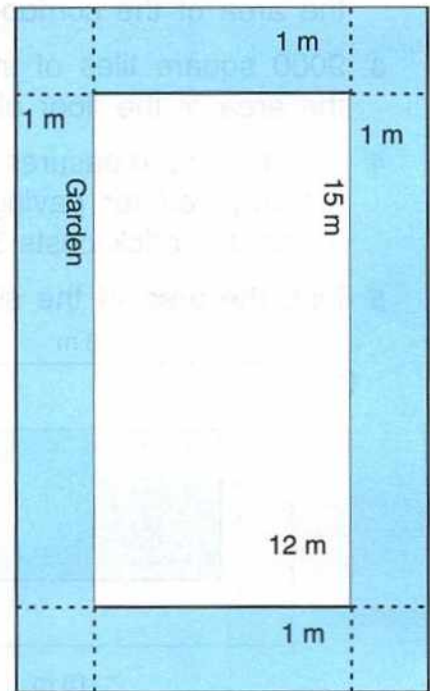
EXAMPLE 2   A room is 8m long and 6.5 m wide. A carpet 6.5m long and 5m wide is laid in the room. Find the area of the floor uncovered by the carpet.

Solution: Area uncovered by the carpet = Area of the floor – Area of the carpet

Area of the floor = 8 × 6.5

= 52.0m²

Area of the carpet = 6.5 × 5

= 32.5m²

Area uncovered by the carpet = 52.0 – 32.5

= 19.5m² **Ans :**
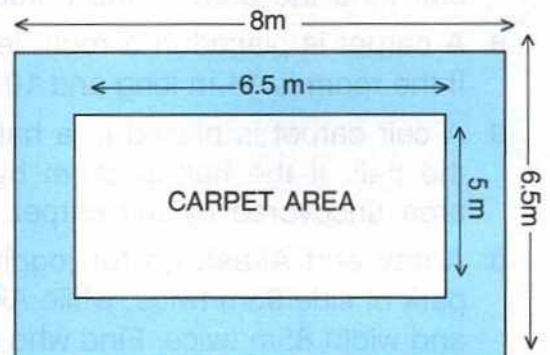
1. How many square tiles of side 30cm will be required for a floor 18m long and 15m wide? If the cost of a tile is ₹ 2.50, find the cost for covering the floor with the tiles.

2. 660 tiles each 15cm long and 12cm wide are required to pave a corridor. Find the area of the corridor. Give your answer first in sq.cm. and then in sq. m.

3. 9000 square tiles of size 20cm are required to pave the floor of a hall. Find the area of the floor of the hall in sq. m.

4. A courtyard measures 28m by 21m. How many bricks each 25cm by 21cm are required for paving the courtyard? Find the cost of paving the floor with bricks if a brick costs 50 paise.

5. Find the area of the shaded portion.

(a)

8 m

1 m

6 m

1 m

(b)

1.5 m

10 m

1.5 m

(c)

18 m

2 m

12 m

2 m

(d)

1.5 m

5 m

2 m

1.5 m
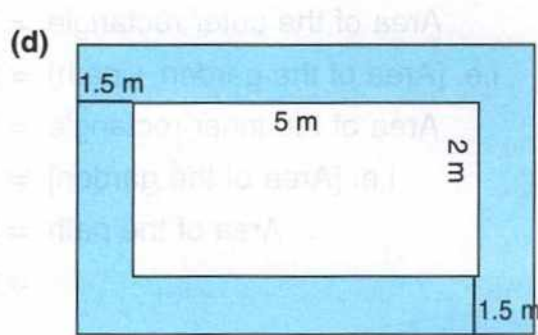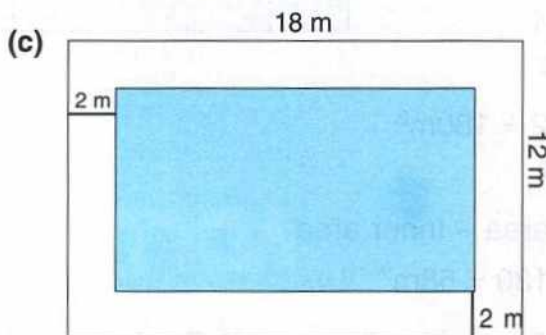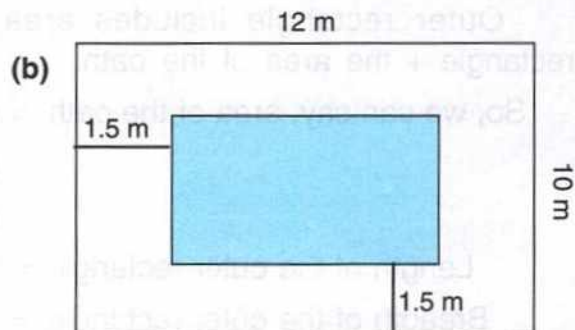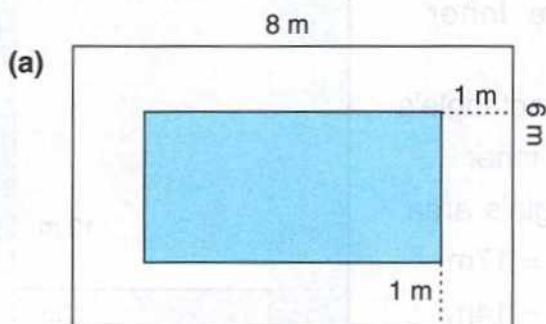
6. A garden 18 m by 15 m is surrounded by a path of uniform width 2.25 m. Find the area of the path.

7. A table cloth is 1.5 m by 1 m. It is bordered with lace of uniform width of 15 cm. Find the area of the border.

8. A carpet is placed in a room leaving a border of 1 m wide all around the room. If the room is 14 m long and 10 m wide, find the area uncovered by the carpet.

9. A coir carpet is placed in a hall so as to leave a border of 2 m wide all around the hall. If the hall is 30 m by 26m, find the area of the carpet and also the area uncovered by the carpet.

10. Arnav and Akash go for jogging every morning. Arnav jogs around a square park of side 95m twice, while Akash jogs around a rectangular park of length 90m and width 85m twice. Find who covers greater distance and by how much.

18 VOLUME

18.1 CONCEPT OF VOLUME

Plane figures like triangles, quadrilaterals and circles do not occupy any space because they lie on a plane. But solid figures like those given below occupy space.
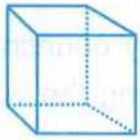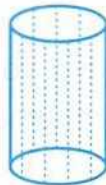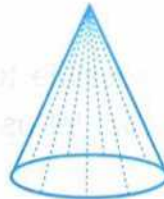
Cube	Cuboid	Cylinder	Cone	Sphere

Every object that occupies space has a volume.

The volume of an object is the amount of space occupied by it.

Take a tumbler. Fill it half with water. Now put a solid into the glass. The level of water will go up. This rise in the level of water gives the volume of the solid.

18.2 UNIT OF VOLUME

Like the measurement of area, the measurement of volume also requires a unit. In the case of area, the units are 1 sq cm, 1 sq m, etc. For the measurement of volume, the most convenient unit to be used is cubic centimetre. A cube is an object having six faces of equal length and breadth. If each side of a cube is 1cm, its volume is 1 cubic centimetre. For larger volumes, we express them in cubic metre, *i.e.* a cube whose side is 1 m. 1 cubic centimetre is written as 1 cu cm or 1 cm^3. Similarly, 1 cubic metre is written as 1 cu m or 1 m^3.

Let us now determine the volume of the cubes and cuboids given below.
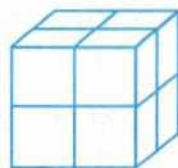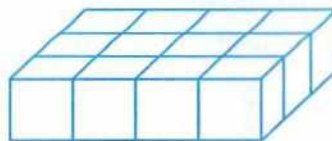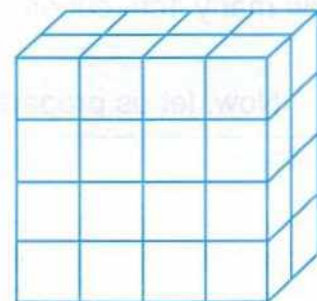
A   B   C   D

Cuboid A consists of four 1 cm cubes. So the volume of cuboid A is 4 cu cm.
Cube B consists of eight 1 cm cubes. So, the volume of cube B is 8 cu cm.
Similarly, the volume of the solids C and D are 12 cu cm and 32 cu cm, respectively.

EXAMPLE   Find the volume of the solid given in fig. 1.

Solution: Since the solid is made of twelve 1 cm cubes,
the volume of the solid is 12 cu cm.
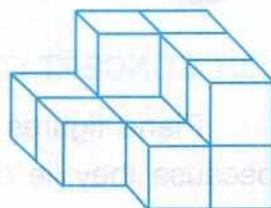
Fig. 1

As it is not always possible to find the volume of a solid by only counting the cubes contained in the solid, let us learn another method for determining the volume of solids.

1 In fig. 2 a cuboid is shown:

What is the length of the cuboid? = 4 cm

What is its breadth? = 2 cm

What is its height? = 3 cm

How many 1cm cubes make the given cuboid?

= 24 cubes

$(4 \times 2 \times 3)$
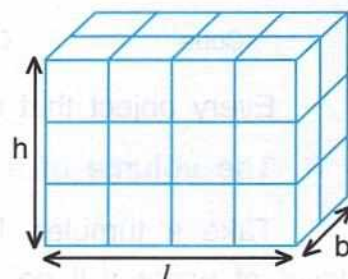
Fig. 2

We find that the volume of the given cuboid with length 4 cm, breadth 2 cm and height 3 cm is 24 cu cm.

2 Again look at the cube shown in fig. 3

What is the length of its edge? = 2 cm

How many 1cm cubes make the given cube? = 8 cubes $(2 \times 2 \times 2)$

We find that the volume of the given cube with edge 2 cm is 8 cu cm.
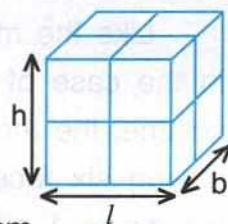
Fig. 3

3 In fig. 4 the length of the cuboid is 3 cm.

Breadth of the cuboid is = 3 cm.

Height of the cuboid is = 2 cm.

How many 1cm cubes make the given cuboid = 18 cubes

$(3 \times 3 \times 2)$
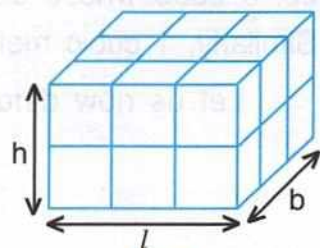
Fig. 4

Now, let us prepare a table of the solids shown above:

Solid	Length (cm)	Breadth (cm)	Height (cm)	Total No. of 1cm cubes	Volume (cu cm)
A cuboid	4	2	3	24 $(4 \times 2 \times 3)$	24
A cube	2	2	2	8 $(2 \times 2 \times 2)$	8
A cuboid	3	3	2	18 $(3 \times 3 \times 2)$	18

Thus,   **Volume of a cuboid = length × breadth × height**

and,   **Volume of a cube = (length of an edge) × (length of an edge) ×
(length of an edge)**

EXAMPLE 1   Find the volume of a box (a cuboid) whose length, breadth and height
respectively are 20cm × 15cm × 10cm.

Solution: Length of the box = 20cm

Breadth of the box = 15cm

Height of the box = 10cm

∴ Volume of the box = (20 × 15 × 10) cu cm

= 3000 cu cm. **Ans.**
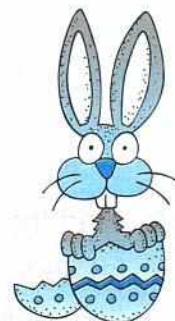
EXAMPLE 2   Find the volume of a cube whose edge is 5cm long.

Solution: Length of the edge of the cube = 5cm

Volume of the cube = (5 × 5 × 5) cu cm

= 125 cu cm. **Ans.**

EXAMPLE 3   Find the volume of a cuboid whose length is 1m, breadth 50cm and
height 25cm.

Solution: Length of the cuboid = 1m or 100cm

Breadth of the cuboid = 50cm

Height of the cuboid = 25cm

Volume of the cuboid = (100 × 50 × 25) cu cm

= 125 000 cu cm.

> Make sure the
> dimensions are in
> the same units.

Thus,   the volume of the cuboid is 125 000 cu cm. **Ans.**

Or

Length of the cuboid = 1m

Breadth of the cuboid = 50cm or .5m

Height of the cuboid = 25cm or .25m

Volume of the cuboid = (1 × 0.5 × 0.25) = 0.125 cu m.

Thus,   the volume of the cuboid is 0.125 cu m **Ans.**

1 Find the volumes of the following cuboids and cubes by counting the unit cubes of volume 1 cu cm.
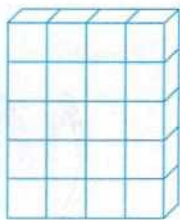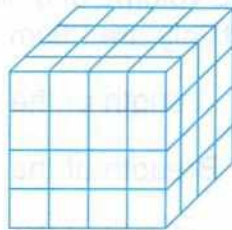
(a) (b) (c) (d)

2 Find the volume of the cuboid whose dimensions are:

(a) length = 8m, breadth = 5m, height = 4m

(b) length = 15m, breadth = 12m, height = 5m

(c) length = 75cm, breadth = 50cm, height = 30cm

3 Find the volume of a cube whose volume is three times the volume of a cuboid of dimensions 20cm × 15cm × 10cm.

4 Find the volume of air in a room 10m long, 8m wide and 6m high.

5 The dimensions of a tank are 12.4m, 7.9m and 5m. How much water can be filled in it?

6 A room is 4.5m long, 4m broad and 3.5m high. How much air does it contain? How many boys can sit in it if each boy occupies 2.5 m³ of air space?

7 How many bricks each 25cm long, 10cm wide and 7.5cm thick, will be required for a wall 15m long, 2.5m high and 1.25m thick?

8 A cuboidal tank is 30cm long, 30cm wide and 1m 60cm high. It has water up to a height of 40cm. How much more cu cm of water can the tank contain?

9 A cubical block of gold was melted and cast into 10 smaller cubes of edge 1.5cm. What was the volume of the cubical block of gold?

10 A block of wood is in the form of a cube and its edge is 4m. How many cuboidal pieces of size 20cm × 10cm × 5cm can be cut from the block if there is no wastage of wood?

11 The dimensions of a rectangular log of wood are 8m, 1.5m and 100cm. Find the number of cubical blocks which can be cut from it if the edge of a block is 50cm.

12 A swimming pool is 30m long and 15m wide. How many kilolitres of water must be pumped into it so as to raise the level of water by 4m? (1000cm³ = 1 litre)

19 MONEY

Money is used to buy things. The money used by a country is called its currency. Indian currency consists of 'rupees and coins'.

Rupee is represented by the symbol '₹' and paise by the symbol 'p'.

There are 100 paise in a rupee : 1 rupee = 100 paise.

19.1 EXPRESSING MONEY IN FIGURES AND WORDS

	Figures	Words
(a) 25 rupees 75 paise	₹ 25.75	Rupees twenty five and seventy five paise
(b) 80 rupees 50 paise	₹ 80.50	Rupees eighty and fifty paise
(c) 30 rupees	₹ 30.00	Rupees thirty
(d) 25 paise	₹ 0.25	Twenty five paise.

- **Conversion of rupees into paise :**

To convert rupees into paise, multiply the given amount by 100.

EXAMPLE 1   Convert the following into paise

(a) ₹ 512.25   (b) ₹ 0.32

Solution :

(a)   ₹ 512.25 = (512.25 × 100) p
            = 51225 p

(b)   ₹ 0.32 = (0.32 × 100) p
         = 32 p

Working rule : To convert the given amount into paise, first write the amount in figures and then remove the decimal and write the same amount. *e.g.*

(a)   ₹ 512.25 = 51225 p

(b)   ₹ 0.32 = 32 p

(c)   ₹ 215.75 = 21575 p

(d)   285 rupees 25 paise = ₹ 285.25
                     = 28525 p

Conversion of paise into rupees.

To convert paise into rupees, divide the given amount by 100.

EXAMPLE   Convert the following into rupees.

(a) 2825 paise   (b) 75 paise   (c) 32515 paise

Solution :

(a)   2825 paise = ₹ (2825 ÷ 100) = ₹ 28.25

(b)   75 paise = ₹ (75 ÷ 100) = ₹ 0.75

(c) 32515 paise = ₹ (32515 ÷ 100) = ₹ 325.15

Working rule : To convert a given amount in paise into rupees, put a decimal after two digits from the right side of the given amount.

For example :

(a)   2825 paise = ₹ 28.25

(b)   75 paise = ₹ 0.75

(c) 32515 paise = ₹ 325.15

EXERCISE 19(A)

1 Express each of the following amounts in figures.

(a) Rupees twenty three and thirty paise.

(b) Rupees two hundred fifty and seventy five paise.

(c) Rupees seven hundred and sixty paise.

(d) Rupees sixty four and five paise.

(e) Rupees five thousand eight hundred thirty five and sixty five paise.

(f) Rupees twenty and two paise.

(g) Rupees seventy three and twenty five paise.

2 Express each of the following amounts in words.

(a) ₹ 43.25   (b) ₹ 237.40   (c) ₹ 17.85   (d) ₹ 463.05

(e) ₹ 368.75   (f) ₹ 12.00   (g) ₹ 0.75   (h) ₹ 0.08

3 Convert the following amounts into paise.

(a) 42 rupees 30 paise   (b) 436 rupees 45 paise

(c) 465 rupees 25 paise   (d) 5681 rupees 25 paise

(e) 64 rupees 75 paise   (f) 89 rupees 05 paise

(g) 6 rupees 15 paise   (h) 5 rupees 08 paise

4 Convert the following amounts into paise.

    (a) ₹ 415.65   (b) ₹ 36.55   (c) ₹ 39.25   (d) ₹ 325.80

    (e) ₹ 75.05   (f) ₹ 403.40   (g) ₹ 200.00   (h) ₹ 500.70

5 Convert the following amounts into rupees.

    (a) 2680 p   (b) 56832 p   (c) 130 p   (d) 50008 p

    (e) 15478 p   (f) 17008 p   (g) 65 p   (h) 3680 p

    (i) 30000 p   (j) 54005 p   (k) 3786 p   (l) 6 p

19.2 ADDITION AND SUBTRACTION OF MONEY

Method :

Step 1 : Write the given amounts in figures in decimal notation.

Step 2 : Add or subtract as any other decimal number. Remember to place decimals one below the other.

EXAMPLE 1   Add ₹ 527.38 and ₹ 45.85.

Solution :

$$
\begin{array}{r}
① ① ① \\
₹\ 5\ 2\ 7\ .\ 3\ 8 \\
+\ ₹\ \ \ \ 4\ 5\ .\ 8\ 5 \\
\hline
₹\ 5\ 7\ 3\ .\ 2\ 3 \\
\hline
\end{array}
$$

Thus, ₹ 527.38 + ₹ 45.85 = ₹ 573.23

EXAMPLE 2   Subtract ₹ 23654.65 from ₹ 813428.00.

Solution :

$$
\begin{array}{r}
⑩⑫⑬⑫⑦\ ⑨⑩ \\
₹\ 8\ \cancel{1}\ \cancel{3}\ \cancel{4}\ \cancel{2}\ \cancel{8}\ .\ \cancel{0}\ \cancel{0} \\
-\ ₹\ \ \ 2\ 3\ 6\ 5\ 4\ .\ 6\ 5 \\
\hline
₹\ 7\ 8\ 9\ 7\ 7\ 3\ .\ 3\ 5 \\
\hline
\end{array}
$$

Thus, ₹ 813428.00 – ₹ 23654.65 = ₹ 789773.35

EXAMPLE 3   Reena bought a pair of jeans for ₹ 880.50 and a top for ₹ 430.25. She gave ₹ 2000 to the shop keeper. How much money will she get back ?

Solution :

$$\begin{array}{r} \text{Cost of the jeans} = & ₹880.50 \\ \text{Cost of the top} = & +₹430.25 \\ \hline \text{Total cost} = & ₹1310.75 \end{array}$$

$$\begin{array}{r} \text{Money given to the shop-keeper} = & ₹2000.00 \\ \text{Total bill} = & -₹1310.75 \\ \hline \text{Balance} = & ₹689.25 \end{array}$$

Thus, she will get ₹ 689.25 back from the shopkeeper. **Ans.**

EXERCISE 19(B)

1 Add the following amounts :

(a) ₹ 512.40 and ₹ 65.95   (b) ₹ 815 and ₹ 75.45

(c) ₹ 9765.42 and ₹ 4564.94   (d) ₹ 57495.44 and ₹ 94754.95

(e) ₹ 65457.68, ₹ 4576.42 and ₹ 452.50

(f) ₹ 45947.45, ₹ 8156 and ₹ 816.40

(g) ₹ 95125.10, ₹ 8156 and ₹ 816.40

(h) ₹ 75146.85, ₹ 4594.40, ₹ 7.65 and ₹ 0.45

(i) ₹ 85159, ₹ 45225.20, ₹ 12.45 and ₹ 1.75

2 Subtract the following amounts.

(a) ₹ 45.50 from ₹ 100   (b) ₹ 855.45 from ₹ 1000.25

(c) ₹ 9540 from ₹ 12450.47   (d) ₹ 85134.92 from ₹ 194556

(e) ₹ 90506.20 from ₹ 122456.10   (f) ₹ 88546.75 from ₹ 245125.60

(g) ₹ 45125.50 from ₹ 95465.10

3 Smrity, Saroj and Sandhya have ₹ 215.05, ₹ 215.50 and ₹ 215.25 in their bags. How much money they have in all ?

4 Rahul purchased trousers worth ₹ 1575.60, T-shirt worth ₹ 999.50, socks worth ₹ 254.20 and shoes worth ₹ 2590.70. How much money did he spend altogether ?

5 Jack got ₹ 1000 as pocket money. He spent ₹ 655.75 on books and ₹ 125.30 on fast food. Find the amount of money he is left with ?

6 Sumit earned ₹ 25600.60 in a month and his brother earned ₹ 22125.75 in a month. Who earned more and by how much ?

7 Gracy bought a dress for ₹ 1756.90 and a doll for ₹ 895.70. She gave ₹ 3000 to the shopkeeper. How much money did she get back ?

19.3 MULTIPLICATION AND DIVISION OF MONEY

Method :

Step 1 : Write the given amounts in figures and in decimal notation.

Step 2 : Multiply or divide as any other decimal number.

EXAMPLE 1   Multiply ₹ 6540.35 × 12.

Solution :

```
                ¹
        6 5 4 0 . 3 5
    ×             1 2
    ─────────────────
      1 3 0 8 0 7 0
    + 6 5 4 0 3 5 ×
    ─────────────────
      7 8 4 8 4 . 2 0
```

Thus, ₹ 6540.35 × 12 = ₹ 78484.20

EXAMPLE 2   Divide ₹ 8041.50 ÷ 15.

Solution :

```
    15 )8041.50( 536.1
        − 75
        ─────
          54
        − 45
        ─────
          91
        − 90
        ─────
          15
        − 15
        ─────
           ×
```

Thus, ₹ 8041.50 ÷ 15 = ₹ 536.10.

EXAMPLE 3   One litre of milk costs ₹ 48.50. Find the cost of 3·5 litre of milk.

Solution :

Since cost of 1 litre milk = ₹ 48.50,

therefore, cost of 3·5 litre milk = ₹ 48.50 × 3·5

```
        ₹ 4 8 . 5 0
        ×     3 . 5
    ─────────────────
        2 4 2 5 0
    + 1 4 5 5 0 ×
    ─────────────────
      1 6 9 . 7 5 0
```

∴ Cost of 3.5 litre of milk

= ₹ 48.50 × 3.5 = ₹ 169.75

1 Multiply the following :

    (a) ₹ 12.75 × 8

    (b) ₹ 1.25 × 10

    (c) ₹ 15.26 × 15

    (d) ₹ 945.75 × 25

    (e) ₹ 526.40 × 16

    (f) ₹ 6450.50 × 15

    (g) ₹ 81256.12 × 42

    (h) ₹ 85132.05 × 55

    (i) ₹ 87152.10 × 75

    (j) ₹ 90456.75 × 95

2 Divide the following :

    (a) ₹ 96 ÷ 2

    (b) ₹ 1.33 ÷ 7

    (c) ₹ 85.14 ÷ 9

    (d) ₹ 275.22 ÷ 6

    (e) ₹ 851.52 ÷ 12

    (f) ₹ 7045.42 ÷ 15

    (g) ₹ 9046.75 ÷ 25

    (h) ₹ 10456.32 ÷ 8

    (i) ₹ 45867.45 ÷ 5

3 If the cost of 1 L pepsi is ₹ 65.75, find the cost of 8 L of pepsi.

4 The monthly income of Aman is ₹ 45750.84. What is his annual income ?

5 If 12 notebooks cost ₹ 315.72, find the cost of each notebook.

6 The price of 15 movie tickets is ₹ 1802.25. Find the price of each movie ticket.

7 The cost of one bag is ₹ 1026.65. Find the cost of 25 such bags.

To measure time we use various units such as seconds, minutes, hours, days, weeks, months, years, etc.

$$1 \text{ year} = 365 \text{ days (Leap year has 366 days)}$$
$$1 \text{ month} = 30/31 \text{ days except February}$$
$$1 \text{ week} = 7 \text{ days}$$
$$1 \text{ day} = 24 \text{ hours}$$
$$1 \text{ hour} = 60 \text{ minutes}$$
$$1 \text{ minute} = 60 \text{ seconds}$$

20.1 CONVERSIONS OF UNITS OF TIME

- **Conversion of minutes into seconds :**

  1 minute = 60 seconds

  Therefore to convert minutes into seconds, we multiply the minutes by 60.

EXAMPLE 1   Convert 6 minutes 16 seconds into seconds.

Solution :

6 minutes 16 seconds

$$= 6 \text{ minutes} + 16 \text{ seconds}$$
$$= 6 \times 60 \text{ seconds} + 16 \text{ seconds}$$
$$= 360 \text{ seconds} + 16 \text{ seconds}$$
$$= 376 \text{ seconds}$$

- **Conversion of hours into minutes :**

  1 hour = 60 minutes

  Therefore to convert hours into minutes, we multiply the hours by 60.

EXAMPLE 2   Convert 4 hours 25 minutes into minutes.

Solution :

4 hours 25 minutes

$$= 4 \text{ hours} + 25 \text{ minutes}$$
$$= (4 \times 60) \text{ minutes} + 25 \text{ minutes}$$
$$= 240 \text{ minutes} + 25 \text{ minutes}$$
$$= 265 \text{ minutes}$$

- **Conversion of days into hours :**

    1 day = 24 hours

    Therefore to convert days into hours, we multiply the days by 24.

EXAMPLE 3   Convert 30 days 10 hours into hours.

Solution :

    30 days 10 hours

            = 30 days + 10 hours

            = (30 × 24) hours + 10 hours

            = 720 hours + 10 hours

            = 730 hours

- **Conversion of weeks into days :**

    1 week = 7 days

    Therefore to convert weeks into days, we multiply the weeks by 7.

EXAMPLE 4   Convert 16 weeks 4 days into days.

Solution :

    16 weeks 4 days

            = 16 weeks + 4 days

            = (16 × 7) days + 4 days

            = 112 days + 4 days

            = 116 days

- **Conversion of years into months :**

    1 year = 12 months

    Therefore to convert years into months, we multiply the years by 12.

EXAMPLE 5   Convert 6 years 3 months into months.

Solution :

    6 years 3 months

            = 6 years + 3 months

            = (6 × 12) months + 3 months

            = 72 months + 3 months

            = 75 months

- **Conversion of seconds into minutes :**

    60 seconds = 1 minute

    Therefore to convert seconds into minutes, we divide the seconds by 60. Quotient gives the minutes and remainder gives the seconds.

EXAMPLE 6   Convert 772 seconds into minutes.

Solution :

772 seconds

    = (772 ÷ 60) minutes

    = 12 minutes 52 seconds

```
        12 ← minutes
   60 ) 772 (
      – 60
       172
      –120
        52 ← seconds
```

• **Conversion of minutes into hours :**

60 minutes = 1 hour

Therefore to convert minutes into hours, we divide the minutes by 60. Quotient gives the hours and remainder gives the minutes.

EXAMPLE 7   Convert 854 minutes into hours.

Solution :

854 minutes

    = (854 ÷ 60) hours

    = 14 hours 14 minutes

```
        14 ← hours
   60 ) 854 (
      – 60
       254
      –240
        14 ← minutes
```

• **Conversion of hours into days :**

24 hours = 1 day

Therefore to convert hours into days, we divide the hours by 24. Quotient gives the days and remainder gives the hours.

EXAMPLE 8   Convert 320 hours into days.

Solution :

320 hours

    = (320 ÷ 24) days

    = 13 days 8 hours

```
        13 ← days
   24 ) 320 (
      – 24
        80
      – 72
         8 ← hours
```

• **Conversion of days into week :**

7 days = 1 week

Therefore to convert days into weeks, we divide the days by 7. Quotient gives the weeks and remainder gives the days.

EXAMPLE 9   Convert 312 days into weeks.

Solution :

312 days

    = (312 ÷ 7) weeks

    = 44 weeks 4 days

```
        44 ← weeks
   7 ) 312 (
      – 28
        32
      – 28
         4 ← days
```

- **Conversion of months into years :**

12 months = 1 year

Therefore to convert months into years, we divide the months by 12. Quotient gives the years and remainder gives the months.

EXAMPLE 10 Convert 76 months into years.

Solution :

76 months = (76 ÷ 12) years

          = 6 years 4 months

$$\begin{array}{r} 6 \leftarrow \text{years} \\ 12\overline{)76} \\ -72 \\ \hline 4 \leftarrow \text{months} \end{array}$$

EXAMPLE 11 Convert 2 weeks into hours.

Solution :

2 weeks = (2 × 7) days

       = 14 days

       = (14 × 24) hours

       = 336 hours

EXERCISE 20(A)

1 Convert :
   (a) 15 hours into minutes.
   (b) 9 hours 56 minutes into minutes.
   (c) 36 minutes into seconds.
   (d) 12 minutes 28 seconds into seconds.
   (e) 5 days into hours.
   (f) 12 days 9 hours into hours.
   (g) 11 hours 45 minutes into minutes.

2 Convert :
   (a) 5 years 9 months into months.
   (b) 9 weeks into days.
   (c) 12 weeks 15 days into days.
   (d) 7 weeks into hours.
   (e) 12 weeks 10 hours into hours.
   (f) 2 years 10 months into months.
   (g) 3 days 5 hours 30 minutes into minutes.

3 Convert :
   (a) 1 day into seconds.
   (b) 5 weeks into seconds.
   (c) 2 months into seconds.

4 Convert :
   (a) 812 seconds into minutes and seconds.
   (b) 924 minutes into hours and minutes.
   (c) 105 hours into days and hours.

(d) 745 hours into days and hours.

(e) 1024 minutes into hours and minutes.

5 Convert :

(a) 512 days into weeks and days.   (b) 365 days into weeks and days.

(c) 52 months into years and months. (d) 86 months into years and months.

(e) 342 days into months and days.   (f) 784 days into months and days.

6 Convert :

(a) 16 hours 600 seconds into minutes.

(b) 9 hours 360 seconds into minutes.

(c) 2 days 180 minutes into hours.

(d) 9 days 420 minutes into hours.

20.2 USE OF A.M. AND P.M.

- Between 12 midnight to 12 noon, the time is written using suffix A.M. or a.m.
- Between 12 noon to 12 midnight, the time is written using suffix P.M. or p.m.
- 12 o'clock at night is written as 12 midnight.
- 12 o'clock at day time is written as 12 noon.

    e.g.   (a) 10 o'clock in the morning is written as — 10:00 a.m.

           (b) 10 o'clock at night is written as — 10:00 p.m.

Conversion of 12 hour clock time into 24 hour clock time

- If the time is in a.m., first replace a.m. by hours.
- If the time is in p.m., then add 12 to the given time and replace p.m. by hours.

EXAMPLE 1   Change 7:20 a.m. to 24 hour clock time.

Solution :

$$7:20 \text{ a.m.} = 07:20 \text{ hours}$$

EXAMPLE 2   Change 7:20 p.m. to 24 hour clock time.

Solution :

$$7:20 \text{ p.m.} = (7:20 + 12:00) \text{ hours}$$
$$= 19:20 \text{ hours}$$

Conversion of 24 hour clock time into 12 hour clock time

- If the given hours are less than 12 then just replace hours by a.m.
- If the given hours are more than 12, then subtract 12 from the given time and replace hour by p.m.

EXAMPLE 3   Change 07:00 hours to a 12 hour clock time.

Solution :

$$07:00 \text{ hours} = 7:00 \text{ a.m.}$$

EXAMPLE 4   Change 18:10 hours to 12 hour clock time.

Solution :

$$18:10 \text{ hours} = (18:10 - 12:00) \text{ p.m.}$$
$$= 6:10 \text{ p.m.}$$

EXERCISE 20(B)

1 Change into 24 hour clock time.

   (a) 7:50 p.m.   (b) 5:00 a.m.   (c) 12 midnight   (d) 8:45 a.m.

   (e) 2:20 p.m.   (f) 4:40 p.m.   (g) 9:35 a.m.   (h) 6:30 a.m.

   (i) 7:20 p.m.   (j) 12:00 noon   (k) 3:15 p.m.   (l) 5:25 a.m.

2 Change into 12 hour clock time.

   (a) 16:30 hours (b) 23:50 hours   (c) 10:45 hours (d) 18:15 hours

   (e) 12:00 hours (f) 00:00 hours   (g) 05:00 hours (h) 16:00 hours

   (i) 03:00 hours (j) 17:10 hours   (k) 08:15 hours (l) 15:30 hours

3 A train reached at New Delhi railway station at 4:45 p.m. What is the time in a 24 hour clock ?

4 Rahul comes back from school at 14:30 hours. What is the time in a 12 hour clock ?

20.3 ADDITION AND SUBTRACTION OF TIME

Follow the given steps for addition and subtraction of time given in hours, minutes and seconds.

- Arrange hours, minutes and seconds in different columns and add or subtract as usual.

- If sum of minutes or seconds is more than 60, then regroup because 60 minutes = 1 hour and 60 seconds = 1 minute.

- In case of subtraction, if we borrow 1 hour, it will become 60 minutes and if we borrow 1 minute, it will become 60 seconds.

EXAMPLE 1   Add 15 hours 12 minutes and 11 hours 25 minutes.

Solution :

  Step 1 : Write the given hours and minutes in different columns.

		Hours	Minutes
Step 2 : Add the minutes.			
12 minutes + 25 minutes = 37 minutes			
Step 3 : Add the hours.		15	12
15 hours + 11 hours = 26 hours		+ 11	25
Thus, 15 hours 12 minutes + 11 hours 25 minutes		26	37
= 26 hours 37 minutes			**Ans.**

EXAMPLE 2   Add 14 minutes 40 seconds and 23 minutes 34 seconds.

Solution :

		Minutes	Seconds
Step 1 : Write the given minutes and seconds in different columns.		14	40
		+ 23	34
Step 2 : Add the seconds.		37	74
40 seconds + 34 seconds		+ 1	− 60
= 74 seconds		38	14
= 60 seconds + 14 seconds			
= 1 minute + 14 seconds			

Write 14 in seconds column and carry over 1 to minutes column.

Step 3 : Add the minutes.

[14 + 23 + 1 (carry over)] minutes = 38 minutes.

Thus, 14 minutes 40 seconds + 23 minutes 34 seconds

= 38 minutes 14 seconds.   **Ans.**

EXAMPLE 3   A train leaves Delhi at 10:40 a.m. and takes 6 hours 10 minutes to reach Allahabad. At what time does it reach Allahabad ?

Solution :

		Hours	Minutes
Step 1 : Change the starting time to 24 hour clock time, which is 10:40 hours.		10	40
Step 2 : Add the time taken by the train to the starting time		+ 6	10
		16	50
10 hours 40 minutes + 6 hours 10 minutes			
= 16 hours 50 minutes			
= 16:50 hours			

Step 3 : Change the time to 12 hours clock time

16:50 − 12 = 4:50 p.m.

Thus, the train reaches Allahabad at 4:50 p.m.   **Ans.**

EXAMPLE 4   Add 12 years 10 months and 16 years 8 months.

Solution :

	Years	Months
	12	10
+	16	8
	28	18
+	1	– 12
	29	6

Step 1 : Write the given years and months in separate columns.

Step 2 : Add the months.

10 months + 8 months = 18 months

= 12 months + 6 months

= 1 year + 6 months

Write 6 in months column and carry over 1 to year column.

Step 3 : Add the years.

[12 + 16 + 1 (carry over)] years = 29 years

Thus, 12 years 10 months + 16 years 8 months

= 29 years 6 months   **Ans.**

EXAMPLE 5   Subtract 23 hours 42 minutes from 36 hours 7 minutes.

Solution :

	Hours	Minutes
	35	67
	36	07
–	23	42
	12	25

Step 1 : Arrange the given hours and minutes in different columns.

Step 2 : Subtract the minutes.

But, 07 minutes < 42 minutes, so we need to regroup.

36 hours 07 minutes = 35 hours 60 minutes + 07 minutes

= 35 hours 67 minutes

Now, subtract 42 minutes from 67 minutes

67 minutes – 42 minutes = 25 minutes

Write 25 in minutes column.

Step 3 : Subtract the hours.

35 hours – 23 hours = 12 hours.

Thus, 36 hours 07 minutes – 23 hours 42 minutes

= 12 hours 25 minutes   **Ans.**

EXAMPLE 6   Subtract 14 years 9 months from 27 years.

Solution :

Step 1 : Arrange the given years and months in different columns.

Step 2 : Subtract the months.

But 00 months < 09 months, so we need to regroup.

27 years = 26 years 12 months

Now, subtract the months

12 months − 9 months = 3 months.

Years	Months
26	12
~~27~~	~~00~~
− 14	09
12	03

Step 3 : Subtract the years.

26 years − 14 years = 12 years.

Thus, 27 years − 14 years 9 months = 12 years 3 months   **Ans.**

EXAMPLE 7   What was the time 3 hours 45 minutes before 2:20 p.m. ?

Solution :

Step 1 : Convert the given time into 24 hour clock time; 2:20 p.m. = 14:20 hours.

Step 2 : Subtract 3 hours 45 minutes from 14:20 hours.

Step 3 : Subtract the minutes.

Hours	Minutes
13	80
~~14~~	~~20~~
− 3	45
10	35

But 20 minutes < 45 minutes.

So, we need to regroup.

14 hours 20 minutes = 13 hours 60 minutes + 20 minutes

= 13 hours 80 minutes

Now, subtract minutes. 80 minutes − 45 minutes = 35 minutes

Write 35 in minutes column.

Step 4 : Subtract the hours.13 hours − 3 hours = 10 hours

Step 5 : Required time is 10:35 hours = 10:35 a.m.   **Ans.**

Note :   To calculate the duration of an event, we subtract the time of start of the event from the time at which it ends.

EXAMPLE 8   Akash goes to school at 7:30 a.m. and returns home at 2:40 p.m. For how long does Akash remain outside his house ?

Solution :

Step 1 : Change the time to 24 hour clock time

7:30 a.m. = 07:30 hours

2:40 p.m. = 14:40 hours

Hours	Minutes
14	40
− 7	30
7	10

Step 2 : Subtract the time at which he leaves for school from the time at which he reaches back home

14 : 40 hours − 7 :30 hours = 7:10 hours

= 7 hours 10 minutes

Thus, Akash remains outside his house for 7 hours 10 minutes. **Ans.**

EXERCISE 20(C)

1 Add.

(a) 6 hours 20 minutes and 5 hours 36 minutes.

(b) 15 hours 35 minutes and 7 hours 45 minutes.

(c) 25 hours 44 minutes and 16 hours 36 minutes.

(d) 7 minutes 25 seconds and 12 minutes 18 seconds.

(e) 16 minutes 29 seconds and 20 minutes 45 seconds.

(f) 28 minutes 46 seconds and 15 minutes 32 seconds.

(g) 2 hours 40 minutes, 5 hours 30 minutes, 7 hours 50 minutes.

2 Add.

(a) 15 years 4 months and 20 years 2 months.

(b) 12 years 6 months and 21 years 8 months.

(c) 10 years 8 months and 6 years 4 months.

3 Subtract.

(a) 5 days 12 hours from 7 days 18 hours.

(b) 7 days 19 hours from 12 days 10 hours.

(c) 9 days 5 hours from 12 days.

(d) 5 weeks 9 days from 8 weeks 3 days.

(e) 9 hours 25 minutes from 11 hours 40 minutes.

(f) 3 hours 46 minutes from 5 hours 25 minutes.

(g) 10 hours 45 minutes from 22 hours.

(h) 12 minutes 40 seconds from 17 minutes 54 seconds.

(i) 15 minutes 28 seconds from 22 minutes 13 seconds.

(j) 25 minutes 50 seconds from 32 minutes.

(k) 12 years 9 months from 15 years 11 months.

(l) 8 years 11 months from 15 years 5 months.

(m) 12 years 10 months from 20 years.

4 (a) What is the time 2 hours 25 minutes before 9:10 p.m. ?

(b) What is the time 5 hours after 10 p.m. ?

(c) What time was it 4 hours 25 minutes before 4 : 35 p.m. ?

(d) What time will it be 5 hours after 8:30 p.m. ?

(e) What time will it be 2 hours 25 minutes after 6:40 p.m. ?

5 Find the time interval between 6:15 a.m. and 4:10 p.m.

6 Find the time interval from 9:45 a.m. to 2:30 p.m.

7 Simran started for morning walk at 5:50 a.m. She came back at 7:00 a.m. For how long did she walk ?

8 A train leaves Delhi for Kolkata at 6:40 a.m. in the morning. It takes 16 hours 50 minutes to reach Kolkata. At what time will the train reach Kolkata ? Give the answer in a.m./p.m.

9 Sandhya's school starts at 7:30 a.m. and ends at 13:00 hours. Find the total working hours of her school.

20.4 TIME TABLE

Introduction

Look at the time-table displayed in your classroom. It gives details of the periods – the days on which they are scheduled, the time at which a particular period starts, the time at which it ends, and the subject you are going to study in that period.

Apart from the time-table displayed in the classroom, there are other kinds of time-tables also. If we go to a railway station, an inter-state bus terminal, or an airport, we find time-tables showing the arrival and departure timings, the source and destination states, etc.

Facts to remember when referring to time tables

- Note carefully the name and number of the train/bus/aeroplane.
- Check the arrival and departure timings accurately.
- Note carefully the days on which the train/bus/aeroplane operates.

20.5 RAILWAY TIME-TABLE

If we visit a railway station, we will notice that there are two separate time-tables. One time-table gives details about the trains departing from the station. The second time-table gives details about the trains arriving at the station.

But if we wish to know more details regarding the in–between stations, distance covered, time taken, etc. we have to consult the Railway Time-Table. This time table, which is in the form of a book, gives complete details of the trains running throughout the

country in the form of tables. A specimen of Table No. 90 taken from 'Trains at a Glance' is given below.

Let us see what information it conveys to us.

1. The first two horizontal rows give the names of the trains and their numbers. The first six vertical columns show the time of the six different trains running between the two cities and the time at which they arrive and depart from the in-between stations.

Specimen of Table No. 90 From Danapur to Katihar

Patna Saharsa Raiya Rani Express	Anand Vihar (T) Jaynagar Garib Rath Express	Patna Katihar Intercity Express	Barauni Saharsa Express	Danapur Saharsa Link Express	Danapur Jaynagar Express	↓ TRAIN NAME ↑			Jaynagar Danapur Express	Saharsa Danapur Link Express	Saharsa Barauni Express	Katihar Patna Intercity Express	Jaynagar Anand Vihar (T) Garib Rath Express	Saharsa Patna Raiya Rani Express
12568*	12570	15714	15276	23226#	13226#	Train Number			13225#	23225#	15275	15713	12569	12567*
CC,2SII	3A	CC II	II	CC II	CC II	Class of accommodation			CC II	CC II	II	CC II	3A II	CC,2S,II
Daily	Tu, Sa	Except Su	Daily	Except Su	Except Su	Days of Operation			Except Su	Except Su	Daily	Except Su	Tu, Sa	Daily
						Km	Dep.	Arr.						
	05.25			06.45	06.45	120	d Danapur a		20.40	20.40				19.32
12.45	05.55 06.05	14.15		07.05 07.15	07.05 07.15	110	a Patna d	d a	19.45 19.35	19.45 19.35		12.40	19.15 19.05	11.00
... ...	08.50 09.00	16.40 16.45	03.45	10.15 10.35	10.15 10.35	0	a Barauni d	d a	16.50 16.05	16.50 16.05	21.15	10.13 10.08	16.35 16.25	... ...
	10.10				11.48	51	d Samastipur d		14.55				15.30	
	11.10 11.15				12.45 12.55	99	a Darbhanga d	d a	13.25 13.15				13.50 13.45	
	13.30				15.00		a Jaynagar d		10.45				12.10	
							d Darbhanga d							
							d Samastipur d							
15.50		18.05	05.04	11.58		56	d Khagaria d			14.33	19.43	09.05		07.58
16.45			06.50	13.45		108	a Saharsa d			12.50	18.00			07.00
		21.35				172	a Katihar d					06.10		

2. The seventh vertical column tells us the following :

   (i) The distance between the two stations in kilometres.

   (ii) The arrival (a) and departure (d) time of the train at a particular station and

   (iii) The stations that the train covers.

   The interval between the arrival and departure time at a particular station is the halt time at that particular station.

   The eleventh to sixteenth vertical columns are respectively the same as the first six vertical columns, giving details of the return journey of the same trains.

3. The arrow (↑) pointing upwards indicates that the trains are coming from the stations mentioned below whereas the downward arrow (↓) indicates that the trains will be going towards the stations mentioned below.

4. The stations at which only '**a**' is mentioned indicates that the train terminates at that station. The stations at which only '**d**' is mentioned indicates that this station is the starting point of the train.

Table No. 19 — Mumbai - Pune - Kolhapur — Table No. 19A

313 Indrayani Exp.	301 Deccan Queen	305 Deccan Exp.	309 Sinhagad Exp.	303 Mahalaxmi Exp.	311 Sahyadhri Exp.	307 Koyana Exp.	KM	↓	STATIONS	↑	308 Koyana Exp.	304 Mahalaxmi Exp.	312 Sahyadhri Exp.	310 Sinhagad Exp.	306 Deccan Exp.	302 Deccan Queen	314 Indrayani Exp.
6.00	17.10	6.45	14.35	17.50	20.25	8.45	0	d	Mumbai	a	21.15	12.05	8.20	10.15	19.45	10.40	22.15
6.12	—	6.57	14.50	18.03	20.40	8.59	9	a	Dadar	d	20.50	11.45	7.58	9.58	19.25	10.25	21.55
6.15	—	7.02	14.55	18.08	20.45	9.04		d		a	20.45	11.40	7.50	9.55	19.20	10.23	21.53
—	—	7.47	15.40	19.00	21.35	9.58	52	a	Kalyan	d	19.55	10.55	7.05	9.07	18.30	—	—
—	—	7.52	15.45	19.05	21.55	10.03		d		a	19.45	10.50	8.55	9.05	18.25	—	—
8.15	19.22	9.50	17.40	20.48	23.35	11.50	128	d	Lonavla	a	17.40	8.45	5.00	7.20	16.23	8.10	19.40
9.25	20.35	11.15	19.05	22.25	1.00	13.30	192	a	Pune	d	16.30	7.25	4.00	8.05	15.15	7.15	18.45
				22.45	1.20	13.50		d		a	16.05	8.55	3.40				
				1.50	3.50	16.50	335	a	Satara	d	12.15	1.55	23.52				
				1.55	3.52	16.55		d		a	12.10	1.45	23.50				
				4.25	5.47	19.35	464	a	Sangli	d	9.45	22.59	21.44				
				4.30	5.50	19.40		d		a	9.40	22.56	21.41				
				5.00	6.30	20.00	472	a	Miraj	d	9.25	22.45	21.30				
				5.15	6.45	20.25		d		a	9.10	22.15	21.15				
				6.45	7.55	21.55	520	a	Kolhapur	d	8.00	21.00	20.00				

Study the above table and answer the following questions :

1 What is the distance between Mumbai and Pune?

2 Which trains will you take to travel from Mumbai to Miraj?

3 How many trains are available to travel from Kolhapur to Kalyan?

4 Which is the fastest train from Kolhapur to Satara?

5 How long does the 303 Mahalaxmi Express halt at Sangli?

6 At what time does Deccan Queen leave Pune for Mumbai?

7 Which of the two trains, '301 Deccan Queen' or '305 Deccan Express', takes more time to travel between Mumbai and Pune?

Solution :

1 The distance between Mumbai and Pune is 192 km.

2 To go to Miraj from Mumbai, we can take Mahalaxmi Express, Sahyadhri Express and Koyana Express.

3 There are 3 trains available from Kolhapur to Kalyan.

4 Sahyadhri Express is the fastest train available to travel from Kolhapur to Satara.

5 Mahalaxmi Express halts at Sangli for 5 minutes.

6 The Deccan Queen leaves Pune at 7.15 A.M. for Mumbai.

7 Train No. 301 Deccan Queen is faster than 305 Deccan Express.

EXERCISE 20(D)

Study the following table and answer the questions that follow.

Table No. 32 – 32A

From Puri to New Delhi via Bhubaneswar, Kharagpur, Gaya, Kanpur

Bhuba-neswar New Delhi Rajdhani Express	Puri New Delhi Puru-shotttam Express	Puri New Delhi Express	Puri New Delhi Neelachal Express	Km	d/a	↓ TRAIN NAME ↑	a/d	New Delhi Puri Neelachal Express	New Delhi Puri Purushottam Express	New Delhi Puri Express	New Delhi Bhuba-neswar Rajdhani Express
2421	2801	2815	8475			Train Number		8476	2802	2816	2422
1A, 2A, 3A P	2A, 3A SL, II, P	2A, 3A SL, II, P	2A, 3A SL, II, P			Class of Accomodation		2A, 3A SL, II, P	2A, 3A FC, SL, II	2A, 3A SL, II, P	1A, 2A, 3A P
W, Su	Daily	M.W. Th. Sa	Tu, F, Su		Dep.	Days of operation Arr.		W, Sa, N	Daily	Tu, Th, F, Su	Tu, Sa
	20.15	09.05	09.05	Km	d	**Puri**	a	18.50	06.45	14.30	
	21.20	10.10	10.10	44	d	Khurda Road	d	17.25	05.30	13.20	
09.10	21.40 / 21.47	10.35 / 10.42	10.35 / 10.42	63	a / d	**Bhubaneswar**	d / a	16.40 / 16.30	04.22 / 04.15	12.13 / 12.05	18.25
09.42	22.25	11.20	11.20	91	d	Cuttack	d	16.00	03.42	11.20	17.25
....	23.40	12.33	12.33		d	Jaipur Keonjhar Road	d	14.25	02.22	09.45	
....	00.47	13.37	13.37		d	Bhadrak	d	13.50	01.47	09.10	
12.32	01.45	14.30	14.30		d	Balasore	d	12.30	00.27	07.50	14.32
14.30 / 14.32	03.45 / 04.00	16.35 / 16.50	16.40 / 16.55	384	a / d	Kharagpur	d / a	10.40 / 10.25	22.45 / 22.30	06.05 / 05.45	12.52 / 12.50
16.30 / 17.00					a / d	Howrah	d / a				11.05 / 10.45
		20.20		552	d	Adra	d			02.15	
19.13 / 19.24					a / d	Asansol	d / a				08.08 / 07.56
	06.15 / 06.25		19.10 / 19.20	519	a / d	Tatanagar	d / a	08.15 / 08.05	20.25 / 20.15		
			22.00	615	d	Muri	d	05.27			
	10.00 / 10.05		23.20 / 23.40	666	a / d	Bokaro Steel City	d / a	04.26 / 04.06	16.55 / 16.50		
....	11.10	23.05	00.53	632	d	Gomoh	d	03.06	16.10	00.15	
22.17	13.38	01.39	03.32	802	d	Gaya	d	23.50	13.10	21.06	04.32
00.43 / 00.55	16.40 / 17.05	04.35 / 04.50	06.30 / 06.50	1044	a / d	Mughal Sarai	d / a	21.10 / 20.50	10.10 / 09.55	18.15 / 18.00	02.34 / 02.22
			07.32 / 07.42	1061	a / d	Varanasi	d / a	20.10 / 19.55			
.... /	19.05 / 19.15	07.10 / 07.20		1196	a / d	Allahabad	d		07.40 / 07.30	15.25 / 15.15	
			13.00 / 13.25	1362	a / d	Lucknow	d / a	14.40 / 14.15			
04.57 / 05.02	21.40 / 21.50	10.05 / 10.15	14.55 / 15.05	1390	a / d	Kanpur	d / a	12.45 / 12.35	05.00 / 04.50	12.35 / 12.25	22.10 / 22.05
10.10	04.40	17.05	21.25	1825	a	**New Delhi**	d	6.30	22.35	06.30	17.15

1. What is the distance between Kanpur and Bhubaneswar?

2. What is the distance between Kharagpur and Mughal Sarai?

3. How long does it take to reach Varanasi from Kharagpur?

4. Which of the two trains, Neelanchal Express or Puri New Delhi Express, takes more time to travel between Puri and New Delhi?

5. How many trains are there from Puri to New Delhi?

6. What is the halting time of Puri New Delhi Express at Allahabad?

7. What is the train no. of Bhubaneswar New Delhi Rajdhani Express?

20.6 BUS TIME-TABLE

Have you ever gone to a bus terminals ? Let us see how the buses operate their services.

Buses plying under State roadways operate from Bus terminals. For the convenience of passengers, the timings of departure and arrival of various buses are displayed on a big board at bus terminals. Besides the timings of departure and arrival of various buses, the routes of various buses and passenger fare for each route are also indicated.

Given below is a specimen of a bus time-table of the Haryana Roadways. It is displayed at the Inter-State Bus Terminal, Delhi.

Haryana Roadways – Bus Time-Table

Route	Dep. Time from Delhi	Dep. time from other direction	Distance (in Km)	Fare (in ₹)
Delhi-Ballabhgarh	0715, 2115		46	5.00
Delhi-Hodel	1110, 1330	1430, 1735	92	10.00
Delhi-Kurukshetra	0808	1510	164	20.50
Delhi-Panipat	0610, 0730	0735, 0836	88	10.50
	1010, 1100	1030, 1310		
	1315, 1630	1400, 1655		
Delhi-Rewari	0658, 0940	1228, 1425	97	10.50
Delhi-Yamuna Nagar	0713, 0852	1230, 1450	191	22.00
Delhi-Faridabad	0500 to 2130 (10 mts frequency)		40	4.00
Delhi-Jind	0715, 0815	1221, 1235	146	16.00

Read the bus time-table given below and answer the questions that follow:

Himachal Pradesh Roadways – Bus Time-Table

Route	Dep. Time from Delhi	Dep. time from other direction	Distance (in Km)	Fare (in ₹)
Delhi-Baijnath	1745, 1820	1630, 1730	550	214.00
Delhi-Manali	1615	2000	597	247.00
Delhi-Dharamshala	2745	1830	525	201.50
Delhi-Hamirpur	2000	1900	473	182.00
Delhi-Mandi	0525	0600	485	192.00
Delhi-Shimla	0721, 0905	0646, 0923	384	150.75

1. What is the title of the bus time-table?

2. How many routes are listed in the time-table?

3. At what time does the bus for Mandi leave Delhi ?

4. At what time does the bus for Delhi leave Manali ?

5. How far is Shimla from Delhi?

6. What is the passenger fare for Delhi-Hamirpur?

Solution :

1. The title of the bus time-table is 'Himachal Pradesh Roadways Bus Time-Table'.

2. There are 6 routes listed in the time-table.

3. The bus for Mandi leaves Delhi at 0525 *i.e.* 5:25 a.m.

4. The bus for Delhi leaves Manali at 20:00 hours hours, *i.e.* 8:00 p.m.

5. Shimla is at a distance of 384 km from Delhi.

6. The fare for Delhi-Hamirpur is ₹ 182.00.

EXERCISE 20(E)

Read the bus time-table given below and answer the questions that follow:

Punjab Roadways – Bus Time-Table

Route	Dep. Time from Delhi	Dep. time from other direction	Distance (in Km)	Fare (in ₹)
Delhi-Amritsar	1635, 2100	1610, 2020	469	56.50
Delhi-Bhatinda	0640	0600	425	48.00
Delhi-Banga	0949	0830	360	44.50
Delhi-Batala	1037	0745	307	38.50
Delhi-Chandigarh	1006, 1130, 1340, 1800	0707, 0900, 1740, 1820	256	33.50
Delhi-Dhuri	1200	0500	319	36.00
Delhi-Hoshiarpur	2015	2020	402	45.00
Delhi-Jammu	0710, 0810	0555, 0640	617	71.00
Delhi-Kapurthala	1450	0435	408	46.00
Delhi-Ludhiana	1450	0500	317	40.00
Delhi-Patiala	1130, 1445	0650, 1850	254	33.50

1 How many buses are there during the day for Chandigarh?

2 At what time is the first bus available at Delhi for Jammu?

3 How far is Batala from Delhi ?

4 What is the distance between:

(a) Delhi-Ludhiana   (b) Delhi-Bhatinda   (c) Delhi-Amritsar ?

Information collected in the form of numerical figures is called **data**. Often the figures in themselves may not be so effective to bring out comparison. However, if we have pictorial representation of data, they can be better understood and remembered.

We can represent data in four different ways :

1. Picture graph or pictograph
2. Bar graph
3. Pie chart
4. Line graph

1. PICTOGRAPH

In a **pictograph**, a symbol is used to represent one or more objects of the data according to the scale/key selected.

A pictograph representing number of students who appeared in the class XII board examination in a year from different State Boards is given below.

Board A	👤👤
B	👤👤👤
C	👤👤👤👤👤
D	👤👤👤👤👤👤👤
E	👤👤👤👤
F	👤👤👤👤👤👤👤
G	👤👤👤👤👤

Key = Picture of one person = 1 lakh students.

From the pictograph we know that in the class XII Examination :

- 2 lakh students appeared from Board A
- 3 lakh students from Board B
- 5 lakh students from Board C
- 7 lakh students from Board D
- 4 lakh students from Board E
- 7 lakh students from Board F
- 5 lakh students from Board G

EXAMPLE 1

The pictograph given below shows the number of visitors who visited a planetarium from Monday to Friday.

Monday	Tuesday	Wednesday	Thursday	Friday
2,000	2,200	1,800	2,400	3,000

Scale = ✡ = 400 persons

△ = 200 persons

Day	Visitors to the planetarium
Monday	✡ ✡ ✡ ✡ ✡
Tuesday	✡ ✡ ✡ ✡ ✡ △
Wednesday	✡ ✡ ✡ ✡ △
Thursday	✡ ✡ ✡ ✡ ✡ ✡
Friday	✡ ✡ ✡ ✡ ✡ ✡ ✡ △

Answer the following questions :

(a) On which day did the maximum number of visitors visit the planetarium and what was the number ?

(b) On which day did the least number of visitors visit the planetarium and what was the number ?

(c) How many visitors visited the planetarium during the week ?

Solution :

From the pictograph, we know that

(a) Maximum number of visitors, 3000 visitors, visited the planetarium on Friday.

(b) Least number of visitors, 1800 visitors, visited the planetarium on Wednesday.

(c) During the week, 11400 visitors visited the planetarium.

1 The arrival of passengers in different time intervals on a particular day at a Railway Station is depicted in the pictograph given below.

(a) Find out the peak hours.

(b) In which time interval was the arrival of passengers the least ?

(c) In which time interval was the arrival of passengers less than 8000 ?

(d) What is the difference between the maximum and minimum number of passengers arrived ?

(e) How many passengers arrived on that day ?

Time interval (Hours)	Number of passengers arrived
00-04	옷옷옷옷옷
04-08	옷옷옷옷옷옷옷옷옷옷옷옷
08-12	옷옷옷옷옷옷옷옷옷옷옷丂
12-16	옷옷옷옷옷옷옷옷
16-20	옷옷옷옷옷옷옷옷옷丂
20-24	옷옷옷옷옷옷옷

Scale = 옷 1000 persons
= 丂 500 persons

2 The pictograph given below gives the weekly sale of milk from a Mother Dairy outlet in Delhi.

(a) Calculate the total milk sold during the week. If it costs ₹ 32 per litre, calculate the weekly sale.

(b) On which day was the sale maximum ?

(c) What was the sale on Wednesday ?

(d) On which two days was the sale minimum ?

Days	Sales
Sunday	🍼 🍼 🍼 🍼 🍼
Monday	🍼 🍼 🍼 🍼
Tuesday	🍼 🍼 🍼 ⌷
Wednesday	🍼 🍼 🍼 🍼 ⌷
Thursday	🍼 🍼 🍼 🍼 🍼 🍼
Friday	🍼 🍼 🍼 ⌷
Saturday	🍼 🍼 🍼 🍼

Scale = 🍼 100 litres
= ⌷ 50 litres

2. BAR GRAPH

For the representation of numerical data, bar graphs are drawn on a graph paper, by choosing a suitable scale. The bars are normally rectangular in shape having a standard width. A bar graph can be drawn horizontally (in rows) as well as vertically (in columns) called **horizontal bar graph** and **column bar graph** respectively.

Horizontal bar graph

Points to remember :

1. Draw first the horizontal and vertical axes.
2. Draw bars of equal width to represent the same items of the data.
3. The horizontal axis should be marked suitably according to the range of data.

EXAMPLES 1 Following is a horizontal bar graph representing number of people visiting a cinema hall on all seven days of the week.

scale 1 sq. cm = 400 persons
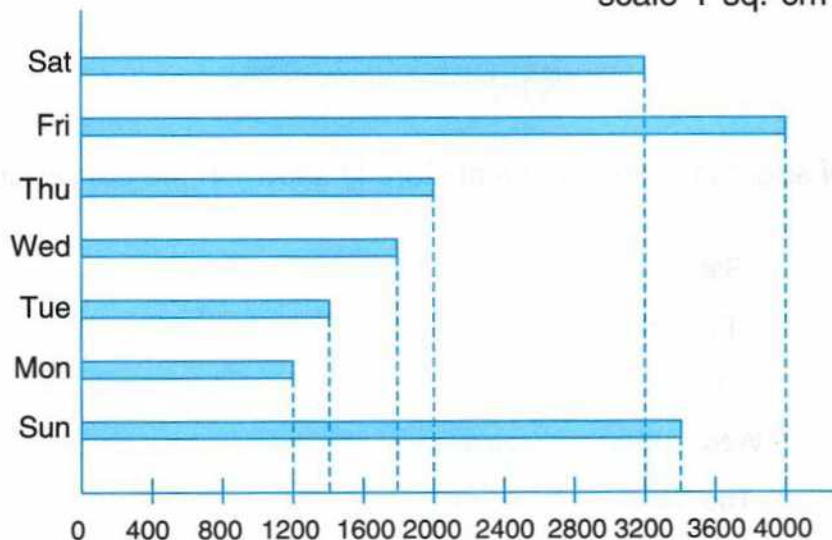
Column bar graph

The above data can be represented by a column bar graph too as shown below. Points to remember :

1. First draw the horizontal and vertical axes.

2. Draw columns of equal width to represent the same item.

3. The columns should be coloured/ shaded the same way.

4. The vertical axis should be marked suitably as per the range of the data.
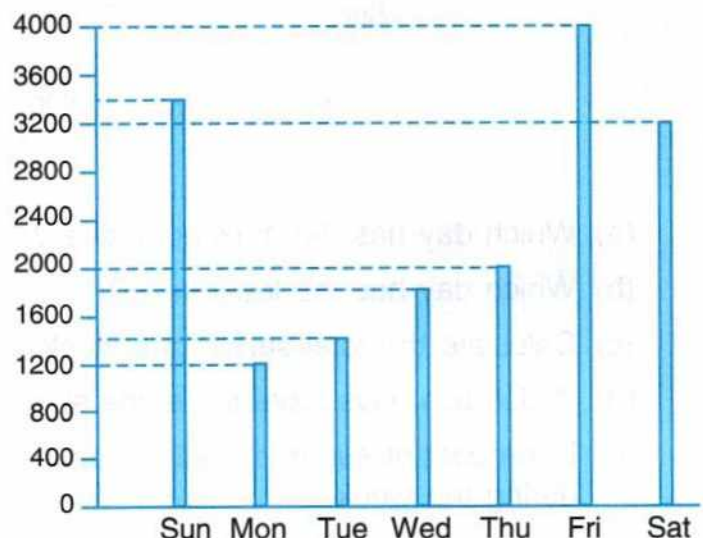
Answer the following questions :

    (a) On which day did the maximum number of people visit the cinema hall ? Mention the number.

    (b) On which day did the minimum number of people visit the cinema hall ? Mention the number.

    (c) How may people visited the cinema hall on Thursday ?

    (d) How many people visited the cinema hall during the entire week ?

Solution :

    (a) Maximum number of people, 4000, visited the cinema hall on Friday.

    (b) Minimum number of people, 1200, visited the cinema hall on Monday.

    (c) 2000 people visited the cinema hall on Thursday.

    (d) 17,000 people visited the cinema hall during the week.

EXERCISE 21(B)

1 Daily sale of sugar in a departmental store is shown in the bar graph below.
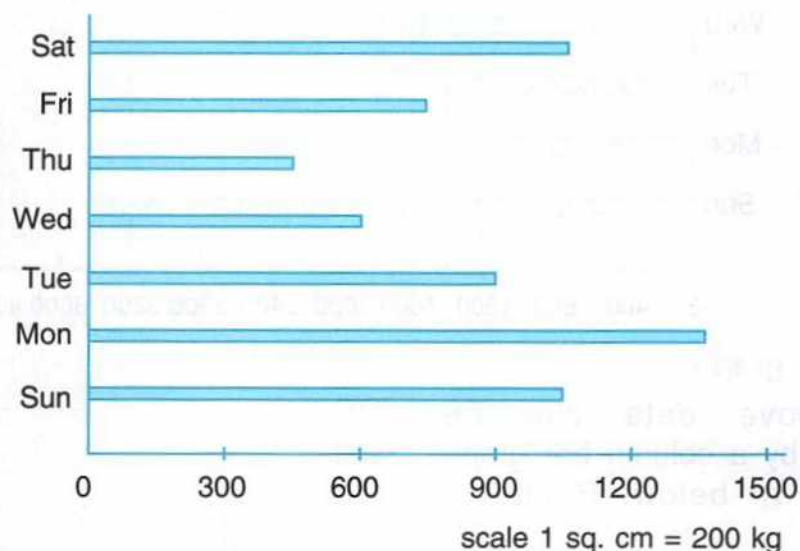
scale 1 sq. cm = 200 kg

    (a) Which day has the maximum sale ?

    (b) Which day has the least sale ?

    (c) Calculate the total sale of the week.

    (d) Which two days have the same sale ?

    (e) If the cost of sugar is ₹ 42 per kg, calculate the amount of money collected during the week.

2 In the bar graph below, sale of chocolates from a store for a week is shown.
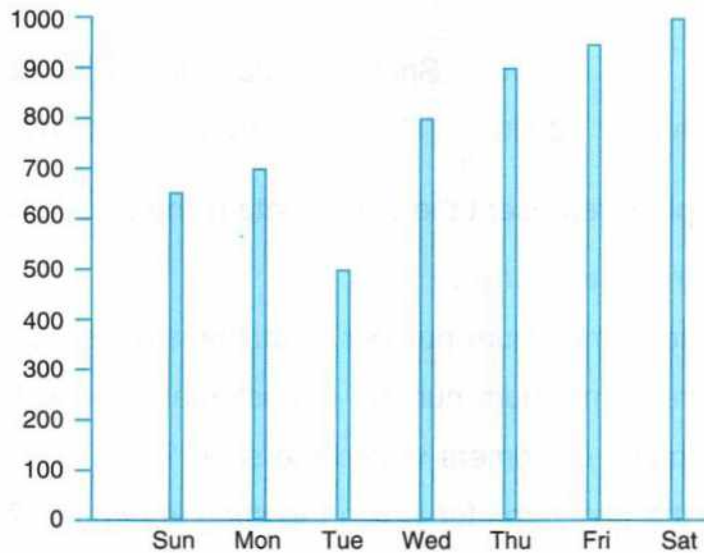
Scale : 1 sq. cm = 100 chocolates

(a) Which day has the maximum sale ?

(b) Which day has the least sale ?

(c) Calculate the total sale of the week.

(d) If the cost of a chocolate is ₹ 25, calculate the total amount collected.

3 A medical shop which opens for 24 hours has the following trend of customers' visit.

Time interval	No. of visitors
From Midnight to 4 a.m.	350
4 a.m. to 8 a.m.	200
8 a.m. to 12 noon	900
12 noon to 4 p.m.	1200
4 p.m. to 8 p.m.	800
8 p.m. to 12 midnight	1000

Draw a bar graph based on the above information. Take a suitable scale.

Answer the following questions :

(a) During which time interval did the maximum number of people visit the shop ?

(b) During which time interval did the minimum number of visit the shop ?

(c) How many visitors visited the medical shop in a day ?

(d) How many visitors visited the shop from 8 a.m. to 8 p.m. ?

4 Sale of few items in a departmental store is as per the details given below for a week.

Items	Food	Sports	Electronic	Clothes	Miscellaneous
No. of customers	2000	500	1500	2200	600

Draw a bar graph to represent the above data using a suitable scale.

Answer the following questions :

(a) For which item, maximum number of customers visited the shop ?

(b) For which item, minimum number of customers visited the shop ?

(c) In all, how many customers visited the shop ?

(d) Which are the two items for which the shop is popular ?

3. PIE CHART

An interesting way of representing data is the pie chart or the pie graph. Pie graphs are circular. Like a cake it can be divided into pieces or slices. Each slice shows a fraction of a total amount.

To draw a pie chart, follow the steps given below :

1. Using a compass, draw a circle of convenient size.

2. Draw a line from the centre to the circumference of the circle as a reference line.

3. Use a protractor to draw the angles required to divide the circle into proportional slices. Remember that the sum of all angles at the centre of the circle has to be 360°.

EXAMPLE 1   Draw a pie chart for the different games played by the students of a school as per the details given below.

S.No.	Games	No. of students
1.	Cricket	600
2.	Football	500
3.	Basket ball	300
4.	Hockey	300
5.	Tennis	100
		1800

We draw a table as follows :

S.No.	Game	No. of candidates	Degree value of slice
1.	Cricket	600	$360° \times \dfrac{600}{1800} = 120°$
2.	Football	500	$360° \times \dfrac{500}{1800} = 100°$
3.	Basket ball	300	$360° \times \dfrac{300}{1800} = 60°$
4.	Hockey	300	$360° \times \dfrac{300}{1800} = 60°$
5.	Tennis	100	$360° \times \dfrac{100}{1800} = 20°$

Now we place the protractor on the reference line and draw an angle of 120°. We shift the protractor to the 120° line and draw the next angle of 100°. Repeat the process till all the angles are drawn.
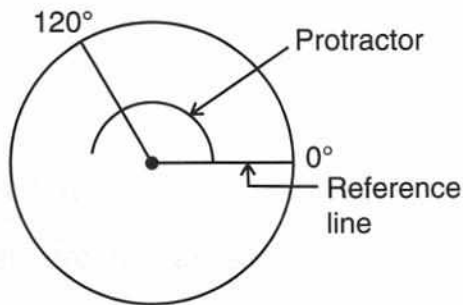
Label the pie chart as shown :
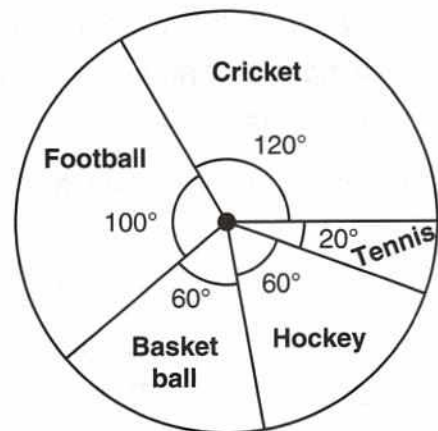
Answer the following questions :

    (a) Which is the most popular game ?

    (b) Which is the least popular game ?

    (c) Which two games have an equal number of participants ?

Solution :

    (a) Cricket is the most popular game.

    (b) Tennis is the least popular game.

    (c) Basketball and hockey have an equal number of participants.

1 Read the pie chart given alongside and answer the following questions :

    (a) On which day maximum books were sold ?

    (b) On which day minimum books were sold ?

    (c) What percentage of books were sold on Wednesday ?

    (d) What percentage of books were sold on Friday ?
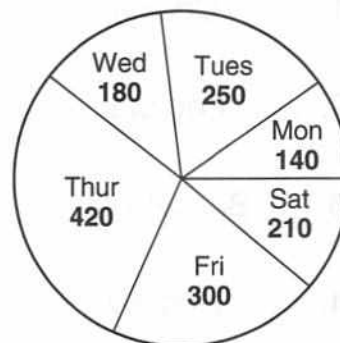
2 Draw a pie chart using the following information.

S.No.	Mode of transport	No. of students using each
1.	School transport	1500
2.	Public transport	500
3.	Own transport	400

Answer the following questions :

    (a) Which is the most popular mode of transport ?

    (b) What percentage of students come on their own ?

    (c) What percentage of students use public transport ?

3 In a class of 48 children, the favourite snacks used are as per the details given below.

S.No.	Snack item	No. of students
1.	Noodles	8
2.	Wafers	16
3.	Sandwiches	8
4.	Cakes	12
5.	Ice cream	4

Draw a pie-chart and answer the questions that follow :

    (a) Which is the most favourite snack ?

    (b) Which is the least favourite snack ?

    (c) What percentage of students prefer cakes ?

    (d) Which are the two items that are favoured by the same percentage of students ?

4. LINE GRAPH

Sometimes we can easily represent a given data by means of a line graph. It consists of a horizontal x-axis and a vertical y-axis and shows data regarding two inter-related parameters.

The data is displayed as a series of dots connected by straight lines. A line graph can be drawn on a squared paper.

Let us consider the line graph given alongside.

Time	Temperature (°C)
6 a.m.	20
9 a.m.	28
12 noon	32
3 p.m.	33
9 p.m.	30
12 midnight	25
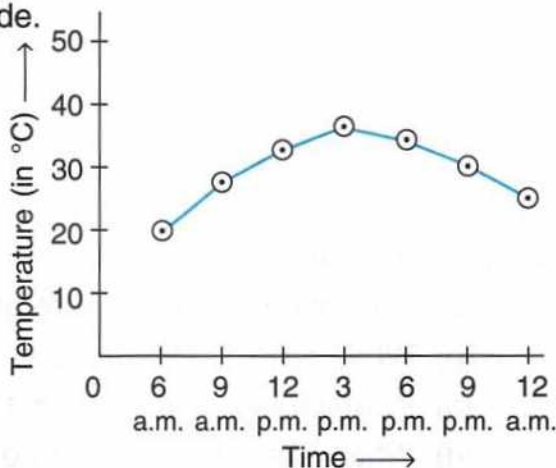
The graph has 2 axes :

Time is shown on x-axis and temperature is shown on y-axis.

The points on the line graph represent the data given in the table. The line graph thus shows the temperature fluctuations in a day.

An upward line ($\nearrow$) indicates increasing values.

A downward line ($\searrow$) indicates decreasing values.

A line graph shows changes better than other types of graphs.

EXAMPLE The line graph alongside shows the height of a plant over a period of 5 weeks.

Answer the following questions.

1. What was the height of the plant after 1 week ?
2. What was the height of the plant after the 4th week ?
3. When did the plant attain a height of 6 cm ?
4. What was the total height attained by the plant in five weeks ?
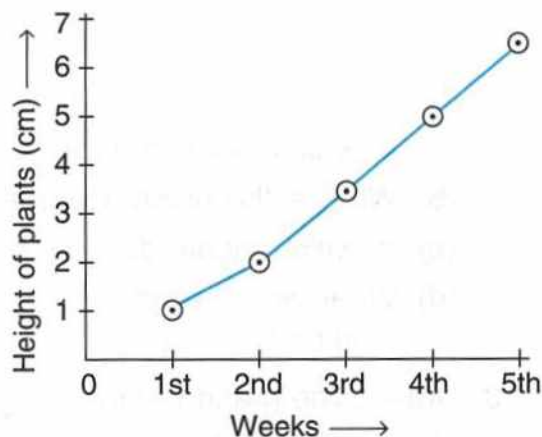
Solution :

1. The height of the plant after 1 week was **1 cm**.
2. The height of the plant after the 4th week was **5 cm**.
3. The plant attained a height of 6 cm in the **5th week**.
4. The total height attained by the plant in five weeks was **6·5 cm**.

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1 The line graph given alongside shows the admission of students in a school for five years. Observe the line graph and answer the questions that follow :
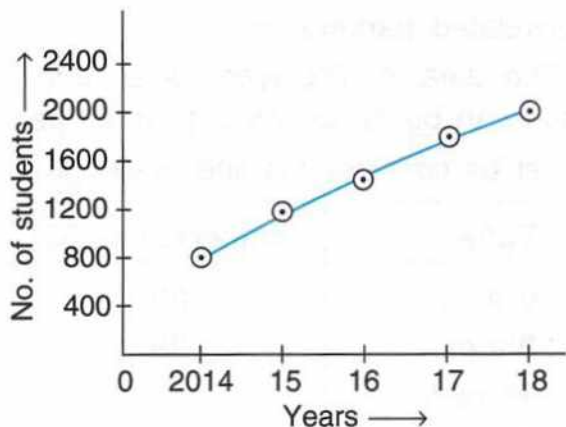
Answer the following questions :

(a) How many students were enrolled in 2016 ?

(b) What was the difference in enrolment in 2016 and 2017 ?

(c) In which years more than 1200 pupils were enrolled ?

(d) What was the increase in enrolment during the five years ?

2 The following line graph shows the monthly expenses of a family for the first five months of the year. Study the line graph and answer the questions that follow :
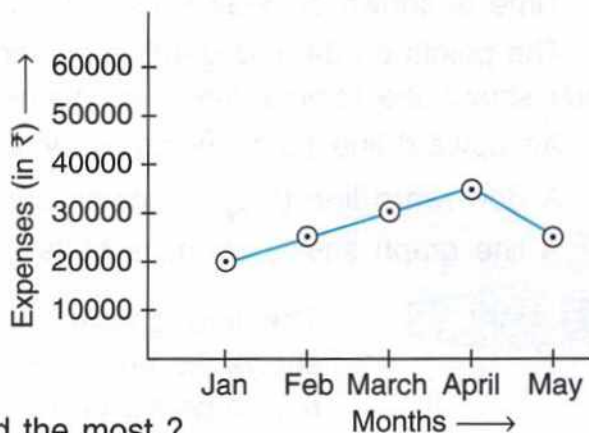
Answer the following questions :

(a) In which month did the family spend the most ?

(b) What is the difference in expenditure in April and May ?

(c) In which month did the family spend the least amount of money ?

(d) What was the total amount of money that the family spent during the five months?

3 Draw a line graph to represent the following data.

Day	Number of visitors to a zoo
Monday	2000
Tuesday	2500
Wednesday	3000
Thursday	4000

Pattern : A pattern is a collection of shapes, numbers, words, etc. which are arranged according to some rules.

Geometrical pattern : A geometrical pattern is an arrangement of shapes, colours, designs, etc. which are repeated at a regular interval according to some rules.

Letter pattern : A letter pattern is an arrangement of letters of the English alphabet according to some rules.

Number pattern : A number pattern is an arrangement of numbers according to some rules.

22.1 MORE ABOUT NUMBER PATTERNS

Triangular number pattern : In this type of a pattern, numbers are represented by dots arranged in a triangular shape. Let us see how.

| 1 | 3 | 6 | 10 | 15 | 21 |
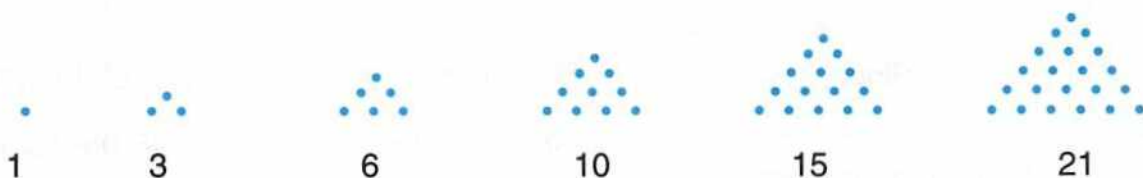
We observe that the number of dots in the bottom row is increasing by one as we go on. The number of dots are decreasing by one as we move up the triangle. Finally, the number of dots in the bottom row is equal to the number of rows.

Can you write the next unit of this pattern ?

Since the last figure has 6 dots in the bottom row, the next figure will have 7 dots in the bottom row and 7 rows. So, 6 dots in 2nd row, 5 in 3rd, 4 in 4th, 3 in 5th, 2 in 6th and finally 1 dot in the 7th row. Adding the number of dots, we get —

$$7 + 6 + 5 + 4 + 3 + 2 + 1 = 28$$

Therefore, the seventh unit in the pattern is 28.

Similarly, can you find out the 23rd unit of the pattern ? Will it be difficult ?

The rule for adding a larger number of dots is given as follows :

$$X_n = \frac{n(n+1)}{2}$$

where X_n = n^{th} term of the pattern

n = number of dots in the bottom row.

We can now find the 23rd unit of the pattern easily using this rule.

$$X_{23} = \frac{23(23+1)}{2} \quad \text{(It will have 23 dots in the bottom row)}$$

$$= \frac{23 \times 24^{12}}{2}$$

$$= 23 \times 12 = 276$$

Therefore, the 23rd unit of the pattern is **276**.

EXAMPLE   Will 1,871 be the 61st unit of the triangular number pattern ?

Solution :   To find the 61st unit, use the rule —

$$X_n = \frac{n(n+1)}{2}$$

$$\therefore \ X_{61} = \frac{61(61+1)}{2} = \frac{61 \times 62^{31}}{2}$$

$$= 61 \times 31 = 1,891$$

Since, $1,871 \neq 1,891$, 1,871 **will not be** the 61st unit of the pattern.

Square number pattern : Here, the dots are arranged in squares having equal number of rows and columns.

1	4	9	16	25

Can you think what will be the next unit of this pattern ?

Will it have 6 rows of 6 dots each ?

$$6 \times 6 = \boxed{}$$

EXAMPLE   Write the 18th unit of the square number pattern.

Solution :   The 18th unit of the pattern will have 18 rows of 18 dots each.

∴ 18th unit = $18 \times 18 = $ **324**.

22.2 GROWING AND REDUCING PATTERNS

A growing or increasing pattern is one in which one or more elements of the sequences increase repeatedly.

A reducing or decreasing pattern is one in which one or more elements of the sequences decrease repeatedly. Reducing and increasing patterns do not have a fixed unit of repeat, but they do follow certain rules :

Consider the following two patterns.

1. Skip counting on a number line
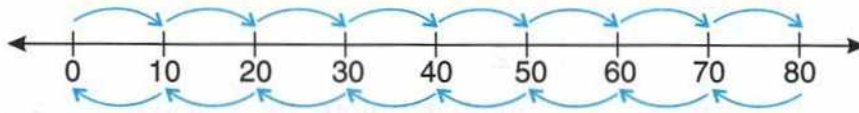
To have a growing (increasing) pattern, the rule is : Start from 0 and skip count by 10 in the forward direction.

To make a reducing pattern on the number line, the rule is : Start from 80 and skip count by 10 in backward direction.

2. Chart of numbers 1-100 as shown alongside.

Observe the chart :

From left to right in each row, the numbers are increasing by 1 and from right to left they decrease by 1.

From top to bottom, each column increases by 10.

Diagonally on moving down from right to left, they increase by 9 and from left to right they increase by 11.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Let us now learn how to extend a pattern in the backward direction.

EXAMPLE

Write the previous two units for the patterns given below :

(a) 34, 46, 58, 70, 82   (b) 84, 105, 126, 147, 168.

Solution :

In pattern (a), each successive unit is greater than the previous unit by 12.

$-12 \quad -12 \quad +12 \quad +12 \quad +12 \quad +12$
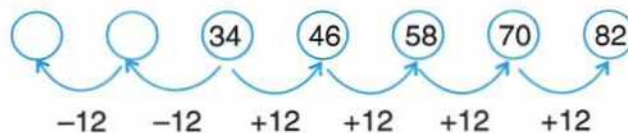
So, the unit before 34 will be $34 - 12 = 22$.

The unit before $22 - 12 = 10$

∴ The pattern will be 10, 22, 34, 46, 58 and so on.

In pattern (b), the ones' digit is increasing by one in the successive terms. Also, ones' digit when divided by the number formed by the remaining digits gives quotient 2.

In 84, $8 ÷ 4 = 2$

In 147, $14 ÷ 7 = 2$

Therefore, the number before 84, will have 3 as its ones' digit. So, its tens digit will be $3 × 2 = 6$.

The number before 84 is 63.

Similarly, the number before 63 will have 2 as its ones' digit. Its tens' digit $= 2 × 2 = 4$. Number $= 42$.

∴ The pattern will be 42, 63, 84, 105, 126 and so on.

EXERCISE 22

1 Draw one more figure at the end in each of the following geometrical patterns.

(a)

(b)
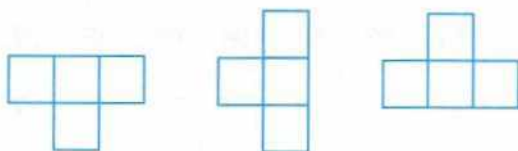
(c)

(d)
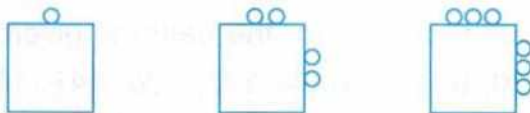
(e)

2 Observe the pattern and fill the next number.

(a) 1, 6, 11, 16, 21, _____   (b) 1, 2, 4, 8, 16, _____

(c) 1, 3, 7, 13, 21, _____   (d) 1, 6, 12, 19, 27, _____

(e) 35, 29, 24, 20, 17, _____   (f) 76, 71, 66, 61, 56, _____

(g) 48, 47, 45, 42, 38, _____

3 Observe the pattern and fill in the blanks.

(a)
$$1 \times 1 = 1$$
$$11 \times 11 = 1\ 2\ 1$$
$$111 \times 111 = 1\ 2\ 3\ 2\ 1$$
$$1111 \times 1111 = 1\ 2\ 3\ 4\ 3\ 2\ 1$$
$$11111 \times 11111 = \rule{3cm}{0.4pt}$$
$$111111 \times 111111 = \rule{3cm}{0.4pt}$$

(b)
$$9 \times 9 = 8\ 1$$
$$99 \times 9 = 8\ 9\ 1$$
$$999 \times 9 = 8\ 9\ 9\ 1$$
$$9999 \times 9 = \rule{3cm}{0.4pt}$$
$$99999 \times 9 = \rule{3cm}{0.4pt}$$

(c)
$$2 \times 2 - 1 \times 1 = 2 + 1 = 3$$
$$3 \times 3 - 2 \times 2 = 3 + 2 = 5$$
$$4 \times 4 - 3 \times 3 = 4 + 3 = 7$$
$$5 \times 5 - 4 \times 4 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$
$$6 \times 6 - 5 \times 5 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$
$$7 \times 7 - 6 \times 6 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$

(e)
$$2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18 + 20 = 2 \times 55 = 110$$
$$3 + 6 + 9 + 12 + 15 + 18 + 21 + 24 + 27 + 30 = 3 \times 55 = 165$$
$$4 + 8 + 12 + 16 + 20 + 24 + 28 + 32 + 36 + 40 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$
$$5 + 10 + 15 + 20 + 25 + 30 + 35 + 40 + 45 + 50 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$
$$7 + 14 + 21 + 28 + 35 + 42 + 49 + 56 + 63 + 70 = \rule{2cm}{0.4pt} = \rule{2cm}{0.4pt}$$

A. Choose the correct answers.

1. The smallest 8-digit number is
   (a) 1,00,00,000   (b) 1,00,00,001   (c) 1,00,00,002   (d) 99,99,999

2. The largest 7-digit number is
   (a) 10,00,00,009   (b) 99,99,99,999   (c) 99,99,999   (d) 1,99,999

3. The place value of 5 in 9,85,43,210 is
   (a) 1 crore   (b) 50 lakh   (c) 50 thousand   (d) five lakh

4. The face value of 9 in 38,95,008 is
   (a) Nine thousand   (b) Ninety thousand   (c) 9   (d) Nine lakh

5. Arrange the following in ascending order
   (a) 38,94,35,678; 98,76,54,321; 11,23,45,331; 4,32,15,673; 42,13,24,567
   (b) 42,31,34,678; 75,32,14,571; 83,24,12,531; 17,32,14,541; 73,24,51,321
   (c) 45,67,89,321; 73,21,45,678; 46,12,34,127; 53,26,78,931; 64,21,41,321

6. Arrange the following in descending order
   (a) 15,63,21,456; 34,56,78,413; 93,21,32,141; 6,46,78,132; 20,13,24,412
   (b) 8,41,23,456; 21,24,13,452; 73,24,56,123; 93,45,67,831; 13,24,12,313
   (c) 13,57,89,032; 83,24,12,321; 43,41,24,217; 53,21,34,567; 73,23,15,678

7. The greatest 9-digit number using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 only once is
   (a) 801234567   (b) 876543210   (c) 801234876   (d) 876501234

8. The smallest 9-digit number formed by using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 only once is
   (a) 012345678   (b) 102345678   (c) 108765432   (d) 1876543210

9. The greatest 9-digit number using the digits 0, 1, 2, 3 and 4 with repetition is
   (a) 444443210   (b) 404444232   (c) 440444231   (d) 410444432

10. The number 38,32,871 is read in International System as
    (a) Thirty eight lakh thirty two thousand eight hundred and seventy one
    (b) Three million eight hundred thirty two thousand eight hundred seventy one
    (c) Thirty eight million thirty two thousand eight hundred seventy one
    (d) Three lakh eight hundred thirty two thousand eight hundred seventy one

11. Five lakh seventy five thousand eight hundred is read in International System as

(a) 5 million seventy five thousand eight hundred

(b) Fifty seven million five thousand eight hundred

(c) Five hundred seventy five thousand eight hundred.

(d) Five crore seventy five thousand eight hundred.

12. When we add 83,24,56,789; 93,24,156; 34,56,789 we get

(a) 85,42,37,734   (b) 84,52,37,734   (c) 85,47,72,334   (d) 84,53,77,234

13. When we subtract 82,34,518 from 39,45,67,812, we get

(a) 368333294   (b) 368294333   (c) 386333294   (d) 863833294

14. When we multiply 6,324 by 762, we get

(a) 48,81,888   (b) 4,88,88,481   (c) 4,88,881   (d) 48,18,888

15. When we divide 83,45,678 by 83, the remainder is

(a) 28   (b) 38   (c) 48   (d) 58

16. When we divide 3,24,558 by 19, the quotient is

(a) 17,802   (b) 18,207   (c) 17,802   (d) 17,082

17. The Roman numeral for 500 is

(a) V   (b) M   (c) D   (d) L

18. The Roman numeral for 39 is

(a) IXXL   (b) LI   (c) XL   (d) XXXIX

19. The prime factors of 750 are

(a) 6, 5 and 25   (b) 2, 15 and 25   (c) 2, 3 and 5   (d) 30, 5 and 5

20. Every number is a factor of

(a) 1   (b) 0   (c) 2   (d) 3

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

(a) 3   (b) 6   (c) 9   (d) 5

22. The only prime number that is even is

(a) 1   (b) 2   (c) 3   (d) 5

23. The HCF of 30 and 50 is

(a) 50   (b) 150   (c) 10   (d) 1,500

24. The LCM of 12, 16 and 20 is

(a) 1,000   (b) 192   (c) 320   (d) 240

25. The sum of $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5}$ is :

(a) $\frac{67}{60}$ (b) $\frac{77}{60}$ (c) $\frac{57}{60}$ (d) $\frac{87}{60}$

26. The decimal fraction 0·02 is equal to

(a) $\frac{1}{80}$ (b) $\frac{1}{200}$ (c) $\frac{1}{100}$ (d) $\frac{1}{50}$

27. 25 km 625 m in metres is

(a) 25265 m   (b) 25625 m   (c) 25256 m   (d) 25526

28. Estimate the sums to the nearest 100

(a) 3,84,781 + 2,37,324 + 8,34,567

(b) 8,32,145 + 3,21,983 + 4,56,789

(c) 4,56,781 + 2,98,749 + 3,45,678

29. 3,845 gm is equal to

(a) 384·5 kg   (b) 38·45 kg   (c) 3·3845 kg   (d) 3·845 kg

30. 97·75 kL is equal to

(a) 9,77,500 L   (b) 977·5 L   (c) 97,750 L   (d) 97·75 L

31. The average marks obtained by Arvind in his annual examination in six subjects was 72·5. The total marks he scored was

(a) 432   (b) 425   (c) 453   (d) 435

32. A train covers a distance of 315 km in 9 hours. The distance covered by it in 12 hours is

(a) 450 km   (b) 320 km   (c) 415 km   (d) 420 km

33. Expressing 16 out of 40 as a percentage, we write

(a) 10%   (b) 20%   (c) 40%   (d) 30%

34. When we convert 25% into a decimal fraction, we get

(a) 0·255   (b) 0·15   (c) 0·25   (d) 1·25

35. 20% of 1,000 is

(a) 300   (b) 200   (c) 400   (d) 500

36. The sum of 180 + (−70) + (−40) + 50 is

(a) 140   (b) 120   (c) 320   (d) 240

37. When we convert 39837850 paise into Rupees we get

(a) ₹ 398378.50   (b) ₹ 398.37850   (c) ₹ 3983.785   (d) ₹ 39837.850

38. 2 years and 12 hours when converted into hours is

    (a) 15272 hrs   (b) 17252 hrs   (c) 17532 hrs   (d) 12752 hrs

B. Fill in the blanks.

1. .... is the biggest eight digit number.

2. When we add 3456789 and 1248975, we get ....

3. When we subtract 3987654 from 5312035, we get ....

4. 48345 × 125 gives ....

5. $\dfrac{1}{1000}$ as a decimal fraction is ....

6. The common fraction for 8·32 is ....

7. 0·725 × 0·25 is ....

8. 0·101 ÷ 0·3 is ....

9. $\dfrac{250}{1000}$ reduced to its lowest term is ....

10. $\dfrac{1}{12} \div \dfrac{1}{3}$ is ....

11. $\dfrac{20}{\frac{7}{3}}$ = ...

12. Rounding off 7·567 kg to the nearest kg we get ....

13. A number is divisible by 4 if ....

14. A prime factor is ....

15. Every number is a multiple of ....

16. HCF of 8, 16 and 24 is ....

17. LCM of 10, 15, 20 and 25 is ....

18. LCM × HCF = ...

19. Roman numeral for 924 is ....

20. Roman numeral for 2,520 is ....

21. Dividend = divisor × quotient + ...

22. If the sum of two numbers is 83,48,32,413 and one of them is 25,67,89,123, the other number is ....

23. 11,723 × 723 = ...

24. 53,46,785 ÷ 35 = ... + remainder ....

25. The additive inverse of –27 is ....

26. The four types of angles are ....

27. Perimeter of a square is ....

28. Area of a triangle is ....

29. 2 km 320 m is = ... m.

30. 300 gm = ... kg.

31. 15 kL = ... L.

32. ₹ 2 as a percentage of ₹ 50 is ....

33. ₹ 5,678 is = ... paise.

34. ₹ 42,565 ÷ 5 = ...

35. 15 weeks and 5 days is .... days.

36. 45 minutes 45 seconds = ... seconds.

37. Observe the pattern and write the next number : 1, 8, 15, 22 ....

38. The word BODMAS stands for ....

39. Average = $\dfrac{\text{The sum of given quantities}}{\text{......................}}$

40. 250 m as a percentage of 4 km is ....

C. Answer the following questions.

1. Write the following numbers in the International System and write their names
   5436787; 38456753; 123456789

2. Write the numeral and number each abacus represents.

3. Express the following in an abacus in International System
   (a) 83245629   (b) 34567823   (c) 53456728

4. Express the following in an abacus in Indian System of numeration.
   (a) 32456789   (b) 34567892   (c) 12356789

5. Find the sum of 3245678, 12345678 and 2983217.

6. Find the difference of 53212345 and 23567891.

7. Multiply 37125 by 215.

8. Divide 645675 by 15.

9. Divide 4832015 by 150 and find the quotient and remainder.

10. Find all the prime factors of 1500.

11. Find the HCF of 30, 40 and 50.

12. Find the LCM of 28, 36 and 45.

13. Arrange the following fractions in ascending order $\dfrac{2}{5}, \dfrac{3}{4}, \dfrac{1}{3}$.

14. Add : $5\dfrac{1}{3} + 2\dfrac{1}{4} + 1\dfrac{1}{4}$.

15. Subtract : $3\dfrac{1}{2} - 1\dfrac{3}{5}$.

16. Multiply : $2\dfrac{1}{3} \times 4\dfrac{1}{3} \times \dfrac{1}{2}$.

17. $\dfrac{22}{25} \div \dfrac{11}{15}$.

18. $4\dfrac{2}{15} - 1\dfrac{1}{5}$.

19. Multiply : $0{\cdot}24 \times 0{\cdot}45 \times 0{\cdot}15$.

20. Divide : $9{\cdot}45 \div 3{\cdot}15$.

21. Estimate the following sums to the nearest 100 and then to the nearest 1000.
    (a) 345678 + 567892 + 783245   (b) 456789 + 6789542 + 842345

22. Simplify, using BODMAS rule : $15 + \{8 - (7 - \overline{8-5})\}$.

23. Simplify : $2\dfrac{1}{2} - \left(3\dfrac{1}{2} - \overline{4\dfrac{1}{4} - 3\dfrac{1}{4}}\right)$.

24. Simplify : $7{\cdot}8 \div [8{\cdot}35 - (2{\cdot}30 - \overline{4{\cdot}50 - 2{\cdot}75})\}$.

25. Find the average of 30·5, 31·7, 30·8, 35·2, 32·8, 30·45, 32·6, 30·8, 32·9, 30·1.

26. A healthy human heart beats 51840 times in 12 hours. How many times will it beat in 5 hours ?

27. In a class of 60 students, 5% failed in the final examination. Find the number of students who have passed ?

28. Convert 1 month (30 days) 5 days and 10 hours into hours.

29. Write the Roman numeral for 1100.

30. Draw a line graph to represent the following data

Day	Number of ice-cream cups sold by a vendor
Monday	150
Tuesday	200
Wednesday	250
Thursday	300
Friday	150

31. The bar graph given below shows the favourite fruits of students of a class of 50 students. Observe the bar graph and answer the questions that follow.
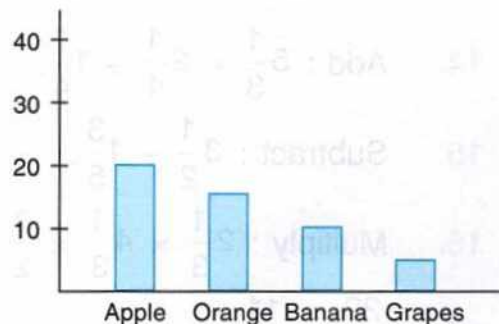
(a) Which is the most popular fruit ?

(b) How many students do not take grapes ?

(c) Which are the two most popular fruits ?

(d) What is the percentage of students who like banana ?

(e) What is the percentage of students who take apple and orange ?

32. Look at the given pie chart and answer the following questions.
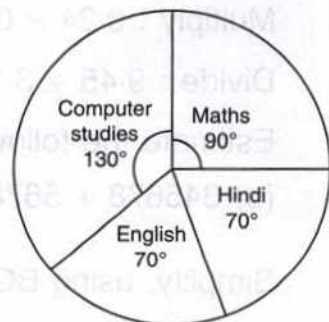
(a) Which is the most popular subject ?

(b) Which two subjects have equal number of participants ?

(c) What is the percentage of students preferring Mathematics ?

(d) What percent of the students preferred English and Hindi ?

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33. In each of the figures below, determine if the dotted line is a line of symmetry.

(a)

(b)

(c)

(d)

(e)

(f)

(h)
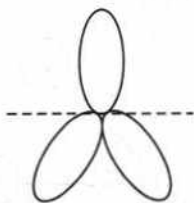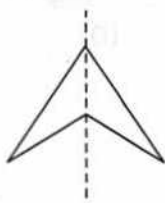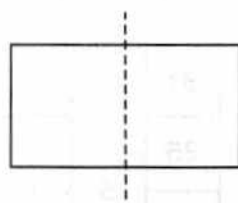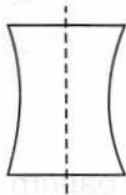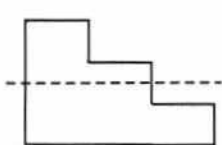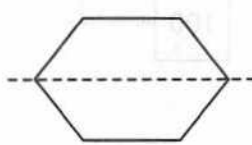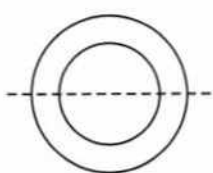
(h)
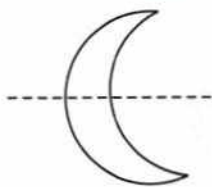
34. Complete the following using a square grid paper.

(a)
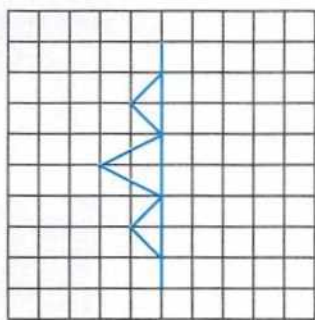
(b)
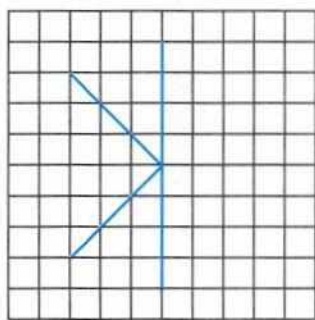
(c)
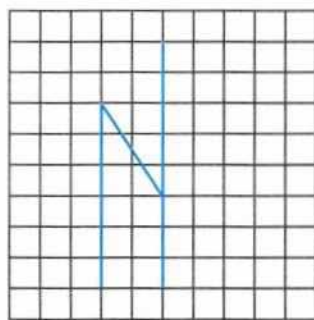
(d)
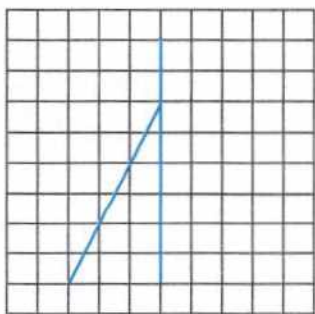
(e)
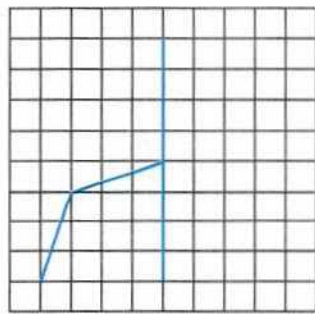
(f)
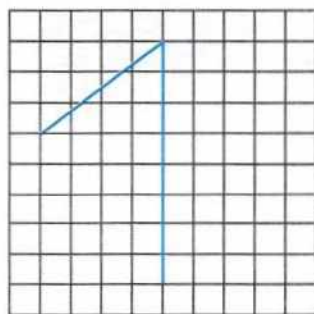
35. Fill in the missing blanks in the following patterns.

(a)

81		
85		
	5	
90		5
	10	
100		
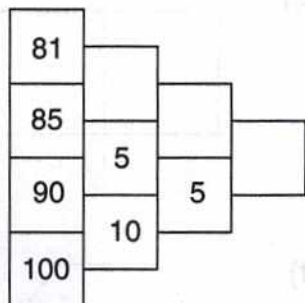
(b)
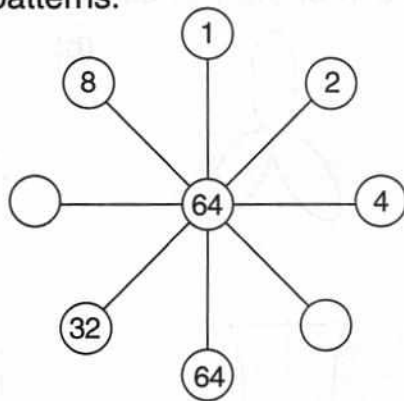
36. Verify if 3,025 will be the 55th unit of the square number pattern ?

EXERCISE 1

1. (a) 46,36,324   Forty six lakh thirty six thousand three hundred twenty four.
   (b) 44,36,535   Forty four lakh thirty six thousand five hundred thirty five.
   (c) 63,39,304   Sixty three lakh thirty nine thousand three hundred four.
   (d) 96,39,424   Ninety six lakh thirty nine thousand four hundred twenty four.
2. (a) Seventy six lakh forty five thousand three hundred twenty one.
   (b) Seventy lakh twenty five thousand three hundred eighty four.
   (c) Eighty one lakh fifty two thousand twenty five.
   (d) Thirty eight lakh forty one thousand nine hundred twenty one.
   (e) Twenty seven lakh nine hundred forty seven.
   (f) Ten lakh thirty five thousand four hundred fifty five.
3. (a) 13,23,528   (b) 65,04,152   (c) 95,60,500   (d) 17,30,005   (e) 33,24,896   (f) 95,75,555
4. (a) 10,00,000 + 7,00,000 + 90,000 + 6,000 + 500 + 40 + 3
   (b) 60,00,000 + 6,00,000 + 70,000 + 5,000 + 200 + 50 + 0
   (c) 50,00,000 + 0 + 0 + 0 + 0 + 0 + 0
   (d) 20,00,000 + 4,00,000 + 60,000 + 5,000 + 700 + 0 + 0
   (e) 30,00,000 + 8,00,000 + 0 + 6,000 + 200 + 40 + 3
5. (a) 12,36,870   (b) 45,21,890   (c) 12,60,740   (d) 31,26,118   (e) 64,32,357
6. (a) 7,00,000   (b) 70,00,000   (c) 7,000   (d) 70,000
7. (a) 6,000   (b) 40,00,000   (c) 5,00,000   (d) 90   (e) 80,00,000
   (f) 400   (g) 70,000   (h) 5,00,000
8. (a) 9,43,071   (b) 28,32,416   (c) 87,32,105   (d) 17,34,580   (e) 73,24,559
9. (a) 82,31,701   (b) 7,86,544   (c) 9,54,620   (d) 34,57,989   (e) 43,21,790
10. (a) >   (b) <   (c) >   (d) >   (e) =
11. (a) 98,76,542,   98,76,543,   98,76,544,   98,76,545,
    (b) 45,69,895,   45,69,896,   45,69,897,   45,69,898,
    (c) 73,16,898,   73,16,899,   73,16,900,   73,16,901,
    (d) 12,46,786,   12,46,787,   12,46,788,   12,46,789,
    (e) 9,67,999,   9,68,000,   9,68,001,   9,68,002,

EXERCISE 2(A)

1. (a) One crore twenty one lakh forty three thousand six hundred fifty four.
   (b) Twenty one crore nine lakh fifty four thousand three hundred seventy eight.
   (c) Thirty eight crore sixty nine lakh fifty six thousand twenty four.
   (d) Eighty crore fifty lakh fifty thousand five hundred fifty.
2. (a) 8,70,50,680   (b) 4,09,24,496   (c) 10,12,36,225   (d) 66,708   (e) 80,00,75,000
3. (a) 1,28,14,601 = 1,00,00,000 + 20,00,000 + 8,00,000 + 10,000 + 4,000 + 600 + 0 + 1
   (b) 16,22,81,946 = 10,00,00,000 + 6,00,00,000 + 20,00,000 + 2,00,000 + 80,000 + 1,000 + 900 + 40 + 6
   (c) 24,16,56,782 = 20,00,00,000 + 4,00,00,000 + 10,00,000 + 6,00,000 + 50,000 + 6,000 + 700 + 80 + 2
   (d) 18,68,18,127 = 10,00,00,000 + 8,00,00,000 + 60,00,000 + 8,00,000 + 10,000 + 8,000 + 100 + 20 + 7
   (e) 32,05,20,600 = 30,00,00,000 + 2,00,00,000 + 0 + 5,00,000 + 20,000 + 0 + 600 + 0 + 0
4. (a) 26,84,27,356   (b) 38,46,42,346   (c) 57,56,83,192   (d) 85,20,25,555   (e) 60,81,40,081
5. (a) Period – Lakhs   (b) Period – Crores   (c) Period – Thousands   (d) Period – Crores
6. (a) 8,00,000   (b) 5,000   (c) 90,00,00,000   (d) 20,00,000
7. (a) Period - Crores : 6,00,00,000   (b) Period - Crores : 60,00,00,000
   (c) Period - Thousands : 8,000   (d) Period - Units : 700
   (e) Period - Lakhs : 40,00,000
8. (b) 7,99,20,000   (c) 49,95,00,000   (d) 19,99,800   (e) 59,99,40,000

9. (a)

Ascending order	Descending order
23,16,348	45,42,18,089
8,26,99,678	8,62,16,438
8,62,16,438	8,26,99,678
45,42,18,089	23,16,348

(b)

Ascending order	Descending order
95,949	24,26,16,800
3,48,616	88,95,919
88,95,919	3,48,616
24,26,16,800	95,949

(c)

Ascending order	Descending order
9,90,909	64,00,18,926
66,25,576	1,42,65,814
1,42,65,814	66,25,576
64,00,18,926	9,90,909

(d)

Ascending order	Descending order
9,94,248	10,10,10,104
92,85,368	5,41,10,105
5,41,10,105	92,85,368
10,10,10,104	9,94,248

(e)

Ascending order	Descending order
68,59,795	2,18,68,714
1,16,04,616	1,61,04,661
1,61,04,661	1,16,04,616
2,18,68,714	68,59,795

10.

	Smallest Number	Largest Number
(a)	13,45,689	98,65,431
(b)	2,34,56,789	9,87,65,432
(c)	1,02,34,567	7,65,43,210
(d)	2,04,56,789	9,87,65,420
(e)	2,03,45,789	9,87,54,320

11. (a) 99,999 (b) 9,99,999 (c) 99,99,999 (d) 9,99,99,999

12. (a) 10,000 (b) 1,00,000 (c) 10,00,000 (d) 1,00,00,000

EXERCISE 2(B)

1. (a) > (b) > (c) > (d) < (e) <
2. (a) Smallest : 2,285 ; Greatest : 2,852 (b) Smallest : 90,183 ; Greatest : 98,013
   (c) Smallest : 31,758 ; Greatest : 38,175 (d) Smallest : 5,092 ; Greatest : 5,902
   (e) Smallest : 18,396; Greatest : 19,863 3. 10,000 4. 99,99,999
5. (a) Smallest : 1,378 ; Greatest : 8,731 (b) Smallest : 2,456 ; Greatest : 6,542
6. (a) Smallest : 30,45,679 ; Greatest : 97,65,430 (b) Smallest : 12,34,567 ; Greatest : 76,54,231

EXERCISE 3

1. (i) 56 536 847 Fifty six million five hundred thirty six thousand eight hundred forty seven.
   (ii) 25 366 774 Twenty five million three hundred sixty six thousand seven hundred seventy four.
   (iii) 532 634 654 Five hundred thirty two million six hundred thirty four thousand six hundred fifty four.
   (iv) 537 345 836 Five hundred thirty seven million three hundred forty five thousand eight hundred thirty six.
   (v) 7 345 465 374 Seven billion three hundred forty five million four hundred sixty five thousand three hundred seventy four.
   (vi) 3 245 476 298 Three billion two hundred forty five million four hundred seventy six thousand two hundred ninety eight.

2. (a) 783,456 Seven hundred eighty three thousand four hundred fifty six.
   (b) 3,521,345 Three million five hundred twenty one thousand three hundred forty five.
   (c) 36,586,324 Thirty six million five hundred eighty six thousand three hundred twenty four.
   (d) 614,835,931 Six hundred fourteen million eight hundred thirty five thousand nine hundred thirty one.
   (e) 1,232,145,678 One billion two hundred thirty two million one hundred forty five thousand six hundred seventy eight.

3. (a) 6,554,730 (b) 24,171,082 (c) 145,088,084 (d) 1,558,000,364

4. (a) *Indian system : 3,74,654* Three lakh seventy four thousand six hundred fifty four.
   International system : 374,654 Three hundred seventy four thousand six hundred fifty four.
   (b) *Indian system : 9,67,845* Nine lakh sixty seven thousand eight hundred forty five.
   International system : 967,845 Nine hundred sixty seven thousand eight hundred forty five.
   (c) *Indian system : 85,47,783* Eighty five lakh forty seven thousand seven hundred eighty three.
   International system : 8,547,783 Eight million five hundred forty seven thousand seven hundred eighty three.

(d) *Indian system* : 71,13,944   Seventy one lakh thirteen thousand nine hundred forty four.

International system : 7,113,944   Seven million one hundred thirteen thousand nine hundred forty four.

(e) *Indian system* : 8,13,61,248   Eight crore thirteen lakh sixty one thousand two hundred forty eight.

International system : 81,361,248   Eighty one million three hundred sixty one thousand two hundred forty eight.

(f) *Indian system* : 9,44,31,748   Nine crore forty four lakh thirty one thousand seven hundred forty eight.

International system : 94,431,748   Ninety four million four hundred thirty one thousand seven hundred forty eight.

(g) *Indian system* : 12,34,09,876   Twelve crore thirty four lakh nine thousand eight hundred seventy six.

International system : 123,409,876   One hundred twenty three million four hundred nine thousand eight hundred seventy six.

(h) *Indian system* : 43,20,15,678   Forty three crore twenty lakh fifteen thousand six hundred seventy eight.

International system : 432,015,678   Four hundred thirty two million fifteen thousand six hundred seventy eight.

5. (a) 782,104   (b) 9,134,018   (c) 1,832,456 (d) 13,247,002   (e) 284,720,123 (f) 6,789,327
6. (a) 83,13,410   (b) 2,34,56,789   (c) 17,48,401 (d) 34,24,15,012   (e) 3,27,89,012   (f) 17,89,328

EXERCISE 4

1. (a) XXC and (b) VL 2. (a) LXXIX   (b) 96   3. (a) True   (b) False
4. (a) VII   (b) IX   (c) XVII   (d) XXV   (e) XL
    (f) LIX   (g) LXVII   (h) LXXXII   (i) CV   (j) CXLIX
    (k) XC   (l) CLXIII   (m) CCXXXIII   (n) CDLXXXIX   (o) DXI
    (p) DCXCV   (q) DCCLXII   (r) DCCCXCIX   (s) CMLVI   (t) M
5. (a) 28   (b) 46   (c) 59   (d) 55   (e) 69
    (f) 67   (g) 39   (h) 60   (i) 72   (j) 93
    (k) 118   (l) 89   (m) 226   (n) 426   (o) 587
    (p) 969   (q) 1667   (r) 1652   (s) 1680   (t) 1669
6. (a) 97   (b) 306   (c) 1306   (d) 1906   (e) 1515
    (f) 2430   7. Wrong ones are : (b) as D is never repeated (d) as X can be subtracted from L and C only. (g) I can be subtracted only from V and X (h) L can not be subtracted at all.

EXERCISE 5(A)

1. (a) 1,35,97,467 (b) 9,60,40,344 (c) 48,63,125 (d) 1,16,75,63,723 (e) 52,02,70,747 (f) 28,14,74,795
2. (a) 87,68,143   (b) 2,50,33,242 (c) 90,14,16,065   (d) 96,00,86,505   (e) 56,91,66,600
3. (a) 74,41,29,260 Seventy four crore forty one lakh twenty nine thousand two hundred sixty.
    (b) 7,90,51,103   Seven crore ninety lakh fifty one thousand one hundred three.
    (c) 6,10,84,000   Six crore ten lakh eighty four thousand.
    (d) 7,16,51,822   Seven crore sixteen lakh fifty one thousand eight hundred twenty two.
4. (a) 29,22,154   (b) 83,390   (c) 9,03,882   (d) 7,76,618
    (e) 22,89,642   (f) 1,96,82,888   (g) 1,87,50,349   (h) 7,69,95,792
    (i) 5,90,93,938   (j) 7,86,96,109   (k) 3,84,92,862   (l) 7,67,39,907
5. 12,83,574   6. 4,10,54,300   7. 48,51,568 greater by 35,982   8. 1,62,790
9. 51,58,742   10. Sum of 12,04,58,757 and 95,00,700   11. 1 08 78 183
12. (a) 2,20,685   (b) 1,63,04,434   (c) 5,04,633   (d) 8,75,086   (e) 5,77,668

Word problems

13. 12,27,48,145   14. ₹ 14,16,15,820   15. ₹ 17,35,66,615   16. ₹ 16,87,62,152

17. ₹ 14,73,49,967	**18.** 75,32,195	**19.** 31,21,433	**20.** 21,610		
21. Candidate A by 2,08,882 votes		**22.** 1	**23.** ₹ 41,49,010		
24. 19,11,883	**25.** 1,27,540 men	**26.** 5,50,531	**27.** ₹ 1,63,468		

EXERCISE 5(B)

1. (a) 132	(b) 168	(c) 195	(d) 192	(e) 256
(f) 225	(g) 169	(h) 25000	(i) 34000	
2. (a) 56 640	(b) 7 50 952	(c) 2 67 096	(d) 17 87 156	(e) 48 18 888
(f) 14 91 560	(g) 32 93 664	(h) 2 86 17 800	(i) 70 31 010	

Word problems

3. ₹ 33,70,125   **4.** 3,64,375 m²   **5.** 19,60,000 L   **6.** ₹ 26,57,950   **7.** ₹ 17,78,38,500

EXERCISE 5(C)

		By 100		**By 1000**		**By 10000**
1. (a) 85 400	(i) Quotient - 854 Remainder - 0		(ii) Quotient - 85 Remainder - 400		(iii) Quotient - 8 Remainder - 5400	
(b) 8 21 600	(i) Quotient - 8216 Remainder - 0		(ii) Quotient - 821 Remainder - 600		(iii) Quotient - 82 Remainder - 1600	
(c) 9 74 800	(i) Quotient - 9748 Remainder - 0		(ii) Quotient - 974 Remainder - 800		(iii) Quotient - 97 Remainder - 4800	
(d) 96 000	(i) Quotient - 960 Remainder - 0		(ii) Quotient - 96 Remainder - 0		(iii) Quotient - 9 Remainder - 6000	
(e) 4 86 000	(i) Quotient - 4860 Remainder - 0		(ii) Quotient - 486 Remainder - 0		(iii) Quotient - 48 Remainder - 6000	
(f) 7 70 000	(i) Quotient - 7700 Remainder - 0		(ii) Quotient - 770 Remainder - 0		(iii) Quotient - 77 Remainder - 0	
(g) 33 60 000	(i) Quotient - 33600 Remainder - 0		(ii) Quotient - 3360 Remainder - 0		(iii) Quotient - 336 Remainder - 0	
(h) 98 76 450	(i) Quotient - 98764 Remainder - 50		(ii) Quotient - 9876 Remainder - 450		(iii) Quotient - 987 Remainder - 6450	

2. (a) Quotient - 1118	Remainder - 35	(b) Quotient - 7289	Remainder - 33
(c) Quotient - 82180	Remainder - 25	(d) Quotient - 64137	Remainder - 73
(e) Quotient - 107	Remainder - 12	(f) Quotient - 116	Remainder - 457
(g) Quotient - 9151	Remainder - 703	(h) Quotient - 8320	Remainder - 423
(i) Quotient - 137187	Remainder - 40		

Word problems

3. 4,845   **4.** 540 shelves   **5.** ₹ 7,525   **6.** ₹ 4,738   **7.** ₹ 4,500

EXERCISE 6(A)

1. (a) 18,500	(b) 15,500	(c) 4,50,000	(d) 22,50,000	(e) 1,65,000	(f) 95,000
2. (a) 320	(b) 980	(c) 1,240	(d) 7,490	(e) 1,000	(f) 9,990
(g) 45,790	(h) 1,06,920	(i) 97,100	**3.** (a) 300	(b) 2,400	(c) 7,400
(d) 26,200	(e) 42,900	(f) 10,000	(g) 2,36,000	(h) 1,00,000	(i) 5,09,900
4. (a) 2,000	(b) 15,000	(c) 29,000	(d) 11,000	(e) 50,000	(f) 1,00,000
(g) 90,000	(h) 4,00,000	(i) 2,01,000	**5.** (a) 20,000	(b) 90,000	(c) 60,000
(d) 2,20,000	(e) 7,30,000	(f) 20,000	(g) 11,10,000	(h) 43,00,000	(i) 59,80,000
6. (a) 6,00,000	(b) 18,00,000	(c) 10,00,000	(d) 8,00,000	(e) 15,00,000	(f) 4,00,000
(g) 95,00,000	(h) 50,00,000	(i) 64,00,000			
7. (a) 14,00,00,000		(b) 5,00,00,000		(c) 3,00,00,000	
(d) 10,00,00,000		(e) 70,00,00,000		(f) 9,00,00,000	
8. (a) 550, 500		(b) 780, 800		(c) 940, 900	
(d) 45,380, 45,400		(e) 53,710, 53,700		(f) 6,98,300, 6,98,300	
(g) 4,940 ; 4,900		(h) 9,710 ; 9,700		(i) 3,00,000 ; 3,00,000	

EXERCISE 6(B)

1. (a) 1,15,00,000 (b) 1,65,00,000 (c) 1,16,00,000 2. (a) 0 (b) 50,000
   (c) 1,00,000 3. (a) 16,000 (b) 56,000 (c) 14,000 (d) 66,000
   (e) 3,000 (f) 6,000 4. (a) ₹ 321, ₹ 68, ₹ 33, ₹ 4, ₹ 9
   (b) 9 p.m., 11 a.m., 6 p.m. 6 a.m., 9 a.m., 3 p.m. (c) 11 yrs., 5 yrs., 25 yrs., 16 yrs.

EXERCISE 6(C)

1. (a) 100 (b) 170 (c) 600 (d) 740 (e) 16,500 (f) 1,29,900
2. (a) 60 (b) 30 (c) 490 (d) 2,400 (e) 1,500 (f) 59,000
3. (a) 600 (b) 1,800 (c) 800 (d) 15,000 (e) 2,10,000 (f) 50,000
4. (a) 600 (b) 7,000 (c) 3,000 (d) 2,000 (e) 90,000 (f) 40,000
5. ₹ 800 6. ₹ 4,000 7. 6171 L, 6000 L (6 kL)

EXERCISE 7(A)

1. 75 scooters 2. 3750 cycles 3. 140 km 4. 16 hours 5. 1800 kg 6. 5 hours
7. 60 compartments 8. ₹ 14,400 9. 17.5 L 10. 15 scooters 11. 7.2 m
12. 2160

EXERCISE 7(B)

1. 4 days 2. 750 men 3. 24 days 4. 60 men
5. 30 people 6. 16 minutes 7. 30 men 8. 40 men
9. 32 students 10. 27 days 11. 25 days 12. 56 more men

EXERCISE 8(A)

1.

Divisible by	Numbers						
	99	184	7065	12480	27534	23343	12210
3	Yes	No	Yes	Yes	Yes	Yes	Yes
4	No	Yes	No	Yes	No	No	No
5	No	No	Yes	Yes	No	No	Yes
6	No	No	No	Yes	Yes	No	Yes
9	Yes	No	Yes	No	No	No	No
11	Yes	No	No	No	No	No	Yes
12	No	No	No	Yes	No	No	No
15	No	No	Yes	Yes	No	No	Yes

2. (a) 1, 2 (b) 2, 2 (c) 3, 2 (d) 5, 1 (e) 7, 2 (f) 2, 9
3. (a) Yes (b) Yes (c) No (d) No (e) No (f) No
   (g) No (h) Yes (i) No (j) Yes (k) No (l) Yes
4. (a) 1, 2, 3, 4, 6, 8, 12, 16, 24, 48 (b) 1, 3,7,9,21,63 (c) 1,2,3,4,6,7,12,14,21,28,42,84
   (d) 1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108 (e) 1, 2, 4, 8, 16, 32 (f) 1,13,169
   (g) 1,7,49,343 (h) 1,2,3,5,6,10,15,25,30,50,75,150
5. (a) 9, 18, 27, 36, 45, 54 (b) 112 (c) 75 (d) 144
   (e) 66,77,88,99,110,121,132,143,154,165,176 (f) 135,150,165,180,195,210
6. (a) 53,59,61 (b) 83,89,97 (c) 113
7. (a) 72, 74, 75, 76, 77, 78 (b) 102, 104, 105, 106, 108 (c) 42, 44, 45, 46, 48, 49
8. No 9. 4 10. 2 11. (a) 3 (b) 5, 7 (c) 3, 7 (d) 7, 13 (e) 2, 5 (f) 7, 11 (g) 2, 3 (h) 11, 13

EXERCISE 8(B)

1. 9 2. 2 3. 1 and 5 ; 5 4. 1, 3, 5, 15; 15 5. 1 and 2 ; 2
6. (a) 25 (b) 6 (c) 7 (d) 14 (e) 9 (f) 25 (g) 8 (h) 8 (i) 20
7. (a) 7 (b) 17 (c) 19 (d) 50 (e) 46 (f) 18 (g) 30 (h) 63

1. (a) $3 \times 3 \times 2 \times 2 \times 7 = 252$ (b) $11 \times 5 = 55$ (c) $5 \times 5 \times 2 \times 2 = 100$
   (d) $2 \times 2 \times 3 \times 3 \times 5 = 180$ (e) $2 \times 2 \times 3 \times 3 \times 5 = 180$ (f) $2 \times 2 \times 3 \times 5 \times 5 = 300$
   (g) $3 \times 5 \times 5 = 75$ (h) $2 \times 2 \times 2 \times 3 \times 5 \times 11 = 1320$
2. (a) 132   (b) 72   (c) 1080   (d) 924   (e) 180   (f) 550   (g) 780   (h) 1260

EXERCISE 8(D)

1. (a) 288, 2880   (b) 124, 4464   (c) 90, 1350   (d) 93, 5580   (e) 102, 6120   (f) 201, 4824
2. 80   3. 64

4.

Number	Product	H.C.F.	L.C.M	L.C.M. × H.C.F.
12 and 15	180	3	60	180
18 and 24	432	6	72	432
27 and 36	972	9	108	972
24 and 32	768	8	96	768
35 and 42	1470	7	210	1470

5. 9240   6. 39   7. 945   8. 9984   9. 240   10. 60

EXERCISE 9(A)

1. (a) $\dfrac{2}{6}, \dfrac{3}{9}, \dfrac{4}{12}, \dfrac{5}{15}$ (b) $\dfrac{8}{10}, \dfrac{12}{15}, \dfrac{16}{20}, \dfrac{20}{25}$ (c) $\dfrac{2}{12}, \dfrac{3}{18}, \dfrac{4}{24}, \dfrac{5}{30}$

   (d) $\dfrac{4}{22}, \dfrac{6}{33}, \dfrac{8}{44}, \dfrac{10}{55}$ (e) $\dfrac{8}{30}, \dfrac{12}{45}, \dfrac{16}{60}, \dfrac{20}{75}$

2. (a) 4   (b) 18   (c) 16   (d) 2   (e) 6   (f) 54   (g) 60
   (h) 13   (i) 35   (j) 60   (k) 10   (l) 1   (m) 66   (n) 11

   (o) 98   3. (a) $\dfrac{1}{2}$ (b) $\dfrac{6}{7}$ (c) $\dfrac{3}{4}$ (d) $\dfrac{43}{81}$ (e) $\dfrac{11}{17}$

   (f) $\dfrac{2}{3}$ (g) $\dfrac{13}{21}$ (h) $\dfrac{19}{23}$ (i) $\dfrac{1}{3}$ (j) $\dfrac{2}{9}$

4. a, d, f, h, j are proper fractions

5. (a) $3\dfrac{1}{2}$ (b) $18\dfrac{2}{3}$ (c) $20\dfrac{1}{2}$ (d) $6\dfrac{1}{8}$ (e) $7\dfrac{1}{2}$ (f) $12\dfrac{7}{18}$ (g) $29\dfrac{2}{3}$

   (h) $25\dfrac{7}{12}$ (i) $3\dfrac{10}{17}$ (j) $35\dfrac{7}{8}$ 6. (a) $\dfrac{59}{4}$ (b) $\dfrac{62}{7}$ (c) $\dfrac{173}{7}$

   (d) $\dfrac{129}{5}$ (e) $\dfrac{389}{8}$ (f) $\dfrac{160}{9}$ (g) $\dfrac{173}{6}$ (h) $\dfrac{569}{8}$ (i) $\dfrac{403}{4}$ (j) $\dfrac{101}{3}$

7. $\dfrac{17}{12}, \dfrac{22}{12}, \dfrac{23}{12}, \dfrac{28}{12}, \dfrac{99}{12}$ 8. $\dfrac{2}{2}, \dfrac{9}{9}, \dfrac{7}{7}, \dfrac{80}{80}, \dfrac{90}{90}$

9. (a) <   (b) <   (c) >   (d) >   (e) >   (f) >   (g) <   (h) >

10. (a) <   (b) >   (c) <   (d) >   (e) >   (f) >   (g) >   (h) >

11. (a) $\dfrac{11}{17} < \dfrac{11}{15} < \dfrac{11}{13}$ (b) $\dfrac{8}{15} < \dfrac{8}{11} < \dfrac{8}{9}$ (c) $\dfrac{8}{17} < \dfrac{15}{17} < \dfrac{16}{17}$ (d) $\dfrac{7}{18} < \dfrac{3}{4} < \dfrac{5}{6}$

   (e) $\dfrac{2}{3} < \dfrac{7}{9} < \dfrac{8}{9}$ (f) $\dfrac{7}{12} < \dfrac{2}{3} < \dfrac{5}{6}$ (g) $\dfrac{11}{24} < \dfrac{2}{3} < \dfrac{7}{10}$ (h) $\dfrac{1}{2} < \dfrac{11}{21} < \dfrac{5}{7}$

12. (a) $\dfrac{7}{8} > \dfrac{5}{12} > \dfrac{1}{4}$ (b) $\dfrac{3}{4} > \dfrac{5}{8} > \dfrac{3}{16}$ (c) $\dfrac{3}{4} > \dfrac{5}{8} > \dfrac{5}{14}$ (d) $\dfrac{7}{9} > \dfrac{2}{3} > \dfrac{5}{14}$

   (e) $\dfrac{7}{16} > \dfrac{5}{12} > \dfrac{3}{8}$ (f) $\dfrac{25}{27} > \dfrac{8}{9} > \dfrac{15}{18}$ (g) $\dfrac{4}{5} > \dfrac{11}{20} > \dfrac{17}{40}$ (h) $\dfrac{11}{17} > \dfrac{1}{2} > \dfrac{1}{4}$

EXERCISE 9(B)

1. (a) $1\frac{5}{12}$ (b) $1\frac{3}{5}$ (c) $1\frac{5}{8}$ (d) $1\frac{27}{70}$ (e) $1\frac{33}{80}$ (f) $1\frac{183}{200}$ (g) $4\frac{5}{8}$

(h) $16\frac{2}{3}$ (i) $42\frac{31}{84}$ 2. (a) $\frac{4}{45}$ (b) $\frac{12}{91}$ (c) $\frac{11}{170}$ (d) $\frac{24}{247}$ (e) $\frac{23}{45}$

(f) $\frac{11}{54}$ (g) $5\frac{13}{36}$ (h) $2\frac{3}{17}$ (i) $5\frac{3}{4}$ (j) $5\frac{7}{12}$ (k) $1\frac{3}{8}$ (l) $1\frac{1}{4}$

3. (a) $\frac{11}{12}$ (b) $1\frac{7}{40}$ (c) $6\frac{1}{4}$ (d) $\frac{9}{16}$ (e) $10\frac{1}{2}$ (f) 6 (g) $1\frac{49}{60}$

(h) $3\frac{1}{8}$ (i) $15\frac{1}{10}$ (j) $2\frac{29}{42}$

EXERCISE 9(C)

(a) $1\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{11}{32}$ (d) $\frac{3}{56}$ (e) $\frac{2}{9}$ (f) 0 (g) $1\frac{2}{5}$

EXERCISE 9(D)

1. (a) $\frac{1}{88}$ (b) $\frac{4}{65}$ (c) 4 (d) $\frac{7}{8}$ (e) $1\frac{1}{5}$ (f) $1\frac{1}{9}$ (g) 120

(h) $94\frac{1}{2}$ (i) $6\frac{6}{275}$ (j) $1\frac{3}{4}$ (k) $7\frac{1}{2}$ (l) $1\frac{13}{15}$

2. (a) $\frac{6}{7}$ (b) $\frac{35}{72}$ (c) $\frac{96}{175}$ (d) $\frac{12}{85}$ (e) $\frac{4}{21}$ (f) $\frac{1}{38}$ (g) $\frac{1}{36}$

(h) $\frac{1}{6}$ (i) $42\frac{6}{7}$ (j) 6 (k) $7\frac{1}{5}$ (l) $2\frac{1}{2}$

3. $115\frac{3}{20}$ km 4. $3\frac{3}{4}$ hr. 5. $66\frac{1}{3}$ km 6. $1\frac{4}{15}$ hr. 7. $138\frac{6}{7}$ km

8. ₹ 7,50,000 9. $\frac{109}{132}$ kg (about 825g)

EXERCISE 10(A)

1. (a) point nine (b) point zero seven (c) point zero eight three
(d) point zero one four (e) point zero zero five (f) point zero three eight
(g) point zero zero three six (h) twenty seven point zero seven five

2. (a) $\frac{1}{5}$, 0.2 (b) $4\frac{1}{2}$, 4.5 (c) $\frac{1}{20}$, 0.05 (d) $11\frac{3}{100}$, 11.03 (e) $\frac{18}{25}$, 0.72

(f) $16\frac{27}{100}$, 16.27 (g) $\frac{1}{200}$, 0.005 (h) $\frac{7}{250}$, 0.028 3. (a) 0.12 (b) 0.37

(c) 0.001 (d) 0.035 (e) 0.112 (f) 21.76 (g) 112.9

4. (a) $\frac{9}{20}$ (b) $\frac{31}{250}$ (c) $\frac{49}{1000}$ (d) $\frac{11}{200}$ (e) $9\frac{1}{20}$

(f) $30\frac{9}{100}$ (g) $100\frac{9}{40}$ 5. (a) 6 tenths' (b) 1 tenth (c) 7 hundredths'

(d) 6 hundredths (e) 7 tenths' (f) 5 hundredths (g) 1 ten

6. (a) 0 + .4 + .08 (b) 0 + .7 + .01 + .004 (c) 1 + .7 + .05
(d) 20 + 3 + .3 + .04 + .005 (e) 9 + .06 + .002 (f) 50 + 2 + .005
(g) 5 + .01 + .005 (h) 800 + 10 + 5 + .4 + .02 + .006

7. (a) < (b) < (c) > (d) < (e) < (f) <
8. (a) 0.43 < 0.6 < 0.7 (b) 0.006 < 0.014 < 0.8 (c) 0.103 < 0.123 < 0.321
(d) 0.8 < 0.83 < 0.9 (e) 1.95 < 1.99 < 3.46 (f) 11.112 < 11.21 < 11.211

9. (a) $0.76 > 0.67 > 0.62$ (b) $0.56 > 0.53 > 0.25$ (c) $6.83 > 3.41 > 1.94$
(d) $1.05 > 0.81 > 0.77$ (e) $6.11 > 1.61 > 1.16$ (f) $0.426 > 0.246 > 0.024$

10. (a) 0.75   (b) 0.875   (c) 15.25   (d) 20.6   (e) 17.1875

(f) 8.525   (g) 58.078125   **11.** (a) $\dfrac{1}{50}$ (b) $\dfrac{7}{40}$ (c) $7\dfrac{3}{5}$

(d) $7\dfrac{5}{8}$ (e) $6\dfrac{1}{8}$ (f) $3\dfrac{3}{4}$ (g) $9\dfrac{11}{20}$

12. (a) 6.0   (b) 39   (c) 12   (d) 190   (e) 642   (f) 305
13. (a) 12.4   (b) 48.4   (c) 98.7   (d) 378.5   (e) 940.1   (f) 505.6
14. (a) 5.58   (b) 33.37   (c) 180.76   (d) 786.10   (e) 388.01   (f) 136.17
15. (a) 9.38, 9.4, 9   (b) 51.18, 51.2, 51   (c) 100.13, 100.1, 100
(d) 499.86, 499.9, 500   (e) 616.07, 616.1, 616
16. (a) 5m, 20m, 21m, 90m, 87m   (b) 3L, 37L, 56L, 5L, 10L
(c) 5kg, 64kg, 88kg, 78kg, 90kg

EXERCISE 10(B)

1. (a) 144.653   (b) 224.9775   (c) 221.95   (d) 13.1928   (e) 97.5952
(f) 1118.7999   (g) 1111.2111   (h) 556.409   **2.** (a) 0.1169   (b) 0.107
(c) 0.018   (d) 0.0765   (e) 0.2848   (f) 1.3061   (g) 24.9664
(h) 0.1859   **3.** 63.17   **4.** 37.4832   **5.** 79.1276   **6.** 0.8055
7. 257.43   **8.** 374.85   **9.** 30.775   **10.** 5.7027   **11.** (a) 1.86
(b) 20.767   (c) 26.578   (d) 15.91   (e) 45.9644   (f) 1314.8738

EXERCISE 10(C)

1. (a) 4.87, 48.7, 487   (b) 5.671, 56.71, 567.1   (c) 60.63, 606.3, 6063
(d) 24.861, 248.61, 2486.1   (e) 518.35, 5183.5, 51835   (f) 1236, 12360, 123600
(g) 0.009, 0.09, 0.9   (h) 150.02, 1500.2, 15002
2. (a) 483.7   (b) 3890   (c) 12380   (d) 32.08   (e) 0.07   (f) 30.17
(g) 100820   (h) 30.9

EXERCISE 10(D)

1. (a) 30.08   (b) 130.56   (c) 1314.56   (d) 342.72   (e) 176.25   (f) 301.2
(g) 4.6882   (h) 116.88   (i) 2502.5   (j) 20002   **2.** (a) 2.208   (b) 0.01573
(c) 0.001056   (d) 0.000256   (e) 0.037996   (f) 0.01   (g) 27.84   (h) 0.000027
3. (a) 38.88   (b) 388.8   (c) 3.888   (d) 0.03888   **4.** (a) 553.14   (b) 5.5314
(c) 55314   (d) 55.314   (e) 0.55314   **5.** (a) 148.8   (b) 1488   (c) 1.488
(d) 0.1488   (e) 14880   **6.** (a) 3.934   (b) 3934   (c) 0.3934   (d) 39.34

EXERCISE 10(E)

1. (a) 1.2, 0.12, 0.012   (b) 7.5, 0.75, 0.075   (c) 176.7, 17.67, 1.767
(d) 8.976, 0.8976, 0.08976   (e) 20.12, 2.012, 0.2012   (f) 0.089, 0.0089, 0.00089
(g) 0.008, 0.0008, 0.00008   (h) 0.00076, 0.000076, 0.0000076
2. (a) 0.6483   (b) 0.328   (c) 1.748   (d) 2.174   (e) 4.648
(f) 0.5478   (g) 0.00036   (h) 0.00476

EXERCISE 10(F)

1. 0.014   **2.** 0.083   **3.** 0.64   **4.** 0.0929   **5.** 0.0087   **6.** 0.0136
7. 1.054   **8.** 11320

EXERCISE 10(G)

1. ₹ 17056.40   **2.** ₹ 5525   **3.** ₹ 634.25   **4.** ₹ 97.10   **5.** ₹ 2368.50
6. ₹ 43   **7.** ₹ 13020   **8.** ₹ 367.15   **9.** ₹ 5475.40   **10.** ₹ 28424

1. (a) 45   (b) 55   (c) 34   (d) 23   (e) $3\frac{31}{120}$

(f) $2\frac{1}{30}$ (g) $1\frac{17}{24}$ (h) $\frac{49}{120}$ **2.** 29.5 cm   **3.** 15

4. 20   **5.** 9 years 1 month, 128 cm, 28.18 kg

6. (a) 54   (b) 9   (c) 9   (d) 2

7. (a) All the three classes had the same attendance   (b) (i) Tuesday   (ii) Thursday

8. (a) English – 63,   Hindi – 50,   Maths – 66,
   Science – 62,   History – 65,   Geography – 62

   (b) Amar – 68,   Balbir – 44,   Chander – 76,   (c) Maths   (d) Hindi
   Dilraj – 62,   Ela – 49,   Fatima – 69

9. 75   **10.** 25.88 kg   **11.** 17 years 3 months   **12.** 20

Simplify

(a) 15   (b) 4   (c) 141   (d) 68   (e) 45   (f) 20   (g) 34   (h) 40   (i) 134

1. $2\frac{3}{5}$ **2.** $5\frac{1}{57}$ **3.** 0.8   **4.** $18\frac{5}{6}$ **5.** $2\frac{13}{20}$ **6.** $3\frac{1}{3}$

7. 7.4   **8.** 40   **9.** $1\frac{9}{13}$ **10.** 1.6

1. (a) 37%   (b) 18%   (c) 3%   (d) 85%   (e) 29%

2. (a) $\frac{41}{100}$ (b) $\frac{56}{100}$ (c) $\frac{62}{100}$ (d) $\frac{69}{100}$ (e) $\frac{93}{100}$

3. (a) 25%   (b) 90%   (c) 85%   (d) 450%   (e) 170%

4. (a) $\frac{19}{50}$ (b) $\frac{47}{100}$ (c) $\frac{39}{50}$ (d) $\frac{41}{50}$ (e) $\frac{101}{150}$

(f) $1\frac{1}{8}$ (g) $\frac{1}{6}$ (h) $\frac{3}{200}$ **5.** (a) 0.13   (b) 0.24

(c) 0.69   (d) 0.81   (e) 1.05   (f) 2.5   (g) 0.0625

(h) 0.1002   **6.** (a) 58%   (b) 48.3%   (c) 276%   (d) 924.3%

(e) 602.5%   (f) 396%   (g) 420%   (h) 875%

7. (b) 0.05   **8.** (d) 0.125   **9.** (b) 750%   **10.** (c) 608%

1. (a) 245   (b) 114   (c) ₹ 378   (d) ₹ 500   (e) 14.4 *l*

(f) 405 metres   (g) 960   (h) 52.5 kg   (i) ₹ 2100

2. (a) 15%   (b) 80%   (c) 6%   (d) 2.5%   (e) 2.4%

(f) 66.66%   (g) 10%   (h) 12.5%   (i) 18.75%   (j) 9.6%

3. 5, 45   **4.** 18   **5.** 28 questions   **6.** 76%   **7.** Maths

8. Both are equal   **9.** Class VI   **10.** 39%, 61%

1. (a) 2   (b) 3   (c) 0   (d) –1   (e) –4   (f) –15

(g) 7   (h) 3   **2.** (a) –4   (b) –2   (c) –7   (d) 0

(e) –15   (f) –10   (g) –13   (h) –20

3. (a) –7, –6, –5, –1, 0, 2, 4, 5   (b) –9, –6, –5, –4, 0, 3, 4, 7   (c) –10, –2, 0, 3, 4, 7, 9, 12

4. (a) 22, 16, 5, 2, 0, –7, –12   (b) 16, 8, 3, 0, –1, –2, –4, –5   (c) 12, 10, 5, 2, 0, –6, –7, –8

5. (a) +12   (b) –6   (c) 0   (d) +7   (e) +4

(f) +10   (g) –8   (h) –4

7. (a) 6   (b) 6   (c) 6   (d) 9   (e) 5   (f) 7

8. (a) −1, 0, 1, 2, 3, 4, 5, 6   (b) −3, −2, −1, 0, 1, 2, 3
    (c) −1, −2, −3, −4   (d) 3, 4, 5, 6, 7, 8
    (e) 0, 1, 2, 3, 4   (f) 1, 2, 3, 4, 5, 6, 7, 8, 9

9. (a) −90   (b) +48   (c) +5   (d) −2   (e) +22   (f) −3

10. (a) A loss of ₹ 700   (b) +13   (c) −27   (d) Going north
    (e) A profit of ₹ 500   (f) Increase in population   (g) Withdrawing money from bank

EXERCISE 14(B)

1. (a) +7   (b) −5   (c) +1   (d) −9   (e) −3   (f) −9

2. (a) −105   (b) +890   (c) −631   (d) −604   (e) −1531   (f) −395
    (g) −145   (h) −25   (i) −80   (j) −370

3. (a) S = −13 ; P = −15   (b) S = 37 ; P = 35   (c) S = −96 ; P = −98
    (d) S = −173 ; P = −175   (e) S = −844 ; P = −846   (f) S = −1093 ; P = −1095
    (g) S = −998 ; P = −1000   (h) S = −999 ; P = −1001   **4.** (a) +7   (b) +1
    (c) −3   (d) 8   (e) −12   (f) −10   **5.** (a) +5   (b) −3
    (c) +12   (d) −16   (e) −25   (f) +54   (g) −8   (h) −4

EXERCISE 14(C)

1. (a) −3   (b) 11   (c) −7   (d) 4   (e) −5   (f) 7
    (g) 4   (h) −11   (i) 5   (j) −24   (k) 17   (l) −10

2. (a) −3   (b) −8   (c) −8   (d) −3   (e) +3   (f) +4
    (g) +5   (h) +1   (i) +2   (j) −5   (k) 0

3. (a) <   (b) <   (c) =   (d) >   (e) >

EXERCISE 15(A)

1. (a) AB, BC, CD, DA, BD, AC   (b) AB, BC, CD, DE, EA, AD, CE
    (c) PQ, QR, RP, PT, TS, SP, QT, RS

2. (a) Vertex : E ; Arms : EF and ED   (b) Vertex : Y ; Arms : YX and YZ
    (c) Vertex : Q ; Arms : QR and QP

3. (a) Actue angle   (b) Obtuse angle   (c) Acute angle   (d) Right angle

4. (a) 4.5 cm   (b) 1·8 cm

6. (a) AB = BC = CD = AD = 4.7 cm   (b) PS = QR = 2·7 cm; PQ = RS = 4·8 cm
    (c) AB = AC = 3 cm ; BC = 5·2 cm   **7.** (a) 68°   (b) 49°   (c) 132°
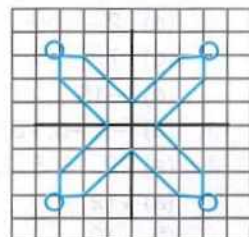
EXERCISE 15(B)
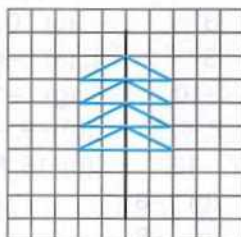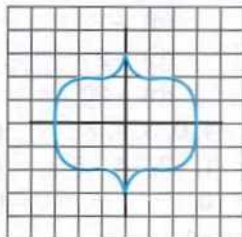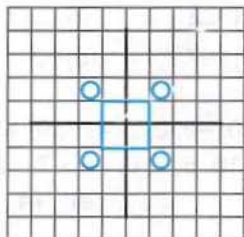
1. (a) Equilateral triangle   (b) Acute triangle   (c) Obtuse triangle   (d) Right triangle
    (e) Scalene triangle   (f) Obtuse triangle

2. (a) 84 cm²   (b) 60 cm²   (c) 180 cm²

EXERCISE 15(C)

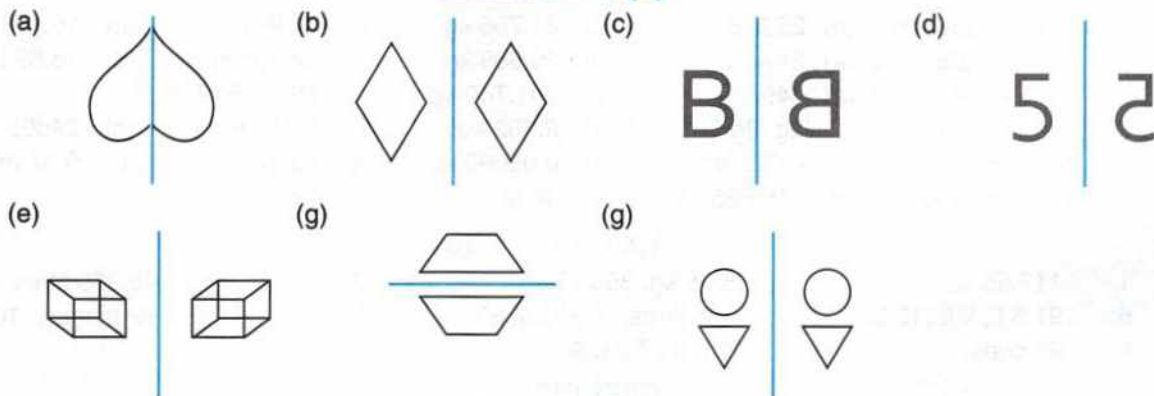**1.** (a) Symmetrical   (c) Symmetrical   (e) Symmetrical   (f) Symmetrical

EXERCISE 15(D)

2. (a) 2   (b) 3   (c) No   (d) One   (e) 0   (f) 4   (g) No   (h) One

3. (a)   (b)   (c)   (d)

(a)　(b)　(c)　(d)

(e)　(g)　(g)

EXERCISE 16(A)

1. (a) 8 m 4 dm 2 cm 5 mm (b) 7 m 7 dm 5 cm (c) 27 m 7 cm 8 mm
   (d) 52 m 6 cm 4 mm (e) 6 dm (f) 9 mm
   (g) 1 m 5 cm (h) 75 m 8 cm

2. (a) 8.652 m (b) 10.865 m (c) 15.819 m
   (d) 1.37 m (e) 0.743 m (f) 0.08 m
   (g) 0.009 m (h) 4.005 m

3. (a) 2 km 3 hm 5 dam 5 m (b) 8 km 1 hm 6 dam 2 m (c) 30 km 7 hm 5 dam
   (d) 35 km 2 hm 5 dam (e) 48 km 8 hm 7 dam 8 m (f) 7 km 7 dam 5 m
   (g) 1 km 5m h) 9 km 3 m

4. (a) 1.129 km (b) 7.822 km (c) 50.087 km (d) 24.506 km
   (e) 0.605 km (f) 0.052 km (g) 1.005 km (h) 2.08 km

5. (a) 3 kg 1 hg 2 dag 7 g (b) 16 kg 4 hg 8 dag 5 g (c) 7 hg 5 dag 8 g (d) 4 hg 8 dag
   (e) 6 kg 5 hg (f) 1 kg 2 hg 5 dag (g) 250 kg 4 dag (h) 8 g

6. (a) 2.272 kg (b) 5.515 kg (c) 7.027 kg (d) 0.503 g
   (e) 10.65 kg (f) 0.642 kg (g) 6.005 kg (h) 9.06 kg

7. (a) 3 g 1 dg 6 cg 4 mg (b) 5 g 7 dg 5 cg (c) 5 dg (d) 1 dg 8 cg 5 mg
   (e) 17 g 6 cg (f) 7 dg 5 cg (g) 9g 9 mg (h) 8 mg

8. (a) 6.702 g (b) 2.271 g (c) 0.572 g (d) 0.066 g
   (e) 0.007 g (f) 0.009 g (g) 0.08 g (h) 0.5 g

9. (a) 6 L 4 dL 5 cL 2 mL (b) 8 L 6 dL 1 cL 6 mL (c) 5 dL (d) 2 dL 5 cL
   (e) 1 dL 2 cL 5 mL (f) 6 L 5 cL 10. (a) 6.672 L (b) 20.8 L
   (c) 5.159 L (d) 0.025 L (e) 0.6 L (f) 0.08 L
   (g) 1.005 L (h) 0.008 L 11. (a) 9 kL 1 hL 2 daL 9 L (b) 7 hL 7 daL 5 L
   (c) 5 daL (d) 1 kL 1 hL (e) 7 hL (f) 2 hL 2 daL 5 L

12. (a) 3.532 kL (b) 6.007 kL (c) 8.05 kL (d) 15.375 kL
    (e) 18.6 kL (f) 5.008 kL 13. (a) 4.153 kg (b) 3 kg
    (c) 3.856 kg (d) 31.636 kg (e) 48.416 kg (f) 0.85 kg
    (g) 0.5 kg (h) 0.075 kg 14. (a) 4300 g (b) 19630 g
    (c) 35365 g (d) 36300 g (e) 15 gm (f) 8 gm
    (g) 220 gm (h) 900 gm 15. (a) 0.365 km (b) 0.66 km
    (c) 0.099 km (d) 0.588 km (e) 1.740 km (f) 4.030 km
    (g) 2.250 km (h) 3.666 km 16. (a) 1500 m (b) 2250 m
    (c) 5750 m (d) 800 m (e) 750 m (f) 6060 m
    (g) 100025 m (h) 60025 m 17. (a) 0.5 m (b) 1 m
    (c) 1.25 m (d) 5 m (e) 7.5 m (f) 2.2 m
    (g) 21.1 m (h) 40.04 m 18. (a) 15 cm (b) 5 cm
    (c) 275 cm (d) 325 cm (e) 855 cm (f) 0.6 cm
    (g) 800.8 cm (h) 111.5 cm

EXERCISE 16(B)

1. (a) 21.350 km (b) 25.596 m (c) 21.765 kg (d) 21.971 L (e) 16.102 kL
(f) 29.368 g 2. (a) 24.425 km (b) 25.883 kg (c) 19.605 kL (d) 15.59 L
(e) 101.45 m 3. (a) 349.2 km (b) 691.740 kg (c) 46 km 512 m
(d) 1232 kg 5 hg 1 dag 2g 4. (a) 8.702 kg (b) 0.916 m (c) 24008 L
(d) 45.61 m (e) 0.623 km (f) 0.05096 kL 5. (a) 60.44 kg (b) 9.51 m
(c) 38.14 kL 6. 115.625 kg 7. 44 m 8. 7 mL

EXERCISE 16(C)

1. 117.55 kL 2. 15.75 kg, 393.75 kg 3. 39.75 m 4. 46.255 litres
5. 91.5 L, ₹ 6212.85 6. 1155 litres, ₹ 36382.50 7. 2 dL 8. 62 pieces, 10 cm
9. 25 cups 10. ₹ 71.30, ₹ 2139

EXERCISE 17(A)

1. (a) 32 m (b) $24\frac{1}{2}$ cm (c) 48.8 cm (d) 3 m 60 cm (e) 25 m 11 cm
(f) 64 m 24 cm (g) 60.6 cm (h) 11 m 24 cm 2. (a) 30.4 cm (b) 74.66 m
(c) 55 m (d) 92.2 cm 3. 16 cm 4. 28 m 5. 108 m
6. 420 m 7. 8 m, ₹ 116 8. 6m, 24m, ₹ 42

EXERCISE 17(B)

1. (a) 18 cm² (b) 27 cm² 2. (a) 9 cm² (b) 7 cm² (c) 11 cm² (d) 7 cm²

EXERCISE 17(C)

1. (a) 70 m² (b) 300cm² (c) 400 cm² (d) 216 cm² (e) 48 dm²
(f) 154 dm² (g) 108 dm² (h) 12500 cm² 2. (a) 12100 cm² (b) 275625 cm²
(c) 576 mm² (d) 2025 mm² e) 256 dm² (f) 12.25 m²
3. (a) 6 cm (b) 13 m (c) 24 m (d) 3 m (e) 18 m
4. 7 m 5. 1225 m², ₹ 6125 6. 9 m, 48 m
7. ₹ 5760 8. 45 m, 162 m 9. 9 m, 108 m² 10. 625 cm²
11. (b) 11 cm² (c) 19.5 cm² (d) 37 cm²

EXERCISE 17(D)

1. 3000, ₹ 7500 2. 118800 cm², 11.88 m² 3. 360 m² 4. 11200, ₹ 5600
5. (a) 24 m² (b) 63 m² (c) 112 m² (d) 30 m² 6. 168.75 m² 7. 0.84 m²
8. 44 m² 9. 572 m², 208 m² 10. Arnav covers greater distance by 60 m.

EXERCISE 18(A)

1. (a) 20 cu cm (b) 5 cu cm (c) 64 cu cm (d) 8 cu cm
2. (a) 160 cu m (b) 900 cu m (c) 112500 cu cm
3. 9000 cu cm 4. 480 cu m 5. 489.8 cu m 6. 63 cu m, 25 7. 25000
8. 108000 cu cm 9. 33.75 cu cm 10. 64000 11. 96 12. 1800 kL

EXERCISE 19(A)

1. (a) ₹ 23.30 (b) ₹ 250.75 (c) ₹ 700.60 (d) ₹ 64.05 (e) ₹ 5835.65 (f) ₹ 20.02
(g) ₹ 73.25
2. (a) Rupees forty three and twenty five paise (b) Rupees two hundred thirty seven and forty paise
(c) Rupees seventeen and eighty five paise (d) Rupees four hundred sixty three and five paise
(e) Rupees three hundred sixty eight and seventy five paise
(f) Rupees twelve (g) Seventy five paise (h) Eight paise
3. (a) 4230 p (b) 43645 p (c) 46525 p (d) 568125 p (e) 6475 p (f) 8905 p
(g) 615 p (h) 508 p 4. (a) 41565 p (b) 3655 p (c) 3925 p
(d) 32580 p (e) 7505 p (f) 40340 p (g) 20000 p (h) 50070 p
5. (a) ₹ 26.80 (b) ₹ 568.32 (c) ₹ 1.30 (d) ₹ 500.08 (e) ₹ 154.78 (f) ₹ 170.08
(g) ₹ 0.65 (h) ₹ 36.80 (i) ₹ 300.00 (j) ₹ 540.05 (k) ₹ 37.86 (l) ₹ 0.06

EXERCISE 19(B)

1. (a) ₹ 578.35   (b) ₹ 890.45   (c) ₹ 14330.36   (d) ₹ 152250.39 (e) ₹ 70486.60   (f) ₹ 54919.85
   (g) ₹ 104097.50   (h) ₹ 79749.35   (i) ₹ 130398.40
2. (a) ₹ 54.50   (b) ₹ 144.80   (c) ₹ 2910.47   (d) ₹ 109421.08 (e) ₹ 31949.90   (f) ₹ 156578.85
   (g) ₹ 50339.60   3. ₹ 645.80   4. ₹ 5420   5. ₹ 218.95
6. Sumit earned more by ₹ 3474.85   7. ₹ 347.40

EXERCISE 19(C)

1. (a) ₹ 102   (b) ₹ 12.50   (c) ₹ 228.90   (d) ₹ 23643.75 (e) ₹ 8422.40   (f) ₹ 96757.50
   (g) ₹ 3412757.04   (h) ₹ 4682262.75 (i) ₹ 6536407.50   (j) ₹ 8593391.25
2. (a) ₹ 48   (b) ₹ 0.19   (c) ₹ 9.46   (d) ₹ 45.87   (e) ₹ 70.96   (f) ₹ 469.69
   (g) ₹ 361.87   (h) ₹ 1307.04 (i) ₹ 9173.49   3. ₹ 526   4. ₹ 549010.08   5. ₹ 26.31
6. ₹ 120.15   7. ₹ 25666.25

EXERCISE 20(A)

1. (a)   900 minutes (b)   596 minutes   (c)   2160 seconds (d)   748 seconds   (e)   120 hours
   (f)   297 hours   (g)   705 minutes
2. (a)   69 months   (b)   63 days   (c)   99 days   (d)   1176 hours   (e)   2026 hours
   (f)   34 months   (g)   4650 minutes
3. (a)   86400 seconds   (b)   3024000 seconds   (c)   5184000 seconds
4. (a)   13 minutes 32 seconds   (b)   15 hours 24 minutes   (c)   4 days 9 hours
   (d)   31 days 1 hour   (e)   17 hours 4 minutes
5. (a)   73 weeks 1 day   (b)   52 weeks 1 day   (c)   4 years 4 months
   (d)   7 years 2 months   (e)   11 months 12 days   (f)   26 months 4 days
6. (a)   970 minutes (b)   546 minutes   (c)   51 hours   (d)   223 hours

EXERCISE 20(B)

1. (a)   19 : 50 hours   (b)   05 : 00 hours   (c)   00 : 00 hours   (d)   08 : 45 hours   (e)   14 : 20 hours
   (f)   16 : 40 hours   (g)   09 : 35 hours   (h)   06 : 30 hours   (i)   19 : 20 hours   (j)   12 : 00 hours
   (k)   15 : 15 hours   (l)   05 : 25 hours
2. (a)   4 : 30 p.m.   (b)   11 : 50 p.m.   (c)   10 : 45 a.m.   (d)   6 : 15 p.m.   (e)   12 : 00 noon
   (f)   12 : 00 midnight (g)   5 : 00 a.m.   (h)   4 : 00 p.m.   (i)   3 : 00 a.m.   (j)   5 : 10 p.m.
   (k)   8 : 15 a.m.   (l)   3 : 30 p.m.   3.   16 : 45 hours   4.   2 : 30 p.m.

EXERCISE 20(C)

1. (a) 11 hours 56 minutes   (b)   23 hours 20 minutes   (c)   42 hours 20 minutes
   (d) 19 minutes 43 seconds   (e)   37 minutes 14 seconds   (f)   44 minutes 18 seconds
   (g) 16 hours   2. (a)   35 years 6 months   (b)   34 years 2 months
   (c) 17 years
3. (a) 2 days 6 hours   (b)   4 days 15 hours   (c)   2 days 19 hours
   (d) 2 weeks 1 day   (e)   2 hours 15 minutes   (f)   1 hour 39 minutes
   (g) 11 hours 15 minutes   (h)   5 minutes 14 seconds   (i)   6 minutes 45 seconds
   (j) 6 minutes 10 seconds   (k)   3 years 2 months   (l)   6 years 6 months
   (m) 7 years 2 months   4. (a)   6 : 45 p.m.   (b) 3 : 00 a.m.   (c)   12 : 10 p.m.
   (d) 1 : 30 a.m.   (e)   9 : 05 p.m.   5. (a) 9 hours 55 minutes
6. 4 hours 45 minutes   7. 1 hour 10 minutes   8. 11 : 30 p.m.   9. 5 hours 30 minutes

EXERCISE 20(D)

1. 1327 km   2. 660 km   3. 14 hours 37 min   4. Neelanchal express takes more time
5. 3 trains   6. 10 minutes   7. 2421

EXERCISE 20(E)

1. 4 Buses   2. 7 : 10 a.m.   3. 307 km   4. (a) 317 km   (b) 425 km   (c) 469 km

1. (a) The peak hours were between 04:00–08:00 (b) The least arrivals were between 00:00–04:00
   (c) During the time periods 20:00–24:00 and 00:00–04:00
   (d) The difference between the maximum and minimum is 7,000
   (e) Total number of passengers of a day = 52,000

2. (a) 3050 *l*, ₹ 97,600 (b) The sale was maximum on Thursday
   (c) The sale was the same on Tuesday and Friday and on Monday and Saturday
   (d) The sale was minimum on Tuesday and Friday

EXERCISE 21(B)

1. (a) Monday (b) Thursday (c) 6150 kg (d) Saturday and Sunday (e) ₹ 2,58,300
2. (a) Saturday (b) Tuesday (c) 5500 (d) ₹ 1,37,500
3. Scale 1 cm = 100 visitors. 4. Scale 1 cm = 200 items.

Solution :
(a) Maximum number of people visit the shop between 12 noon and 4 pm.
(b) The shop has minimum number of customers between 4 am and 8 am.
(c) 4450 customers.
(d) 2900 customers.
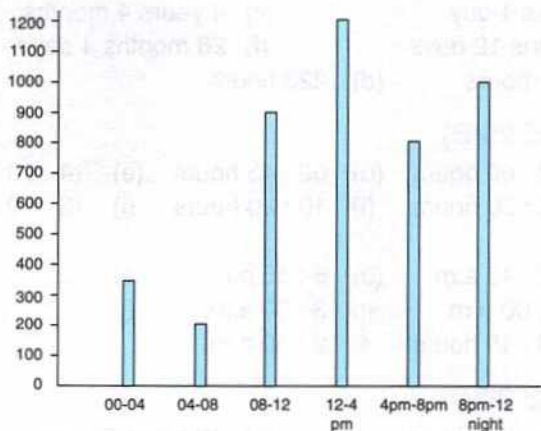
Solution :
(a) Maximum number of customers visited the shop for clothes.
(b) Minimum number of customers visited the shop for sports items.
(c) In all 6800 customers visited the shop.
(d) The shop is popular for clothes and food items.
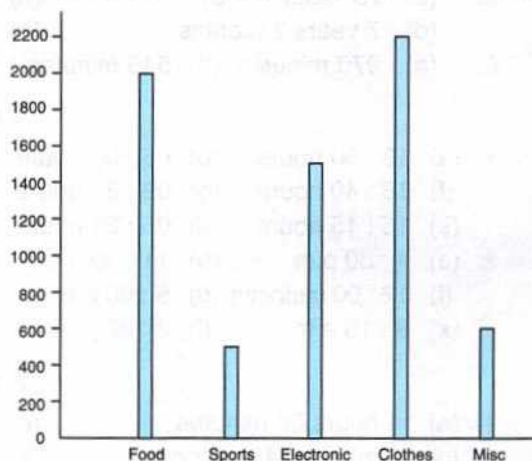
EXERCISE 21(C)

1. (a) Thur (b) Mon (c) 12% (d) 20%

2. **Solution :**
   (a) The most popular mode of transport is the school transport.
   (b) 16.67% students come on their own.
   (c) 20.83% students use public transport.

3. **Solution :**
   (a) The most favoured snack is wafers.
   (b) The least favoured snack is ice-cream.
   (c) 25% students prefer cakes.
   (d) Noodles and sandwiches are the two items that are favoured by the same percentage of students.
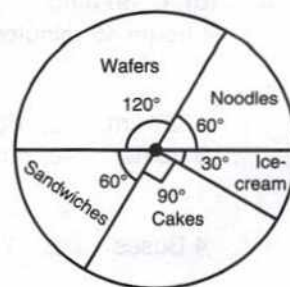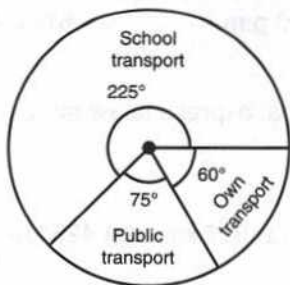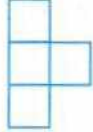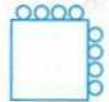
1. (a) 1400   (b) 1800 – 1400 = 400
   (c) 2016, 2017 and 2018   (d) 1200
2. (a) April   (b) ₹ 35,000 – ₹ 25,000 = ₹ 10,000
   (c) January   (d) ₹ 1,35,000
3. Scale on Y-axis : 1 sq. cm = 1000 visitors
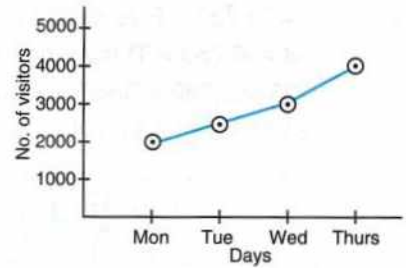
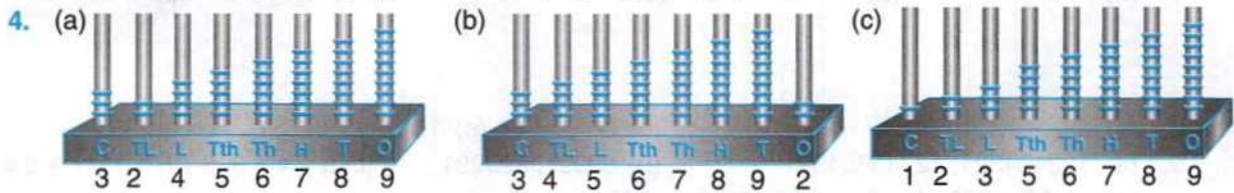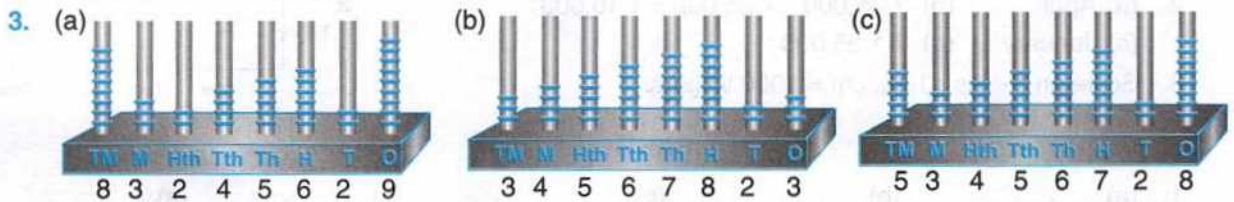## EXERCISE 22

1. (a)   (b)   (c)   (d)   (e)

2. (a) 26   (b) 32   (c) 31   (d) 36   (e) 15   (f) 51   (g) 33
3. (a) 123454321, 12345654321   (b) 89991, 899991   (c) 5 + 4 = 9; 6 + 5 = 11; 7 + 6 = 13
   (e) 4 × 55 = 220; 5 × 55 = 275; 7 × 55 = 385

SELF ASSESSMENT

A. 1. (a) 1,00,00,000   2. (c) 99,99,999   3. (d) Five lakh   4. (c) 9
5. (a) 4,32,15,673; 11,23,45,331; 38,94,35,678; 42,13,24,567; 98,76,54,321
   (b) 17,32,14,541; 42,31,34,678; 73,24,51,321; 75,32,14,571; 83,24,12,531
   (c) 45,67,89,321; 46,12,34,127; 53,26,78,931; 64,21,41,321; 73,21,45,678
6. (a) 93,21,32,141; 34,56,78,413, 20,13,24,412; 15,63,21,456; 6,46,78,132
   (b) 93,45,67,831; 73,24,56,123; 21,24,13,452; 13,24,12,313; 8,41,23,456
   (c) 83,24,12,321; 73,23,15,678; 53,21,34,567; 43,41,24,217; 13,57,89,032
7. (b) 876543210   8. (b) 102345678   9. (a) 444443210
10. (b) Three million eight hundred thirty two thousand eight hundred seventy one
11. (c) Five hundred seventy five thousand eight hundred   12. (b) 84,52,37,734
13. (c) 386333294   14. (d) 48,18,888   15. (a) 28   16. (d) 17,082
17. (c) D   18. (d) XXXIX   19. (c) 2, 3 and 5   20. (b) 0
21. (c) 9   22. (b) 2   23. (c) 10   24. (d) 240
25. (b) $\dfrac{77}{60}$ 26. (d) $\dfrac{1}{50}$ 27. (b) 25625 m
28. (a) 14,56,700   (b) 16,10,900   (c) 11,01,200
29. (d) 3·845 kg   30. (c) 97,750 L   31. (d) 435   32. (d) 420 km
33. (c) 40%   34. (c) 0·25   35. (b) 200   36. (b) 120
37. (a) ₹ 398378.50   38. (c) 17,532 hrs

B. 1. 9,99,99,999   2. 47,05,764   3. 13,24,381   4. 60,43,125
5. 0·001   6. $\dfrac{832}{100} = \dfrac{208}{25}$ 7. 0·18125   8. 0·3367
9. $\dfrac{1}{4}$ 10. $\dfrac{1}{4}$ 11. $\dfrac{60}{7}$ 12. 8 kg
13. its last two digits are divisible by 4, or the last two digit are both zeroes.
14. a number divisible only by 1 or the number itself   15. 1
16. 8   17. 300   18. Product of numbers   19. CMXXIV
20. MMDXX   21. remainder   22. 57,80,43,290   23. 84,75,729
24. 1,52,765 ; 10   25. +27   26. acute, right, obtuse and straight angles
27. 4 × side   28. 1/2 Base × Height   29. 2320   30. 0·3 kg
31. 15,000   32. 4%   33. 5,67,800   34. ₹ 8513
35. 110   36. 2,745   37. 29
38. Brackets, of (×), Division, Multiplication, Addition and Subtraction   39. Number of quantities
40. 6·25%

C. **1.** 5,436,787 = Five million four hundred thirty six thousand seven hundred eighty seven

38,456,753 = Thirty eight million four hundred fifty six thousand seven hundred fifty three

123,456,789 = One hundred twenty three million four hundred fifty six thousand seven hundred eighty nine

2. 24,356,331; 135,6644

3. (a)

TM	M	Hth	Tth	Th	H	T	O
8	3	2	4	5	6	2	9

(b)

TM	M	Hth	Tth	Th	H	T	O
3	4	5	6	7	8	2	3

(c)

TM	M	Hth	Tth	Th	H	T	O
5	3	4	5	6	7	2	8

4. (a)

C	TL	L	Tth	Th	H	T	O
3	2	4	5	6	7	8	9

(b)

C	TL	L	Tth	Th	H	T	O
3	4	5	6	7	8	9	2

(c)

C	TL	L	Tth	Th	H	T	O
1	2	3	5	6	7	8	9

5. 1,85,74,573   **6.** 2,96,44,454   **7.** 79,81,875   **8.** 43,045

9. Q = 32,213; R = 65   **10.** 1,500 = 2 × 2 × 3 × 5 × 5 × 5   **11.** 10

12. 1,260   **13.** $\dfrac{1}{3}, \dfrac{2}{5}, \dfrac{3}{4}$ **14.** $8\dfrac{5}{6}$ **15.** $1\dfrac{9}{10}$

16. $5\dfrac{1}{18}$ **17.** $1\dfrac{1}{5}$ **18.** $2\dfrac{14}{15}$ **19.** 0·0162

20. 3   **21.** (a) 16,96,800; 16,97,000   (b) 80,88,600; 80,89,000

22. 19   **23.** 0   **24.** 1   **25.** 31·785

26. 21,600 times   **27.** 57 students   **28.** 850 hours   **29.** MC

30.

Scale on Y-axis : 1 sq. cm = 100 ice-cream cups sold
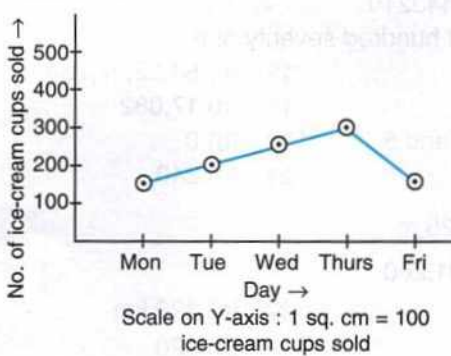
31. (a) Apple   (b) 45 students
(c) Apples and Oranges
(d) 20 %   (e) 70%

32. (a) Computer studies   (b) English and Hindi
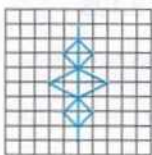(c) 25%   (d) 38·9%

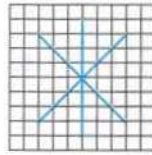**33.** (a) No   (b) Yes
(c) Yes   (d) Yes
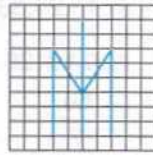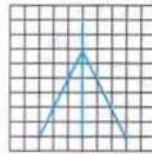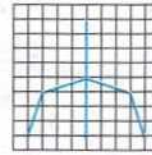(e) No   (f) Yes
(g) Yes   (h) Yes

34. (a)   (b)   (c)   (d)   (e)   (f)

35. (a)
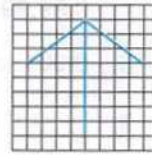

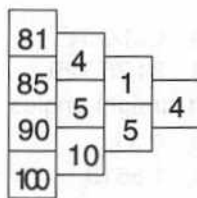
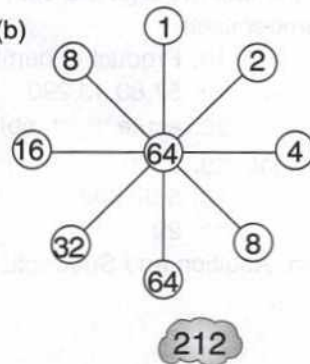| 81 | | | |
85	4	1	
90	5	5	4
100	10		

(b)

36. Yes, 3,025 is the 55th unit of the square number pattern.

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