OUR

New Edition

6

Mathematics

Grade -6

Our Mathematics

Grade 6

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About the book

Education should bring forth magnanimity in students, in harmony with democratic norms, after having acquired the capability to exploit human resources, so as to develop skilful, well-disciplined and responsible citizens capable enough to withstand competitive life-style for this purpose. As per the recommendation specified in the reports of the National Education Commission 2049 and the High Level National Education Commission 2055, some time relevant changes have been made in the school level curriculum. This textbook has been brought out in course of updating curriculum and textbook to meet the requirement.

Efforts have been made to make this book activity based to enable students to think creatively as well as develop skills for finding solutions. This book has incorporated suggestions generated in the regional and national level workshops by teachers, guardians and subject specialists. It contains example activities related to our everyday life. In fact, most of the activities are related to our daily life.

Originally written by Sambhu Narayan Baidhya in 2051 B.S., the present form of this book is the work of a task force comprising of Lekhnath Poudel, Man Raja Rajopadhyaya, Umanath Pande and Barun Baidhya. Further, revision was done by the Subject Committee members comprising of Shiva Prasad Satyal, Jaganath Awa, Birendra Kumar Jha, Bal Krishna Man Singh, Dr. Hira Bahadur Maharjan, Krishna Bhakta Tuladhar, Jwala Nepali, Koji Takahasi and Takayaki Kitadai. Language editing was done by Hari Gautam, cover design by Tarjan Rai, illustration by Sri Hari Shrestha, and type and layout by Kamal Prasad Dhungana and Sagar Dahal. CDC expresses its profound gratitude to all those who contributed to the development of this book.

Textbook is a vital tool in the process of teaching/learning. Experienced teachers and enthusiastic students can teach and learn the subject matter specified by the curriculum by using various resources. It is felt that most of the schools solely depend on textbooks due to the lack of reference materials. Plenty of efforts have, therefore, been made in order to bring this book up to the standard. Despite all our efforts, there might exist some textual errors like language, style, subject matter, presentation and graphics. To improve all such errors teachers, guardians, students and experts concerned can play a vital role, therefore, the Curriculum Development Centre cordially invites their constructive suggestions.

Government of Nepal
Ministry of Education
Curriculum Development Centre
Sano Thimi, Bhaktapur, Nepal

Preface

One of the major tasks of the Government is to provide education to all the people. Curriculum Devֿelopment Centre (CDC) is the authorized institution in the country to design and produce the textbooks used throughout the kingdom.

Janak Education Materials Centre (JEMC) prints and distributes the textbook to all public schools in the country. To cater the needs of both private and public schools JEMC has taken a step forward- to translate the authorized version of Nepali books into English. We are confident that we shall gradually and surely be able to provide English version books of different subjects as reference materials.

JEMC really feels proud of accomplishing a substanial job of translating school texbooks into English for English medium learners across the country.

This book has been translated by Narayan Prasad Acharya, Pawan Kumar Malik and Mahendra Chaulagain from the original Nepali version *Hamro Ganit* of grade 6. JEMC invite constructive suggestions from all concerned to make this book more effective.

JEMC is specially grateful to CDC and the principals of both the public and private schools for encouraging us to publish the English version textbooks. We are also grateful to Shalik Ram Bhusal of CDC, Mukunda Bahadur Shrestha of Anandakuti Vidyapeeth, Chandra Mohan Shrestha of Himalaya Secondary School who were involved in evalution of the subject matter of the text and language editing.

Finally, we would like to express our heartfelt thanks to all those who contributed in the preparation of these books.

Date: 2066, Baishakh

JEMC
Sano Thimi, Bhaktapur

CONTENTS

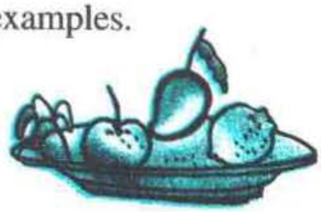
1. Sets

1.1 Introduction to Sets:

(a) Study the following examples.

There is a banana.

There is an apple.



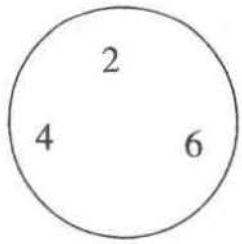
There is a mango.

There is an orange.

These all are fruits.

This is a set of fruits kept in the plate.

(b) 2 is an even number.
4 is an even number.
6 is also an even number.
These all are even numbers less than 7.

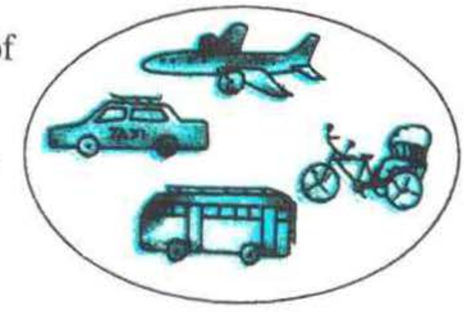


This is a set of even numbers less than 7.

(c) Kathmandu is the capital of Nepal.
Delhi is the capital of India.
Similarly, Thimpu, Dhaka, Islamabad, Male and Colombo are the capitals of Bhutan, Bangladesh, Pakistan, Maldives and Srilanka respectively.

This is a set of the capitals of the SAARC countries.

Nepal, India, Bhutan, Bangladesh, Pakistan, Srilanka and Maldives are the seven members of the SAARC Country.



(d) Study the pictures and answer the following question

- Are the objects given in the figure belong to a set ?
- What is this set formed of?

The objects given in the figure is a set of means of transportation.

(e) Pick the odd one out from the set given below.

Does it form another set?

This is a set of the means of transportation run by fuel.

What kind of set is formed?

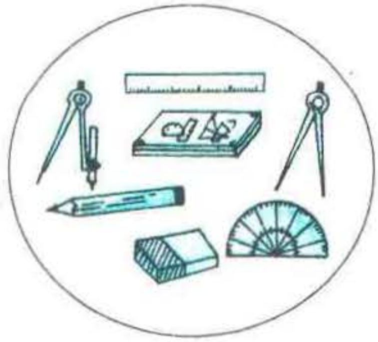
What kind of set is formed when the aeroplane is excluded from this set? Discuss it.

(f) Manisha collected and brought the things scattered in her room.

The things brought by her are placed inside the boundary given.

What is this set formed of ?

These all are the examples of sets.



Umesh, Bimala, Shanti, Sheela and Raju are the five students who sit on the first bench of Class 6. They are standing in order of taller to shorter as shown in the figure.

Now, the teacher said, "You all make a set of the taller students only".

Who should be included in the set of the taller students?

The students got confused.

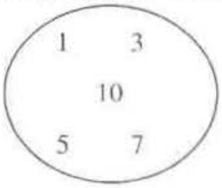
This is because Raju is the only tallest person. He belongs to that set. Sheela is taller than Shanti but she is shorter than Raju. Does Sheela belong to this set or not? Similarly, what about others? That is why, who are the taller students, cannot be confirmed? Therefore, such type of collection cannot be named as a set.

If all the objects in a collection can be confirmed then such type of collection is called a well-defined collection and a set indeed is a collection of well-defined objects.

In example (a), banana, apple, mango and orange are the members of set. Likewise, in example (b), 2, 4 and 6 are the members of the set of even numbers less than 7.

Example: 1

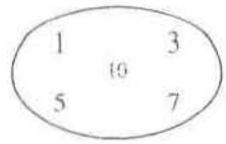
Cross ($\times$) the odd one in the set. Now name the new set formed.



Answer:

Here, 1, 3, 5, 7 are odd numbers.

10 is an even number.



A set of odd numbers is formed when 10 is excluded from this.

Example: 2

Mark (√) against the well-defined set and ($\times$) against the not well-defined set of the following sets.

i. The set of slow-writing students of Class 6.
ii. The set of English months starting from English alphabet J.

Answer:

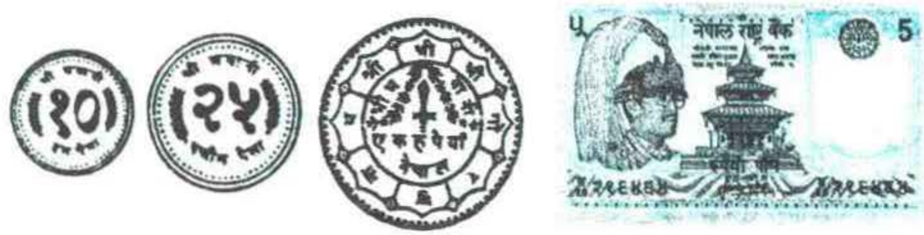
i. ($\times$) because, here the speed limit of the writing of the students is not fixed. Therefore, this set is not well defined.
ii. (√) because, those months are January, June, July.

Exercise 1.1

Of the given sets (1-15); mark ($\times$) against the odd one. Now, what type of new sets are formed by the remainders? Write.

1. Sunday, Monday, Tuesday, Wednesday, Thursday, Shrawan, Friday, Saturday.

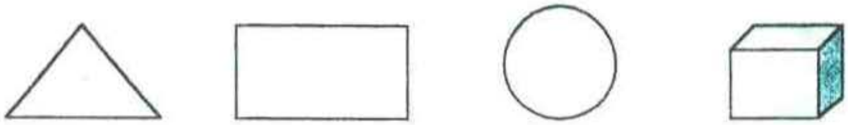
2.



3. Nepal, China, India, Bhutan, Bangladesh, Maldives, Pakistan, Srilanka.

4. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17

5.



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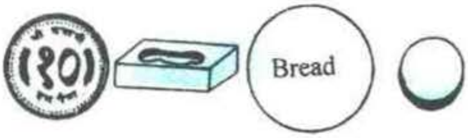

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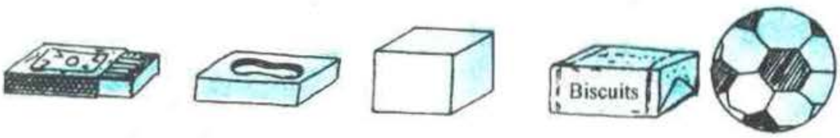
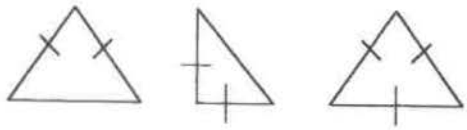


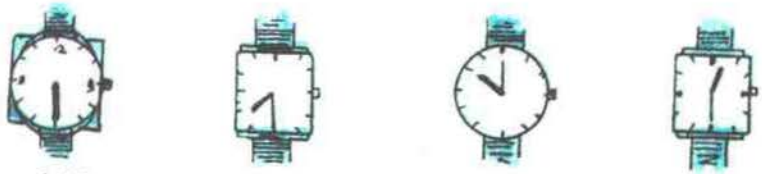
8.

9. 2, 3, 4, 7, 10, 11

10. 10, 15, 20, 25, 30, 32

11. $\frac{1}{3}, \frac{2}{3}, \frac{3}{3}, \frac{4}{3}$

12. 

13. 

6:30 7:30 10:00 12:30

14. x^2+2x, $2x+3y$, $2a+3b+4c$, $5p-10q$
15. a, e, i, o, p, u,
16. Of the following sets, mark (√) for the well-defined sets and mark (×) for the not well-defined sets.
    (a) A set of the girls having long hair in a class.
    (b) A set of the teachers of a school teaching in Class 6.
    (c) A set of the teachers who teach in shrill voice.
    (d) A set of the students who play volleyball in your school.

1.2 Notation of Sets and Methods of Describing

Notation of Sets

Generally, sets are denoted by the capital letters of English alphabet like A, B, C, D, ... X, Y, Z etc. Each member of the set is separated by a comma (,) and are kept within a pair of braces { }. For example

: A={ banana, apple, mango, orange}

A set can be described by the following three ways:

By describing	By listing	Set builder method
A set of seven days of a week	{Sunday, Monday, Tuesday, Wednesday, Thursday, Friday }	{x : x is a day of a Week}
A set of vowels of the English	{A, E, I, O, U }	{x : x is a vowel of English alphabet}
A set of the odd numbers greater than 5 and less than 21.	{7,9,11,13,15,17,19,}	{x : x is an odd number greater than 5 but less than 21 }

(a) **By describing:** The objects or the members of a set are expressed in words or sentences on the basis of their properties. In this method only words or sentences are used.

(b) **By listing:** The members of a set are kept within a pair of medium brackets { } separating by a comma.

(c) **Set builder method:** In this method, the variable is described on the basis of the common property of the members of set. In the above example, x is placed for the days of a week. This is a variable. The symbol (:) indicates such that.

For example: A set of the first five counting numbers.
$C = \{1, 2, 3, 4, 5\}$

The set of the first five counting numbers can also be written as follows.

$\{1,2,3,4,5\}$ or $\{1,3,4,2,5\}$ or $\{2,3,1,5,4\}$

Note: The members of a set within braces { } can be written in any order.

Similarly, let us take another example, N represent the set of the digits used to write two lakh forty five thousand four hundred and twenty five.

$N = \{2,4,5\}$

or, $N = \{4,2,5\}$

or, $N = \{5,2,4\}$

To represent a set of letters of the English alphabet to write the word 'COFFEE',

We write, $W=\{C, O, F, E\}$ but not $W= \{C, O, F, F, E, E\}$

Note: None of the members of a set are repeated more than once in the braces { }.

A set is represented by the capital letters of the English alphabet where as the members of a set are denoted by both small letters or capital letters of the English alphabet. For example: A set of vowels of English alphabet can be written as, $V= \{a, e, i, o, u\}$

Example: 1

If 'P' represents a set of the nine planets of the solar system, then represent the set by listing method and also by set builder method.

Answer:

By listing method,

P = {Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto }

By set builder method,
{x: x is a planets of the solar system}

Example: 2

Express the given set in words.

T = {Right angled triangle, acute angled traingle, abtuse angled triangle}

Answer:

'T' is a set of triangles classified on the basis of angles.

Example: 3

If 'J' is a set of the least and the greatest numbers of three digits then express by listing method.

Answer:

J = {100, 999}.

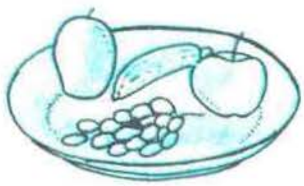
Exercise 1.2

Express each of the following sets by listing method.

1. A set of 14 zones of Nepal.
2. A set of the numbers on the dial of a clock.
3. A set of the names of 12 Nepalese months.
4. A set of the colours used in the Nepalese flag.
5. A set of the subjects to study in Class 6.
6. A set of the development region of Nepal.

7. A set of the odd numbers less than 10.
8. A set of the numbers upto 50 exactly divisible by 5.
9. A set of the prime numbers upto 20.
10. A set of the composite numbers upto 20.
11. A set of multiples of 3 less than 20 but exactly divisible by 3.
12. A set of the numbers having 4 at the unit place from 1 to 50.
13. A set of the numbers from 10 to 50 having remainder 2 when divided by 5.
14. A set of the quotients obtained when each members of the set L= {3,6,9,12,15,18} is divided by 3.
15. A set of the numbers which divide both 15 and 25 exactly.
16. If A= {1,2,3,4,5}, prepare the list of following sets.
    (a) B = set of the numbers when one is subtracted from each member of set A.
    (b) C = set of the numbers when each members of set A is multiplied by 3.
    (c) D = set of the even numbers of the members of set A.
    (d) E = set of the odd numbers of the members of set A.
    (e) F = set of the least and the greatest numbers of the members of set A.
17. Express each of the following sets in words.
    (a) R= {I, II, III, IV, V, VI, VII, VIII, IX, X}
    (b) C= {10, 12, 14, 16, 18, 20}
    (c) O= {21, 23, 25, 27,29}
    (d) E= {a, b, c, d, e}
    (e) U= {mm, cm, m, km}
18. Express the sets from Q. No. 1 to 7 by the set builder method.

1.3 Membership of Sets



Let us suppose the set of the fruits in the plate be F.

F = {Mango, Banana, Apple, Grapes}
'Mango' is present in this set.

Therefore, Mango ∈ {Mango, Banana, Apple, Grapes}

Likewise, banana is also present in this set.
Therefore, Banana ∈ {Mango, Banana, Apple, Grapes}

Mango, Banana, Apple and Grapes are the members of the set F.

But, Orange ∉ {Mango, Banana, Apple, Grapes}

Orange ∉F

That is, orange does not belong to the set F.

Orange is not a member of the set F.

V= {a, e, i, o, u}

a ∈ V
a is one of the members of set V.
o ∈ V
o is one of members of set V.

But b ∉ V
b is not a member of set V
c ∉ V
c is not a member of set V.

The symbols ∈ denotes "is a member of or belongs to the set".
The symbol ∉ denotes ""is not a member of or does not belong to".

Example: 1

Use the symbols ∈ or ∉ in the blank space appropriately.

(i) 3 ....{1,2,3,4} (ii) 5 ....{1,2,3,4}

(iii) H = set of the days of a week when all the schools remain closed.

Tuesday .... H
Saturday .... H

Answer:

(i) 3 belongs to this set therefore 3 is a member of this set,
3 ∈ {1,2,3,4}
(ii) 5 does not belong to this set, therefore, 5 is not a member of this set.
5 ∉ {1,2,3,4}
(iii) On Tuesday, schools do not remain closed. Therefore, Tuesday is not a member of the set H.

Therefore, Tuesday $\notin$ H

On Saturday, schools remain closed. Therefore, Saturday is a member of the set H.

That is, Saturday $\in$ H

Example: 2

If P = set of the domestic animals and
W = set of the wild animals, then

Write (T) for correct statements and (F) for incorrect statements.

(i) Dog $\in$ W (ii) Fox $\notin$ P (iii) Cow $\in$ P (iv) Tiger $\notin$ W

Answer:

(i) 'Dog' is not a wild animal. Therefore, incorrect (F)
(ii) 'Fox' is not a domestic animal. Therefore, correct (T)
(iii) 'Cow' is a domestic animal. Therefore, correct (T)
(iv) 'Tiger' is a wild animal. Therefore, incorrect (F)

Exercise 1.3

1. Fill in the blanks with the symbols $\in$ or $\notin$ appropriately.

   (i) 5 .... {1,2,3,4,5}
   (ii) 6 .... {1,2,3,4,5}
   (iii) 5 .... {3,5,7,11}
   (iv) 9 .... {1,3,5,7,11}
   (v) □ .... { △ , ◺ , ▭ , ▱ }
   (vi) cm .... {mm, cm, m, km}

2. If W denotes the set of objects sold by weighing then put the symbols $\in$ or $\notin$ in the blank space appropriately.

   (i) Potato .... W (ii) Oil .... W
   (iii) Sugar .... W (iv) Cloth .... W
   (v) Meat .... W (vi) Flower .... W

3. Write (T) for true and (F) for false statements.
(i) If S represents the member nations of the SAARC, then

Nepal $\notin$ S......... Bhutan $\in$ S......... China $\in$ S.........
Thailand $\notin$ S...... Burma $\in$ S......... Bangladesh $\in$ S.........

(ii) If C represents the capitals of the countries then,

Delhi $\in$ C......... Kathmandu $\in$ C...... Beijing $\notin$ C.........
Karachi $\in$ C......... Dhaka $\in$ C......... Thimpu $\in$ C.........

(iii) If P= {Fish, Meat, Fruit, Milk, Grains} then Milk $\in$ P, Meat$\in$P, Suger $\in$ P

4. If A= {e, n, g, l, i, s, h} and B= {m, a, t, h, e, i, c, s} then build the sets by listing method.
(i) Set of the members common in sets A and B both.
(ii) Set of the members belong to set A but do not belong to Set B.
(iii) Set of the members belong to set B but does not belong to set A.

1.4. Finite and Infinite Sets:

Study the following examples.

If V represents a set of the vowels of English alphabet and E represents a set of the even numbers less than 11, then V= {a, e, i, o, u} and E= {2, 4, 6, 8, 10} can be written.

Here, the total number of numbers in both the sets V and E is 5 each. Symbolically, it can be written as follows:

$n(V) = 5$ and $n(E) = 5$

Here, n denotes the number of members.
Let's take another example, a teacher has kept 23 teaching materials in his drawer. If F represents the set of the materials kept in the drawer, $n(F) = 23$.

That is, the number of the members of the set F is 23.

The number of the elements (members) of set is called card inanity or cardinal number of that set.

The set of the vowels of English alphabet V= {a, e, i, o, u} have 5 elements in set.

Set of the days of a week (D) = {Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday}

There are 7 elements in this set.

Set of capital of Nepal (K) = {Kathmandu}
There is only one element in this set.

Set of the counting numbers from 1 to 100
(C) = {1,2,3, ... 98,99,100}

The number of elements in this set is 100.
The 4 sets V, D, K and C given above are all finite sets.

A set having finite number of members or fixed number of members is called a finite set. In other words, if the number of elements of a set is countable then the set is called a finite set.

Now, Let us have a look at some other sets.

N = {1,2,3,4 ....}

This is a set of counting numbers.
That is, this is a set of natural numbers.
What is the number of elements in this set?
Here, what is the actual number of the elements in the set N?
Can we give the exact number?

Therefore, N is an infinite set.

For example, Set of even numbers E = {2,4,6,8,10 ....}
Set of odd numbers O = {1,3,5,7,9 ....}

Here too, the number of elements in the sets E and O cannot be determined exactly. These sets have infinite number of elements.

Therefore, Sets E and O are infinite sets.

A set having infinite number of elements or whose number of elements cannot be determined exactly is called an infinite set. While writing such sets after having written few elements, at least three dots are given conventionally.

Example: 1

Distinguish the following sets as finite or infinite sets and also give the number of elements in case of a finite set.

(i) Set of the even numbers less than 10.
(ii) Set of the even numbers greater than 10, and more.
(iii) Set of even numbers.

Answer:

(i) Let us suppose the set of the even numbers less than 10 be E_1,
$E_1 = \{2,4,6,8\}$
There are total 4 members (elements) in the set E_1.
Therefore E_1 is a finite set.

(ii) Let us consider the set of even numbers 10 and greater than 10 be E_2
$E_2 = \{10,12,14,16\ldots\ldots\ldots\ldots\}$
E_2 is an infinite set.

(iii) Let us suppose the set of even numbers be E_3
$E_3 = \{2,4,6,8,10,12,14,16 \ldots\ldots\}$
E_3 is an infinite set.

Example: 2

What type of set (finite or infinite) is formed by the numbers having 5 at their unit place?

Answer:

The numbers having 5 at their unit place are: 5, 15, 25, 35 ....
Let us suppose the set of the numbers having 5 at their unit place be F.

$F = \{5, 15, 25, 35 \ldots\ldots\ldots\}$
F is an infinite set.

Exercise 1.4

(1). Which of the following sets are finite sets? Write the number of the elements of the finite sets as well.

(i) $A = \{1, 3, 5, 7\}$
(ii) $B = \{1, 3, 5, 7 \ldots\ldots\ldots 50\}$
(iii) $C = \{2, 4, 6, 8 \ldots\ldots\ldots\ldots 100, 102 \ldots\ldots\ldots\}$
(iv) $D = \{100, 102, 104, 106 \ldots\ldots\ldots\ldots\}$

(2) Make the sets by listing method. Distinguish between finite sets and infinite sets. Write the number up to elements also if the sets are finite.

(i) O_1 = Set of odd numbers less than 20.

(ii) O_2 = Set of odd numbers from 20 to 40.

(iii) O_3 = Set of even numbers above 40.

(iv) T_1 = Set of the numbers having 3 at their unit place.

(v) T_2 = Set of the numbers below 33 having 3 at their unit place.

(vi) T_3 = Set of the numbers between 3 and 50 having 3 at their unit place.

(vii) T_4 = Set of the numbers greater than 50 having 3 at their unit place

(viii) Set of the numbers giving 1 as remainder when divided by 5.

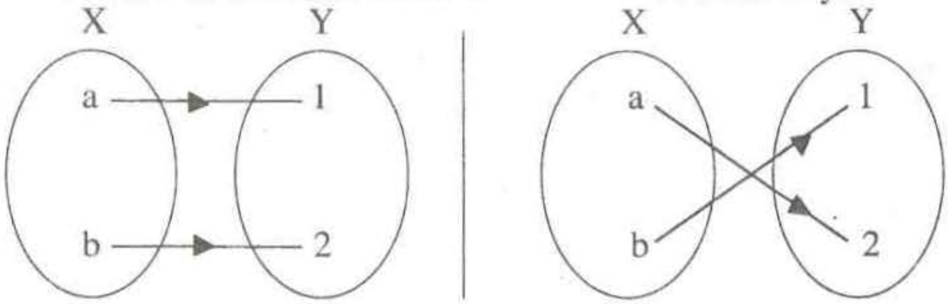
(ix) Set of the numbers, from 1 to 50 giving 1 as remainder when divided by 5.

(x) D = Set of the numbers having 4 at their tens place.

1.5 Equivalent and Equal Sets:

Equivalent Sets,

If two sets X and Y are equivalent then the elements of the set X can be matched with the elements of the set Y in the different ways.



Here, each element of set X has got a pair in the set Y in whatever ways the elements are matched. Here, there is a one to one corespondence among the elements of the sets X and Y. In the above figures, sets X and Y are equivalent to each other.

If in any two sets A and B, the number of elements are equal then it can be written as n(A) = n(B). Such types of sets A and B are called equivalent sets. Symbolically it can be written as A ~ B.

Example: 1

If set A = {set of counting numbers below 10}
And set B = {odd numbers less than 18}, then
Find n(A) and n(B)
Is n(A) = n(B)?
Are the sets A and B equivalent?

Answer:

Here, A = {1,2,3,4,5,6,7,8,9}
and B = {1,3,5,7,9,11,13,15,17}
$\therefore$ n(A) = 9 and n(B) = 9

In the above example, since the values of both n(A) and n(B) is 9, n(A) = n(B). Therefore, sets A and B are equivalent.

Example: 2

If set P = {Factors of 5} and
Set Q = {Factors of 6} then,
find n(P) and n(Q)
Are n(P) and n(Q) equaal?
Are sets P and Q equivalent?

Answer:

Here, P = {1,5} n(P) = 2
Again, Q = {1,2,3,6} $\therefore$ n(Q) = 4
$\therefore$ n(P) $\neq$ n(Q). Therefore, sets P and Q are not equivalent.

Equal sets

Set A represents the numbers greater than 1 and less than 4.
Hence A= {2,3}. Set B represents prime factors of 6. hence, B = {3,2}
What can you say about the members of sets A and B?

If two sets have same number of elements and same elements as well then the sets are called equal sets. In the above example, sets A and B are equal. This is written as A = B.

Study the following examples and discuss in your classroom.

If A = {0,2,4,6,8} and B = {a,b,c,d,e} then n(A) = n(B) = 5,
But A $\neq$ B, why?

Empty sets

Set T = {Set of the people surviving for more than 600 years}
What does this set mean?

Kamala was asked to write the above set by listing method. But she did not find even a single person who has survived for more than 600 years. Therefore, she wrote the above set as follows:

T = {   }

Hence, the set formed by her in this manner is called an empty set.

A set having no element (member) is called an empty set and it is denoted by ∅ or { }.

Exercise 1.5

1. Distinguish the equal sets from the following sets and write them using the proper sign.
   {2,4,6}, {y,x}, {1,3,5,7}, {x,y}, {1,4,9,16}
   {Vowels of English alphabet}, {2,6}, {4,2,6}, {x,y,z}
   {9,4,1,16}, {first 4 odd numbers}, {a,e,i,o,u}
   {n,i,l,e}, {r,e,a,d}, {d,e,a,r}, {l,i,n,e}
2. From Q. No. 1, separate the equivalent sets and write them by using the sign (~).
3. Which of the following sets are equal sets, if they are equal write them using the symbol '='.
   (a) A = {2,3,5,7}, B ={Prime numbers less than 8}
   (b) C = {p,q,r,s}, D = {r,q,p,s}
   (c) E = {A,B,C,D}, F = {a,b,c,d}
   (d) G = {G,O,L,F}, H = {F,L,O,G}
   (e) I = {l,e,a,d}, J= {d,e,a,l}
   (f) K = {M, I, S, H, P}, L = letters used to write 'MISHISSIPPI'
   (g) M = {numbers divisible by 2}, N = {Even numbers}
   (h) O = {Mars, Jupitar, Pluto}, P = {any three planets of the solar system}
   (i) Q = {Mercury, Venus, Earth}
   R = {First three planets of the solar system nearer to the sun in order}
   (j) S = {1,5,7,9}, T = {odd numbers less than 10}
   (k) U = {e,a,t}, V = {t,e,a}

4. In Q. No.3, which equivalent sets are not equal?

5. Write down the following sets by listing method.
   A = {Whole numbers from 1 to 9}
   B = {Even numbers between 10 to 26}
   C = {Multiples of 7 from 1 to 50}
   Now, answer the following questions.
   (a) Give the values of n(A), n(B) and n(C).
   (b) Which two sets are equivalent?

6. If A = {1,2,3,4} and B = {1,2,3,4} then why are sets A and B equal? Is it necessary for n(A) and n(B) to be equal?

7. X indicates the set of prime factors of 2310 and Y indicates the set of prime numbers less then 13, then
   (a) Show the members of sets X and Y by one to one correspondence figure.
   (b) Can X = Y be written? Why?

8. If A = {0, 2, 4, 6}, B = {2, 4, 6}, C = {0}, D = { }, E= {2, 4, 6} F= {1} then, answer the following questions.
   (a) Write the number of elements of each set.
   (b) In which sets number of elements are equal?
   (c) Name the unequal sets despite the sets having equal number of elements.
   (d) Which of the above sets are equal?

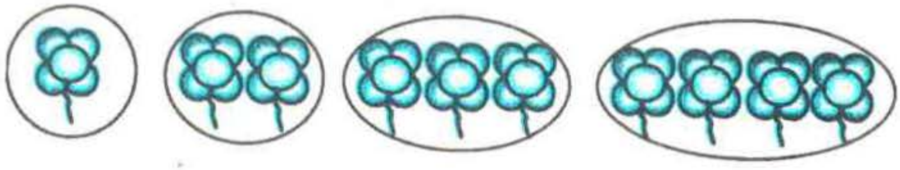
9. Which of the following sets are empty sets and keep writing the symbol ∅ in front of the empty sets?
   (a) Set of whole numbers between 3 and 4,
   (b) Set of numbers between 3 and 4,
   (c) Set of the students studying in class 6 whose age is less than 5,
   (d) Set of odd numbers divisible by 2,
   (e) Set of even prime numbers,
   (f) {0}
   (g) { }
   (h) Set of the prime numbers between 13 and 15.

10. Fill in the blanks:
   (a) If A = {1, 2, 3} then n(A) = ...
   (b) If P = {w, a, y, b}, then n(p) = ...
   (c) If R = {i, c, r, e, a, m}, then n(R) = ...
   (d) If N = {2, 3, 4, 5, 6}, then n(N) = ...

2. Whole Numbers

2.1 Development of whole numbers and Hindu-Arabic numeration system.

- How many flowers are there in each of these sets?

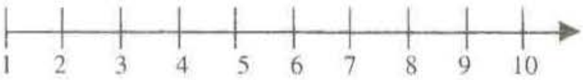


- How many students are there in your class?
- How many members are there in your family?
- How many zones are there in the Kingdom of Nepal?

In the numbers so obtained are written from 1, it goes to infinity Numbers 1,2,3, ... 10,11,12,..........100,101,....... are called Natural numbers. If it is so, where do the Natural numbers start from and where do they finish?

Natural numbers are the counting numbers. If begins from 1 and goes upto infinity. The set of natural numbers are denoted by N.

There are infinite number of elements in set N. N={1,2,3,4,5,......}

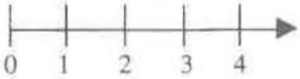


Let us find out the answers to the following questions.

- How many oceans are there in Nepal?
  None, that is zero (0).
- How many students are there above 20 years in your class?
  None, that is zero (0).

Natural numbers only cannot solve the complete practical problems. To make the natural numbers a complete set 'O' is inserted and the set so obtained is called whole numbers and is denoted by W.

W= {0,1,2,3,4,5,6, ...}

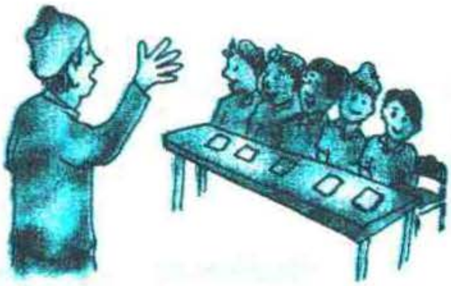


In the figure alongside, the teacher is showing five fingers.

There are five students on this bench.

There are five books on this table.

In this figure,



The number of the student = the number of the books = the number of the fingers in a hand = 5. This number was expressed by three students in three ways.

५ students → This symbol of showing number five is a Devnagarik numeral.

5 books → This symbol of showing number five is the Hindu-Arabic numeral.

V fingers → This symbol of showing the number five is the Roman numeral.

The number of all these three sets are equal.

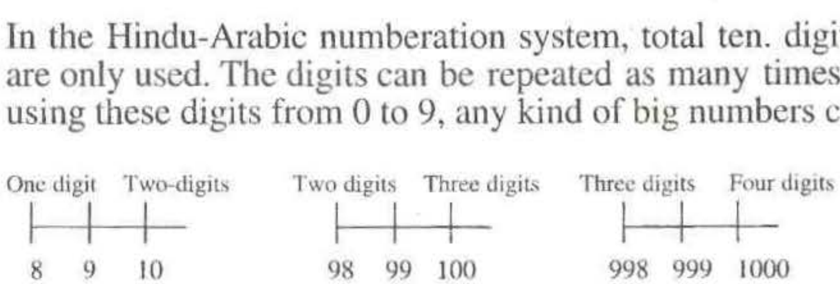
But, the symbols denoting these numbers, that is, numerals are different.

Numbers are denoted by different symbols. Hence, the different symbols denoting the numbers are called numerals.

Different people across the world have been using different digits to write the numbers.

- There are 24 hours in a day. In 365 days there are $365 \times 24 = 8{,}760$ hours.

In the Hindu-Arabic numeration system, total ten. digits from 0 to 9 are only used. The digits can be repeated as many times as needed. By using these digits from 0 to 9, any kind of big numbers can be written.



The smallest numeral formed by one digit is 1
The greatest numeral formed by one digit is 9
The smallest numeral formed by two digits is 10
The greatest numeral formed by two digits is 99
The least numeral formed by three digits is 100
The greatest numeral formed by three digits is 999

Let us observe these numbers- 120, 201, 102, 210

In all these numerals, altogether three digits 0,1,2, are used.

Do all these numerals have same value?

While counting the numeral 210 by placing the place value, 2 is at the place of hundreds and the place value of 2 is 200. Similarly, 1 is at the tens place, 1 shows 10 and 0 at unit place so 0 show 0.

It's total value = 200+10+0 = 210.

In the Hindu-Arabic numberation system,

Though digits may be same but their place values are different. 0 is placed at the empty place.

After 100 years of Christ, that is, near about 100 A.D, Hindus developed total ten digits 0,1,2,3,4,5,6,7,8,9 to write the numbers according to the Hindu-Arabic system and Arabians spread this system throughout the world, Therefore, this system of numberation is well-known as the Hindu-Arabic numberation system across the world.

We discuss the following properties of the Hindu-Arabic numberation system,

1. Any big numbers can also be written by using total ten digits from 0 to 9.
2. The values of digits are according to their place values, so change of place of digits is enough to write the big numbers.
3. Zero '0' is also available in this system, so it has been convenient to write 0 even at the empty place.

In the Roman numberation system and other numberation system as well, there is no provision of zero '0'. So these systems could not develop and spread as desired. But in the Hindu-Arabic numberation system, the invention of '0' made possible to give the place values of the digits. Writing the big numbers become easier by using few digits. Similarly, the fundamental operations like addition, subtraction also become simple. Because of this reason, the Hindu-Arabic numberation system has been practiced successfully since a long time.

Example: 1

Find the difference between the greatest and the smallest number formed by 2,5 and 7.

Answer:

In 2,5 and 7; 7 is the greatest digit and 2 is the smallest digit.
Therefore, the greatest number formed by 2,5 and 7 is 752 and the smallest number is 257,

$\therefore$ The difference between these two numbers = 752-257 = 495

Example: 2

Find the difference between the greatest number and the smallest number formed by 7,0 and 8.

Answer:

Here, in 7,0 and 8; 8 is the greatest digit and 0 is the smallest digit. Therefore, the greatest number formed by three digits is 870 and the smallest number is 708.

$\therefore$ Difference = 870 - 708 = 162.

Exercise 2.1

1. Write down the place value of 6 in the following numbers.

   (i) 6503 (ii) 5761 (iii) 45678 (iv) 23456

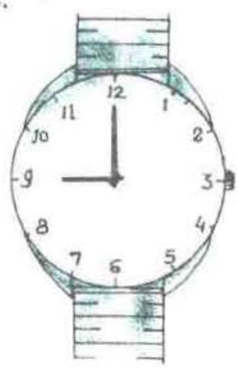
2. (i) What are the numbers formed by 5,7 and 8?
   (ii) Which three different digits make the smallest three digit-number and what is that number?
   (iii) Which three different digits make the greatest number of three digits and what is that number?

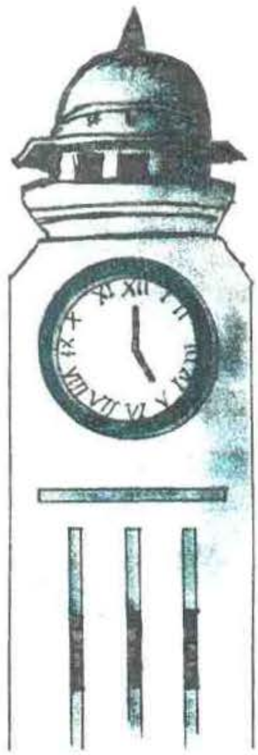
3. Find the sum of the greatest and smallest numbers formed by 1, 7, 0, 2, 3.
4. Write the greatest and the smallest numbers formed by four digits and find their (i) sum and (ii) difference.
5. Two columns of the following numerals are given. Two numerals in the right column are same as the left column, but the numerals are reversed and are written in the reversed order. Which column's sum will be greater? First guess and then check by adding.

000000001	123456789
000000021	123456780
000000321	123456700
000004321	123456000
000054321	123450000
000654321	123400000
007654321	123000000
087654321	120000000
+ 987654321	+ 100000000

2.2 Roman Numerals

In the figure, the clock of a clock tower is shown. The digits used in this clock are Roman Numerals.





Let's compare these two clocks to know which Roman digit indicates which number.

Roman Numerals	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Hindu-Arabic Numerals	1	2	3	4	5	6	7	8	9	10	11	12

Let's observe the facts revealed this table.

To write from 1 to 12, in Roman by numerals mainly three symbols are used. Those basic symbols or digits are I, V and X.

While writing 3 and 8, I is repeated only three times. No digit is repeated four times.

Example: 1

Write in the Hindu-Arabic number: IV and IX

Answer:

IV = V-I = 5-1 = 4 IX = X-I = 10-1 = 9

If the digit left to the base digit is smaller, the smaller digit is subtracted from the greater digit.

Example: 2

Write in the Hindu-Arabic number: VI, VII, XI, XII.

Answer:

VI = V + I = 5+1 = 6 VII = V+I+I = 5+1+1 = 7
XI = X+I = 10+1 = 11 XII = X+I+I = 10+1+1 = 12

If the digits after (right) the base digit are smaller, then this smaller digits are respectively added to the base digit.

Study this table and discuss:

Roman digits	I	V	X	L	C	D	M
Hindu-Arabic Number	1	5	10	50	100	500	1000

Rules to be remembered while writing Roman Numerals:

Rule 1: If any number is formed by repeating the same digit then the the net value of that number is equal to the repeated digit times number of repetition. For example:

(a) II = 2 × 1 = 2
(b) XXX = 3 × 10 = 30
(c) CCC = 3 × 100 = 300

Note: No digit is repeated more than three times.

Rule 2: If any smaller digit is the right side to the greater digit then while placing the value of the smaller digit it is added to the value of the greater digit. e.g.

(a) VI = V+I = 5+1 = 6
(b) CX = C+X= 100+10 = 110
(c) CL = C+L = 100+50 = 150

Rule 3: If any smaller digit is to the left side of the greater digit then the value of the smaller digit is subtracted from the value of the greater digit. e.g.

(a) IV = V-I = 5-1 = 4
(b) IX = X-I =10-1 = 9
(c) XL = L-X = 50-10 = 40
(d) XC = C-X = 100-10 = 90
(e) CD = D-C = 500-100 = 400

Rule 4: As per rule 3, the whole number formed by two digits are right to the side of the greater number, then they are added to the greater number. e.g.

(a) XIV = X+IV = 10+4 = 14
(b DCXC = D+C+XC = 500+100+90 = 690

Rule 5: If a bar is placed over any digit, then the value of that digit is equal to 1000 times the digit over which bar is placed. e.g.

(a) $\overline{\text{V}}$ = 1000 × 5 = 5000

(b) $\overline{\text{X}}$III = 1000 × 10+3
= 10000+3
= 20003

Exercise 2.2

1. Write in the Hindu-Arabic numerals.

(i) XVIII (ii) XLIX (iii) XCIX (iv) LXXV (v) DCLX
(vi) LXX (vii) CCLXIV (viii) MCD (ix) MCM
(x) MCMXC (xi) $\overline{VI}X$ (xii) $\overline{XI}V$ (xiii) $\overline{MV}III$

2. Write in the Roman numerals:

(i) 44 (ii) 83 (iii) 149 (iv) 700
(v) 990 (vi) 1351 (vii) 3149 (viii) 2764
(ix) 5670 (x) 5007 (xi) 10008 (xii) 500009
(xiii) 1000000

2.3 Place value and commas in the national system.

Places	Numerals	Writing in the base of ten
Unit	1	10^0
Tens	10	10^1
Hundreds	100	10^2
Thousands	1,000	10^3
Ten thousands	10,000	10^4
Lakh	1,00,000	10^5
Ten lakh	10,00,000	10^6
Crore	1,00,00,000	10^7
Ten crore	1,00,00,00,00	10^8
Arab	10,00,00,00,00	10^9
Ten arab	1,00,00,00,00,00	10^{10}
Kharab	10,00,00,00,00,00	10^{11}

The population of Kathmandu valley is approximately 10,00,000 (ten lakh). The Population of the kingdom of Nepal is approximately 2,00,00,000 (two crore). Two crore means how many times of 10 lakh?

10 Hundreds = 1000 = 1 Thousand
100 Thousands = 1,00,000=1 Lakh
100 Lakhs = 1,00,00,000=1 Crore
100 Crores=1,00,00,00,000= 1 Arab
100 Arabs=1,00,00,00,00,000=1 Kharab

A black and white T. V. costs Rs. 5,000 while a colour T.V. costs Rs. 35,000.

Here, comma (,) are used to make reading easier.
At which places, commas are used in the following numbers?
Population of the Kathmandu valley is approximately 10,00,000.
Population of the kingdom of Nepal is approximately 2,00,00,000.
Approximately 1,35,67,89,000 people of Asia continent watched live telecast of the World Cup Football of 1994.

There is a convention of placing comma (,) for the sake of making reading and writing great numbers easier.

In this way, as per the Nepalese system, while placing the commas first comma is kept by leaving three digits from right and after that other commas are kept by leaving every two digits.

1,35,67,89,643 when shown in the place value table,

Kharab	Ten Arab	Arab	Ten Crore	Crore	Ten Lakh	Lakh	Ten Thousand	Thousand	Hundred	Ten	Unit
10^{11}	10^{10}	10^9	10^8	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
		1	3	5	6	7	8	9	6	4	3

In this way, when the commas are kept in the numbers, finding out the place values of the number and reading becomes easier.

Example: 1

Put commas (,) in the following numbers and write them in words.

(i) 9132705 (ii) 8010005436

Answer:

(i) 91,32,705

→ 91 lakh 32 thousand 7 hundred and 5

→ Ninety-one lakh thirty two thousand seven hundred and five.

(ii) 8,01,00,05,436 leaving three numbers from right and putting comma after every two digits.

8,01,00,05,436

→ 8 Arab 1 crore 5 Thousand 4 hundred 36

→ Eight Arab one crore five thousand four hundred and thirty six.

Example: 2

Write in numbers by using commas.
One crore fortyfive lakh seven thousand and forty

Answer:

1,45,07,040
1 crore 45 lakh 07 thousand 0 hundred 40

Example: 3

How many seconds are there in 210 days? Write in numbers and words by using commas.

Answer:

210 days	$= 210 \times 24$ hours	
	$= 210 \times 24 \times 60$ minutes	(1 day = 24 hours)
	$= 210 \times 24 \times 60 \times 60$ seconds	(1 hour = 60 minutes)
	= 18144000 seconds	(1 minute = 60 seconds)
	= 1,81,44,000 seconds	(putting commas after three digits from right and after that leaving every two digits)
	= 1 crore 81 lakh 44 thousand	
	= One crore eighty-one lakh forty-four thousand seconds	

Example: 4

How many rupees are there in Rs. 157 thousand? Write in a figure by using commas and in words.

Here, Rs. 175 thousand
= Rs. 175,000
= Rs. 1,75,000
= Rs. 1 lakh 75 thousand
= Rs. One lakh seventy-five thousand

Exercise 2.3

1. Use commas (,) in the following numbers and also write them in words.
   (i) 95432 (ii) 6435278 (iii) 10000501
   (iv) 432675683 (v) 30052604 (vi) 902603460505
   (vii) 105022039

2. Write the following numbers in figures by using commas.
   (i) Five crore thirty-four lakh three thousand seven hundred sixty-nine.
   (ii) Twenty-five crore two lakh eighteen thousand five hundred fifty-five.
   (iii) Thirty arab ninety-four crore twenty two lakh six hundred.
   (iv) Six kharab forty-three crore eighty-two thousand sixty-four.
   (v) Three kharab three arab three crore three lakh three thousand three hundred three.

3. Estimate the following first and then write in figures and words by using commas.
   (i) How many paisas are there in Rs. 4732?
   (ii) How many ml are there in 2000 litres of kerosene oil? (1000ml=1l)
   (iii) How many cm are there in 695 km.? (100cm=1m, 1000m-1km.)
   (iv) Weight of one sack of rice is 100 kg. then how much g do 1000 such sacks of rice weigh ? (1000g=1 kg)
   (v) How many seconds are there in one year ?

4. What are the values of the following? write in words.
   (i) Rs. 425 thousand (in rupees)
   (ii) 340 lakh litres of kerosene (in litres)
   (iii) 3670 thousand kg of fertilizers (in kg)
   (iv) 195 crore metre of cloth (in metres)
   (v) 6005 lakh unit of electricity (in units)

5. Find the (i) difference and (ii) sum of the greatest and the smallest numbers formed by eight digits.

6. What is the difference between the smallest number of nine digits and the greatest number of eight digits.

7. Who am I? Write in figures and words.
   (i) I am composed of nine digits. All my digits are 3.
   (ii) Number composed of five digits, all digits are 0 except one digit being 4.
   (iii) The largest number formed by using all the digits from 1 to 9 without repeating them.
   (iv) The smallest number formed by using all the digits from 1 to 9 but without repeating them.

2.4 Simplification including brackets.

Is 5 the quotient when the sum of 8 and 12 is divided by 4?
The sum of 8 and 12 is 20 and when 20 is divided by 4, the quotoent is 5. Here, solving and expressing this in mathematical language, we should assure the sum of 8 and 12 as a single number and put it in small brackets. Then only we should divide it by 4, assuming the sum of 8 and 12 as a single number, is kept in small brackets ( ). Then only it should be divided by 4.

Therefore, in mathematical language,
$$(8+12) \div 4$$
$$= 20 \div 4$$
$$= 5$$

Because of this reason, while simplifying, the terms inside the brackets should be operated first.

Example: 1

Simplify: $8 \div (4 \times 2)$

Answer:

$$8 \div (4 \times 2)$$
$$= 8 \div 8$$
$$= 1$$

Example: 2

Simplify: $55 \div 11[20 \ \div 2\{4+(10+5-7\}]$

Answer:

$55 \div 11[120 \div 2\{4+(10+5-7)\}]$

=	$55 \div 11[120 \div 2\{4+(15-7)\}]$	is operated first in the small bracket.
=	$55 \div 11[120 \div 2\{4+8\}]$	is operated within the small bracket.
=	$55 \div 11\ [120 \div 2\{12\}]$	is operated in the middle bracket.
=	$55 \div 11[120 \div 24]$	removing the middle bracket.
=	$55 \div 11[5]$	is operated in the big bracket.
=	$55 \div 55$	Removing the big bracket.
=	1	is operated.

Therefore,

- First of all, the terms inside the small brackets (), then middle brackets { } and at last the big brackets [ ], should be operated.
- While operating within the brackets, first of all, after performing division and multiplication, addition and subtraction should be done.
- In multiplication and division also in addition and subtraction which comes first should be operated first.
- Brackets should be removed when only one number is left after performing the last operation within the brackets. In this way while removing the brackets, if there is no sign of operation in the brackets, then in place of brackets, the numbers within and outside the brackets should be kept by multiplying each other.

Example: 3

Solve by writing in mathematical language.

The sum of 70 and 50 is divided by 10 and 13 is added to the quotient and again the sum is divided by 5.

Answer:

While writing in mathematical language,

$[\{(70+50) \div 10\}+13] \div 5$

By solving,

Required value $= [\{(70+50) \div 10\} +13] \div 5$
$= [\{120 \div 10\} +13] \div 5$
$= [12+13] \div 5$
$= 25 \div 5$
$= 5$

Example: 4

Simplify: $80 \div 4(2+3) \times 6$

Answer:

$80 \div 4(2+3)\times 6$
$= 80 \div 4(2+3) \times 6$ (operated within the brackets)
$= 80 \div 4\ (5) \times 6$
$= 80 \div 20 \times 6$ (5 multiplied by 4, to remove the brackets)
$= 4 \times 6$

Exercise 2.4

(a) Simplify:

1. $25-(16+3)$
2. $21 \div 3(10-3)$
3. $(39+16) \div 11$
4. $3+ (6 \times 12) \div 6$
5. $27 \div (13-4) \times 5$
6. $36+(16+2 \times 4 - 4)$
7. $39 \div 13\ (15-48 \div 4)$
8. $48 \div 3(12 \times 4 \div 2-20)$
9. $3\{12+(8 \div 4 \times 2)\}$
10. $3\{12+8 \div 2(2 \times 2)\}$
11. $4\{6+2(7-4)\} \div 6$
12. $(22+16 \times 2) \div (27 \div 9 \times 3)$
13. $16-8\{15-(45 \div 3)\}$
14. $26-3\{24 \div (18 \div 6)\}$
15. $35-7\{42 \div (56 \div 8)\} +7$
16. $39-4\{16 \div (7-3)\}-23$
17. $\{45-(28+17)\} \times 4$
18. $(20-5-10) \div \{2(7-4)-1\}$

(b) Solveby writing in mathematical language.

1. Divide 49 by 7 and subtract 7 (From quotient).
2. Divide 52 by 13 and add 4.
3. Multiply 3 by 5 and divide 15.
4. Multiply 12 by 3 and divide by 9.
5. Add the product of 3 and 5 to 12.
6. How much is left when the product of 3 and 4 is subtracted from 16?
7. How much is left when 25 is subtracted from 5 times the product of 3 and 4?
8. What is the quotient, when 6 times the difference of 10 and 7 is divided by 9?
9. What is the quotient, when the difference of 20 and 6 is divided by the product of 7 and 2?
10. What is left when 10 is subtracted from the product of 2 and the quotient of 15 divided by 3?

2.5 Test of divisor and divisibility

Let's study the following examples.

Let's observe according to the formula after dividing 347 by 8 and 234 by 3.

Formula: Quotient × Divisior + Remainder = Dividend.

43		Test	43
8) 347		→	×
32			344
27			+3
24			347
3	remainder		

78		78
3) 234	→	×3
21		234
24		+0
24		234
0		

divided without remainder

Now, what type of number can be divided by what type of number. let us see few examples.

Number	Nature of the dividend	Example
2	If the last digit of a number is zero '0' or even then such number is divisible by 2.	30, 50, 100, 134, 758, 1296 are divisible by 2.
4	If the number formed by the last two digits of any number is divisible by 4 then that whole number is divisible by 4.	$124 \rightarrow 24$ is divisible by 4. $15240 \rightarrow 40$ is divisible by 4. $16512 \rightarrow 12$ is divisible by 4.
5	If the last digit of any number is 0 or 5, then is divisible by 5.	In 50, 360 and 123800, the last digit is 0. In 75435 and 193895, last digit is '5'.
7	If the difference of two times of the last digit of a number and the number formed by the remaining digits is divisible by 7 then that whole number is divisible by 7.	$924 \rightarrow$ two times of the last digit '4' is $4 \times 2 = 8$. The number formed by the remaining digits. $92 - 8 = 84$.
9	If the sum of the digits of any number is divisible by 9 then that number is divisible by 9.	$99 \rightarrow 9+9 = 18$, divisible by 9. $252 \rightarrow 2+5+2 = 9$, divisible by 9. $102348 \rightarrow 1 + 0 + 2 + 3 + 4+8 = 18$, divisible by 9.
10	The number divisible by 10 has '0' at the end.	In 60, 100, 500, 15230 have '0' at the end.

Exercise 2.5

1. Which of the following numbers is divisible by 2?

(i) 7111 (ii) 2376 (iii) 9230

(iv) 352 (v) 23702 (vi) 97812

(vii) 2371 (viii) 9233

2. In Question number 1, which of the numbers are exactly divisible by 5 and 10? Are the numbers divisible both by 2 and 4 also divisible 8?

3. Is 24 exactly divisible both by 4 and 2?

4. Which of the following numbers are divisible by 3?
(i) 2376 (ii) 9235 (iii) 352
(iv) 23702 (v) 97812

5. In Question No. 4, which of the numbers are exactly divisible both by 2 and 3? Are the numbers divisible both by 2 and 3 also divisible by 6?

6. Which of the following numbers are divisible by 10?
(i) 1250 (ii) 35765 (iii) 123530 (iv) 2345

7. Which of the following numbers are divisible by 8?
(i) 1048 (ii) 7268 (iii) 4520 (iv) 35000

2.6 Multiples and Factors

$$\boxed{\begin{aligned} 2\times 1 &= 2\\ 2\times 2 &= 4\\ 2\times 3 &= 6\\ 2\times 4 &= 8\\ 2\times 5 &= 10\\ 2\times 6 &= 12\\ 2\times 7 &= 14\\ 2\times 8 &= 16\\ 2\times 9 &= 18\\ 2\times 10 &= 20 \end{aligned}}$$

{2, 4, 6, 8, 10, 12, 14, 16, 18, 20 ....}
This is a set of the multiples of 2.
This can be denoted by $M_{(2)}$.

In the set $M_{(2)}$, which number comes after 20?

In the set $M_{(2)}$, let us also write three numbers which immediately come after 20. Let us see the sets of other multiples as well.

Set of the multiples of 3 $M_{(3)}$ = {3, 6, 9, 12, 15 ....}

Set of the multiples of 4 $M_{(4)}$ = (4, 8, 12, 16, 20 ....}

Set of the multiples of 5 $M_{(5)}$ = {5, 10, 15, 20, 25 ....}

Set of the Natural numbers N = {1, 2, 3, 4, 5, 6, 7 ....}

Each number of N multiplied by 2, {2, 4, 6, 8, 10, ...} becomes the set $M_{(2)}$ of the multiples of two.

Like wise, each number of N multiplied by 3, form {3, 6, 9, 12, 15 ....}

Again, when N is multiplied by 5, set of $M_{(5)}$, {5, 10, 15, 20, 25 ....} is formed.

Hence, any number multiplied by a number, the product is called the multiples of that number.

$M_{(5)}$ = {5, 10, 15, 20, 25 ....}.

Each member of $M_{(5)}$ is exactly divisible by 5.

$M_{(7)}$ = {7, 14, 21, 28, 35 ....}

Each member of $M_{(7)}$ is exactly divisible 7.

Example: 1

Write each of the following sets by listing method.

(a) Set A of the multiples of 4 less than 35.
(b) Set B of the multiples of 6 between 10 and 50.
(c) Set C of the common multiples of sets A and B.

Answer:

(a) Set of the multiples of 4, $M_{(4)}$ = {4, 8, 12, 16, 20, 24, 28, 32, 36, 40 .....}

Set of multiples of 4 less than 35, A= {4, 8, 12, 16, 20, 24, 28, 32}

(b) Set of multiples of 6, $M_{(6)}$ = {6, 12, 18, 24, 30, 36, 42, 48, 54, 60, ...}

Set of multiples of 6 between 10 and 50, B= {12, 18, 24, 30, 42, 48}

(c) Set of common multiples of sets of A and B, C = {12, 24}

Factors

Multiplication Table

From this multiplication table

×	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

Product
$1 \times 6 = 6$
$2 \times 3 = 6$
$3 \times 2 = 6$
$6 \times 1 = 6$

Product
1,2,3 and 6 ← are factors of 6.
1,2,3 and 6 exactly divide 6.

Similarly,

$24 = 1 \times 24$
$24 = 2 \times 12$
$24 = 3 \times 8$
$24 = 4 \times 6$
$24 = 6 \times 4$
$24 = 8 \times 3$
$24 = 12 \times 2$
$24 = 24 \times 1$

Factors of 24; 1,2,3,4,5,6,8,12 and 24
1,2,3,4,6,8,12 and 24 exactly divide 24.

Factors of a number are the numbers, which exactly divide that number.

All numbers are divisible by 1. Therefore, 1 is the factor of any number. Except O, any number divides itself. Therefore, the given number itself is a factor. Here, assuming a, b and c as natural numbers and c the product when a and b are multiplied, then i.e. if $a \times b = c$ then c is divisible both by a and b.

a and b both are factors of c.

$a \times 1 = a\ (1)$ and a itself divides a.

Therefore, a and 1 both are the factors of a.

Note: Division of any number by zero (0) is not defined, so the factors in the set of whole numbers automatically denote whole number except zero '0'.

Example: 2

$F_{(12)}$ denotes set of multiples of 12 and $F_{(20)}$ denotes set of multiples of 20, then write the set of common elements of sets $F_{(12)}$ and $F_{(20)}$ by listing method.

Answer:

Here, $12 = 1 \times 12$ Therefore, $F_{(12)} = \{1,2,3,4,6,12\}$

$= 2 \times 6$

$= 3 \times 4$

$= 4 \times 3$ Similarly $F_{(20)} = \{1,2,4,5,10,20\}$

$= 6 \times 2$

$= 12 \times 1$

Set of common elements of $F_{(12)}$ and $F_{(20)} = \{1,2,4\}$

Exercise 2.6

1. Write each of the following sets by listing method.
   - (a) Multiples of 2 less than 25
   - (b) Multiples of 3 less than 30
   - (c) Multiples of 4 less than 28
   - (d) Multiples of 5 less than 40
   - (e) Multiples of 7 greater than 20 and less than 50
   - (f) Multiples of 8 between 60 and 100
   - (g) Multiles of 9 between 50 and 100
   - (h) First 5 multiples of 6
   - (i) First 10 multiples of 11
   - (j) 4 multiples of 12 after 50
2. Make the set of the common multiples from Q No. 1 (a). and (b). Are this set and the set of (h) same?.

3. (a) Prepare a list of multiples of 9 less than 100 and make a set as well.
   (b) Find the sum of digits of the multiples formed by 2 digits in this set. Is this sum divisible by 9?

4. (a) Write Set A of the multiples of 2 less than 20.
   (b) Write Set B of the multiples of 3 less than 20.
   (c) Write Set C of the multiples of 6 less than 20.
   (d) Write Set D of the common elements of the sets A, B and C. Are the sets D and C differen Sets?

5. (a) Are all the multiples of 4 also the multiples of 2?
   (b) Are all the multiples of 2 also the multiples of 4?

6 Write the factors of each of the following numbers.
   (a) Set of factors of 10, $F_{(10)}$.
   (b) Set of factors of 15, $F_{(15)}$.
   (c) Set of factors of 11, $F_{(11)}$.
   (d) Set of factors of 17, $F_{(17)}$.
   (e) Set of factors of 25, $F_{(25)}$.
   (f) Set of factors of 35, $F_{(35)}$.
   (g) Set of factors of 30, $F_{(30)}$.

7. Write the sets by listing method.
   (a) Set of factors of 20, $F_{(20)}$.
   (b) Set of factors of 2 less then 21, $A_{(2)}$.
   (c) Make a next set of the common elements of the sets $F_{(20)}$ and $A_{(2)}$.

8. What kind of sets are the following? Are they intersecting or disjoint? Are the common factors of the union of sets finite or infinite?
   (a) $M_{(5)}$ and $F_{(25)}$
   (b) $M_{(3)}$ and $M_{(5)}$
   (c) $F_{(20)}$ and $F_{(30)}$
   (d) $M_{(4)}$ and $F_{(16)}$
   (e) $M_{(7)}$ and $F_{(17)}$

9. Find the multiples of 5 of more than 30 and less than 100 in such a way that the sum of their digits is 9.

10. A rabbit can jump 2 feet in every attempt while another rabbit can jump 3 feet distance in every attempt. If those two rabbits started

to jump in a straight path simultaneously, at what distances those both will step together at the same place?

11. In 200 k.m. long Prithivi Highway from Kathmandu to Pokhara, initially pillars were placed at a distance of every 25 km. Later again, other pillars were erected at a distance of every 10 km. Then from Kathmandu, at what distances the initial pillars and the later ones were found to be at the same place?

12. Two clocks placed in a room, were adjusted at 12:00 in such a way that one of them rings at the interval of every 3 hours and another at every 4 hours. At what times will both the clocks ring together?

2.7 Prime and Composite Numbers:

Look at the following number-table once nicely.

	Numbers	Factors
	1	1
Prime number	2	1,2
Prime number	3	1,3
	4	1,2,4
Prime number	5	1,5
	6	1,2,3,6
Prime number	7	1,7
	8	1,2,4,8
	9	1,3,9
	10	1,2,5,10

Some Prime numbers

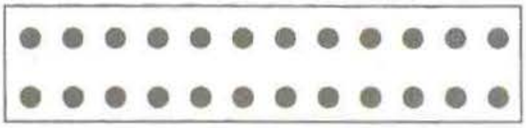
2, 3, 5, 7, 11, 13, 17 ....

In the above table, the numbers encircled are all prime numbers. Let us think for a while, how many total factors are there for such prime numbers? What are these factors?

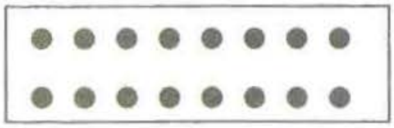
A number having factors 1 and itself only is called a prime number. A number having factors more than two is called a composite number.

Note: 1 is neither a prime nor a composite.

Set of natural numbers, N = {1, 2, 3, 4, 5 ....}. When 1 and prime numbers are excluded from the set of natural numbers then the remaining numbers are called composite numbers.



2×12



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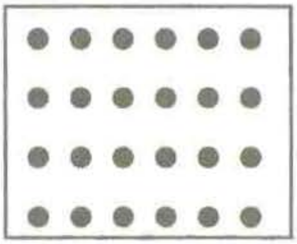


4×6

24 is a composite number. As composite numbers, can be arranged in a rectangular shape, composite numbers are also called rectangular numbers.

But prime numbers cannot be arranged in such rectangular shape.

Example: 1:

If $P_{(15)}$ denotes set of prime numbers from 1 to 15, A denotes the set of multiples of 3 less than 15 and $F_{(21)}$ denotes the set of the factors of 21, then find out

(i) Common members of $P_{(15)}$ and A
(ii) Common members of $P_{(15)}$ and $F_{(21)}$

Answer:

(i) $P_{(15)} = \{2, 3, 5, 7, 11, 13\}$
$A = \{3, 6, 9, 12\}$

$\therefore$ The common member of $P_{(15)}$ and A is 3.

(ii) $P_{(15)} = \{2, 3, 5, 7, 11, 13\}$
$F_{(21)} = \{1, 3, 7, 21\}$

$\therefore$ The common member of $P_{(15)}$ and $F_{(21)}$ are 3 and 7.

Exercise 2.7

1. Copy the following table, from 1-100 arranged in a column of 10 as tabulated below.

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

Now, do the following sums respectively.

- Encircle 1 because 1 is neither a prime nor a composite.
- Cross the numbers divisible by 2 (i.e. all even numbers) except 2.
- Let us cross all the numbers divisible by 3 except 3.
- Let us cross all the numbers divisible by 5 excluding 5.
- Let us cross all the numbers divisible by 7 excluding 7.

(i) What type of numbers are the uncrossed numbers?
(ii) What type of numbers are the crossed numbers?
(iii) How many prime numbers are there altogether from 1 to 20?
(iv) How many prime numbers are there altogether from 1 to 50?
(v) How many prime numbers are there altogether from 1 to 1000?
(vi) In which column of 10(1-10 or 11-20 or 21-30) there are maximum and minimum (less) number of prime numbers?

2. Whether it will be true (T) or false (F)? Write.

(i) All the prime numbers are odd numbers.
(ii) All the odd numbers are prime numbers.

(iii) Even numbers can never be prime numbers.
(iv) There is only one number which is both prime and even.
(v) All the composite numbers are even.
(vi) All the even numbers are composite.
(vii) Prime numbers have only 2 factors.
(viii) Composite numbers are called rectangular numbers.

3. Write the sets by listing method.

(i) Set of prime numbers from 1 to 20, $P_{(20)}$
(ii) Set of composite numbers from 1 to 20, $C_{(20)}$
(iii) Set of even numbers from 1 to 20 $E_{(20)}$
(iv) Set of odd numbers from 1 to 20, $O_{(20)}$
(v) Set of factors of 20, $E_{(20)}$
(vi) Set of multoples of 7 less then 20, A.

4. Find on the basis of Q. No. 3.

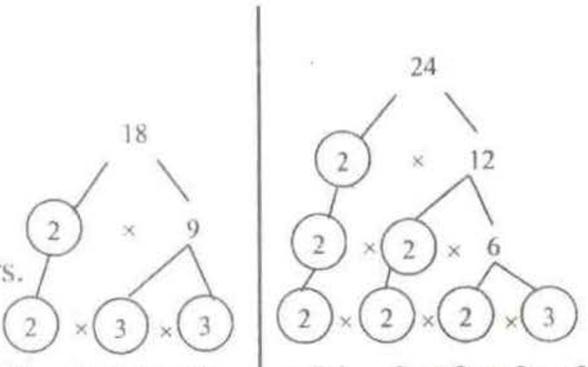
(i) Do the set $O_{(20)}$ and $E_{(20)}$ have common elements?
(ii) Do the set $C_{(20)}$ and $E_{(20)}$ have common elements?
(iii) Make a set of the common elements of the sets $P_{(20)}$ and $E_{(20)}$.
(iv) Make a set of the common elements of the sets A and $P_{(20)}$.
(v) Make a set of the common elements of the sets $C_{(20)}$ and $E_{(20)}$.
(vii) Make a set of the common elements of the sets $C_{(20)}$ and A.

2.8 Prime Factorization:

Let us take composite numbers 18 and 24,

2 is a prime number.

These all are prime numbers.



$\therefore 18 = 2 \times 3 \times 3$ $\therefore 24 = 2 \times 2 \times 2 \times 3$

In this way, the figure so drawn after factorization is called a factor tree.

Any composite number can be expressed as the product of prime numbers. Hence, the process of writing in the form of the product of prime numbers, after factorizing a composite number is called prime factorization.

Performing prime factorization of 24 briefly.

{24 is an even number. Therefore, dividing by 2} {12 is an even number. Therefore, dividing by 2} {6 is also an even number. Therefore, diving by 2}

$$\begin{array}{r} 2\,\underline{)\,24} \\ 12 \end{array} \Rightarrow \begin{array}{r} 2\,\underline{)\,24} \\ 2\,\underline{)\,12} \\ 6 \end{array} \Rightarrow \begin{array}{r} 2\,\underline{)\,24} \\ 2\,\underline{)\,12} \\ 2\,\underline{)\,6} \\ 3 \end{array}$$

3 prime number is obtained

Therefore,

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

Similarly, performing prime factorization of 90,

$$\begin{array}{r|l} 2 & 90 \\ \hline 3 & 45 \\ \hline 3 & 15 \\ \hline & 5 \end{array}$$

90 is an even number and divisible by 2. In 45, 4+5 = 9, therefore divisible by 3. Again, in 15, 1+5 = 6, therefore divisible by 3. Now, 5 is a prime number. Therefore, let us stop here.

While performing prime factorization, the given composite number should be respectively divided by the prime numbers 2, 3, 5, 7, 11 .... and again the quotient so obtained should be kept dividing further.

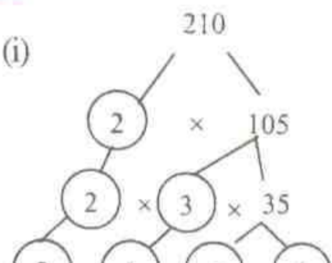
Example: 1

Perform prime factorization of the number 210.

(i) By drawing a factor-tree (ii) By division method.

Answer:

(i)



$\therefore 210 = 2 \times 3 \times 5 \times 7$

(ii)
$$\begin{array}{r|l} 2 & 210 \\ \hline 3 & 105 \\ \hline 5 & 35 \\ \hline & 7 \end{array}$$

$(\therefore\ 1+0+5=6,$ so divisible by 3)

$\therefore 210 = 2 \times 3 \times 5 \times 7$

Example

(i) Find prime factors of 75 and 90.
(ii) Also write the product of common primes.
(iii) Does this product exactly divide both 75 and 90?

Answer:

(i)

$$\begin{array}{r|l} 3 & 75 \\ \hline 5 & 25 \\ \hline & 5 \end{array} \qquad\qquad \begin{array}{r|l} 2 & 90 \\ \hline 2 & 45 \\ \hline 2 & 15 \\ \hline & 5 \end{array}$$

$$75 = 3 \times 5 \times 5 \qquad\qquad 90 = 2 \times 3 \times 3 \times 5$$

(ii)

$$\begin{array}{rccccc} 75 = & & 3 & \times & 5 & \times 5 \\ 90 = & 2 \times & 3 & \times & 5 & \times 3 \end{array}$$

$\therefore$ Common prime numbers $\rightarrow 3, 5$

Their product $= 3 \times 5 = 15$

(iii)

$$\begin{array}{r} 5 \\ 15\overline{)\ 75} \\ \underline{75} \\ 0 \end{array} \qquad\qquad \begin{array}{r} 6 \\ 15\overline{)\ 90} \\ \underline{90} \\ 0 \end{array}$$

Hence, the product of the common prime numbers, 15 divides 75 and 90 exactly.

Exercise 2.8

1. (a) Find the prime factors of each of the following numbers by making a factor tree.

(i) 18 (ii) 20 (iii) 46 (iv) 72

(b) Find the prime factors of each of the following numbers by division method.

(i) 21	(ii) 30	(iii) 56	(iv) 80
(v) 105	(vi) 144	(vii) 275	(viii) 625

2. Find the product of the common prime numbers of the following numbers.

(a) 18 and 20	(b) 20 and 21	(c) 72 and 144
(d) 105 and 275	(e) 275 and 625	

2.9 Highest Common Factors and Lowest Common Multiple

Highest common factors.

Set of factors of 12 is,

$F_{12} = \{1, 2, 3, 4, 6, 12\}$

Likewise, set of factors of 18 is,

$F_{18} = \{1, 2, 3, 6, 9, 18\}$.

Set of common factors of these two sets F_{12} and $F_{18} = \{1, 2, 3, 6\}$. That is, the common factors of 12 and 18 are 1, 2, 3, and 6. Out of these, the Largest Common Factors is 6.

Hence, Highest Common Factor = 6. Highest Common Factors is written as H.C.F. in short.

Highest Common Factor (H.C.F.) of natural numbers is the greatest factor among all the common factors:

Example: 1

Find the H.C.F. of 15 and 20.

Solution

The factors of 15 are

$15 = 5 \times 3$

Similarly, the factors of 20 are

$20 = 5 \times 4$

Here the common factor is 5

$\therefore$ H.C.F. = 5

Example: 2

Find the greatest number of person among whom 18 lemons and 24 apples can be equally distributed. Also find the number of fruits each will get.

Here. $18 = 2 \times 3 \times 3$
And $24 = 2 \times 2 \times 2 \times 3$
Here, the common factors are 2 and 3

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

That is, lemons and apples can be equally distributed to 6 persons.

Now, 18 is divided by 6

```
6) 18 (3
   18
   --
    ×
```

Each will get 3 lemons.

Similarly 24 is divided by 6

```
6) 24 (4
   24
   --
    ×
```

Each will get 4 apples.

Exercise 2.9 (A)

1. Find H.C.F. of the following numbers by making the group of factors.

   (a) 4, 6 (b) 6, 9 (c) 8, 12 (d) 9, 18 (e) 9, 12 (f) 8, 16

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

   (a) 12, 15 (b) 12, 30 (c) 16,40
   (d) 18, 27 (e) 27, 36 (f) 24, 60

3. Find the greatest number which divides 18 and 45 without a remainder.

4. Find the greatest number of person among whom 9 oranges and 12 apples can be equally distributed. What will be the share of fruits for each ?

5. What is the maximum number of person among whom 12 lemons and 18 oranges can be equally distributed? And how many fruits will each get?

6. One pot contains 30 liters of milk and the other contains 50 liters of milk. How much will be the maximum holder capacity of the next pot which can measure the milk in such a way that it can empty each pot?

7. A rectangular courtyard is 21 m. long and 9 m. wide. If it has to be paved with the same size square marbles of what will be the length of the greatest square marble?

8. A basket contains 25 guavas and another contains 30 pears. What maximum number of guavas or pears should be taken out at a time from each basket to empty the baskets at the time?

Lowest Common Multiple

The set of multiples of 2 and 3 can be made as the following ways.

The set of multiples of 2 are
$M_2 = \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20, ...\}$

The set of multiples of 3 are

$M_3 = \{3, 6, 9, 12, 15, 18, 21, 24, 27, 30, ...\}$

Now the common multiples of the numbers 2 and 3 are

$\text{Set} = \{6, 12, 18, ...\}$

The number 6 of this set is the lowest multiple or lowest common multiple of 2 and 3. In short form lowest common multiple is written as L.C.M.

L.C.M. of two or more than two natural number is the smallest natural number which is exactly divisible by those numbers.

Example: 3

Find the L.C.M. of 4 and 6.

Solution

While finding the prime factor of 4 and 6

$4 = 2 \times 2, \quad 6 = 2 \times 3$
Thus, L.C.M. $= 2 \times 2 \times 3 = 12$
Because, the common factor is the H.C.F.
Here, H.C.F. $= 2$

L.C.M. of two numbers = H.C.F. × Remaining factors.

Example: 4

Two bells ring at the interval of 20 minutes and 24 minutes respectively. If they ring together at 10 a.m., at what time will they ring together again?

Solution:

Here, 20 min. $= 2 \times 2 \times 5$
and, 24 min. $= 2 \times 2 \times 2 \times 3$

60) 120 (2 hours
$\underline{120}$
×

$\therefore$ H.C.F. $= 2 \times 2 = 4$
$\therefore$ L.C.M. $= 4 \times 5 \times 2 \times 3 = 120$ min.
$\therefore$ They will ring together again second time at 12 noon.

Exercise 2. 9 (B)

1. Find the L.C.M. of each of the following numbers by making the set of their multiples.

a) 3, 5	b) 4,6	c) 6, 8	d) 8, 10
e) 8, 12	f) 6, 7	g) 9, 12	h) 6,9

2. Find the L.C.M. of each of the following numbers by prime factor method.

a) 6, 9	b) 9, 12	c) 8, 12	d) 10, 14
e) 14, 20	f) 20, 24	g) 24, 30	h) 24, 36

3. Two bells ring at the interval of 24 minutes and 30 minutes respectively. If they ring together at 9 am, at what time will they ring second time together?

4. Out of two companies, the first company's meeting helds at the interval of every 4 weeks and the other at every 6 weeks. If their meeting take place together on Baishakh 2nd, 2058 after how many weeks will their second meeting take place together at the same day? Find the particular day month and date with the help of calendar 2058.

5. After traveling every 80 km. a motorcycle needs to fill petrol and after 100 km. it needs to change mobil. If these works are done together, after traveling which distance both the works will repeat again?

2.10 Sequence and Pattern of Numbers

(i) Natural numbers:

→ 1 2 3 4 ....

(ii) Odd numbers:

→ 1 3 5 7 ....

(iii) Even numbers:

→ 2 4 6 8 ....

In the sequence of the above numbers

- What will be the number of 5th term?
- Can the numbers of 8th and 10 th term be found out?
- Numbers of how many maximum terms can be written?
- Observe and do: Number of the second term-number of the first term, the third term - the second term, the fourth term - third term.
- By what number is each term increased? What did you get?

In this way, numbers proceeding ahead by following a rule is called the sequence of the numbers. Any number of term can be found out in the sequence of the numbers.

Let us observe the following patterns of the numbers.

(i)

1 4 16 ,

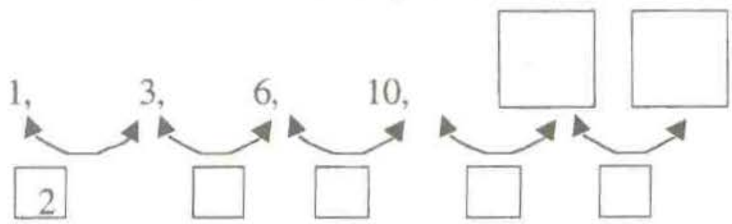
In these dots are arranged in the form of a square. All the dots representing the numbers 1, 4, 9, 16 .... can be arranged in the form of square. So, these numbers are called square numbers.

Square numbers can be written as

1	4	9	16	....	....	....
1×1	2×2	3×3	4×4	....	....	....
1^2	2^2	3^2	4^2	....	....	....

(ii) 1 3 6 10 ....

Such numbers are called 'Triangular numbers'.



- Observe experimentally

  Second term - first term = $\square$

  Third term - second term = $\square$

  Forth term - third term = $\square$

- In the above sequence, fill in the first empty space $\square$ with correct number. Fill in the empty spaces $\square$ given below with the correct number.

Example: 1

Fill the number in the blanks by observing the following pattern of the numbers and cheek it.

$$
\begin{array}{llllll}
1\times & 8 & + & 1 & = & 9 \\
12\times & 8 & + & 2 & = & 98 \\
123\times & 8 & + & 3 & = & 987 \\
 & & & & = & \\
 & & & & = & \\
 & & & & = & \\
 & & & & = &
\end{array}
$$

Answer:

The number 8 is confirmed Every number must be 8	The other numbers in the sequence 1, 2, 3, must be 4, 5, 6 ....

1, 12, 123, ...

The next number of the sequence is

$$1234 \times 8 + 4 = 9876$$

If the sequence is continue, then

$$12345 \times 8+5 = 98765$$
$$123456 \times 8 + 6 = 987654$$

Let us check,

$1234 \times 8 + 4$

$$\begin{array}{r} 1234 \\ \times 8 \\ \hline 9872 \\ +4 \\ \hline 9876 \end{array}$$

Exercise 2.10

I. In the sequence of natural numbers 1, 2, 3, 4, 5, 6, ...

(i) Write other four numbers

(ii) First number = 1
First number + second number = 1+2 = 3
Second number + third number = ... + ... = ...
Third number + fourth number = ... = ...
Fourth number + fifth number = ... = ...
.... = ...
.... = ...
.... = ...

- What types of the sequence of number is formed?

(iii) Again, first term = 1
First term+ second term = 1+2 = 3
First term + second term + third term =
First term + second tem + third term + fourth term =
First term + second term + third term + fourth term + fifth term=

- What type of sequence of number is formed?

(iv) Again, in the sequence of (iii)

First number = 1
First + second = 1 +3=4
Second + third =
Third + fourth =
Fourth + fifth =
Fifth + Sixth =

- What type of sequence of number is formed?

2. Study the following number pattern carefully and fill the blanks without doing calculation and then check with the help of calculation.

(i)

$11 + 1 = 12$
$12 + 2 = 14$
$13 + 3 = 16$
$14 + 4 =$ ....
$15 + 5 =$ ....
$16 + 6 =$ ....
$17 + 7 =$ ....
$18 + 8 =$ ....
$19 + 9 =$ ....
$20 + 10 =$ ....

(ii)

$11 \times 9 = 99$
$22 \times 9 = 198$
$33 \times 9 = 297$
$44 \times 9 =$ ....
$55 \times 9 =$ ....
$66 \times 9 =$ ....
$77 \times 9 =$ ....
$88 \times 9 =$ ....
$99 \times 9 =$ ....

(iii)

$0 \times 9 + = 1$
$1 \times 9 + 2 = 11$
$12 \times 0 + 3 = 111$
....
....
....

(iv)

$6 \times 7 = 42$
$66 \times 67 = 4422$
$666 \times 667 =$
$6666 \times 6667 =$
....
....

(v)

$9 \times 1 = 9$
$9 \times 21 = 198$
$9 \times 321 =$ ....
$9 \times 4321 =$ ....
$9 \times 54321 =$ ....
....
....
....

(vi)

$9 \times 9 + 7 =$ ....
$9 \times 98 + 6 =$ ....
$9 \times 987 + 5 =$ ....
$9 \times 9876 + 4 =$ ....
....
....
....
....

3. Fill in the box with appropriate number.

(i) 1, 6, 11, 16, ☐, 26, 31, ☐, 41, ...

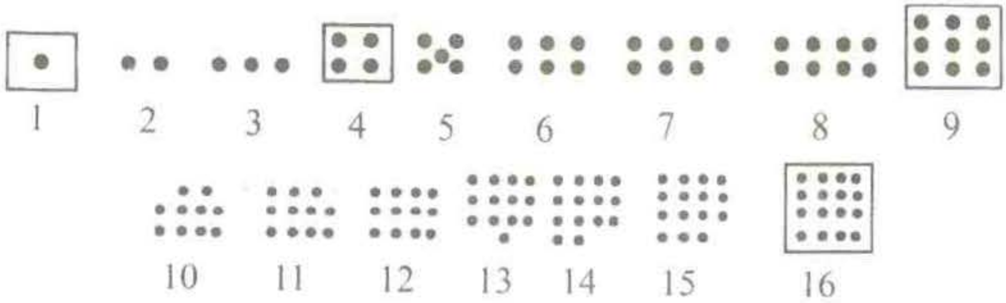
(ii) 3, 7, ☐, 15, 19 ☐, 27, ☐, 35, ...

(iii) ☐, 13, 21, ☐, 37, ☐, 53, 61, 69, ...

2. 11 Perfect Square Number and Square Root.

Perfect Square Number

Observe the figure given below and answer the following questions..



(a) In the figure, why are the dot pattern of the numbers inside the squares different than the other dot pattern of the numbers?

(b) Can the other numbers in the figure be arranged in the number pattern or dot pattern kept in the square? How?

(c) What is the image formed by the dot pattern inside the square?

(d) If the number of dots in one of the row, of the dot pattern arranged in the square is known, then how can the total number of points in the dot pattern be known?

(e) Can the numbers given by the dot pattern arranged in the square, be written as $1 \times 1, \times 2 \times 2, 3 \times 3, 4 \times 4$?

(f) Can 3 each similar additional numbers be removed from the number-rows obtained from the question number (e)?

If the dot pattern of a number can be expressed in the square form, such type of numbers are called perfect square number.

If a number can be expressed by the product of the same two factors, then such number is called a perfect square number.

For example:

$4 = 2 \times 2$	$16 = 4 \times 4$	$36 = 6 \times 6$
$9 = 3 \times 3$	$25 = 5 \times 5$	$49 = 7 \times 7$

Example: 1

Distinguish whether 125 and 121 are perfect square numbers or not.

Solution

Here, $125 = 5 \times 5 \times 5$ (by prime factor method)
and $121 = 11 \times 11$

Hence 121 is a perfect square number but 125 is not a perfect square number.

Example: 2

Find the least whole number by which 125 should be multiplied to make it perfect square number.

Solution

Here,
$125 = 5 \times 5 \times 5$

Multiplying both sides by 5

$125 \times 5 = 5 \times 5 \times 5 \times 5$

or, $625 = 25 \times 25$

Thus, 125 should be multiplied by 5 so 'that the result 625 becomes a perfect square number.

Example: 3

What is the perfect square number of 13?

Answer:

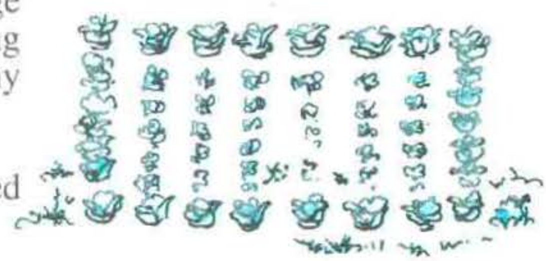
Here, to find the perfect square number of 13 means, to express in the form of product after multiplying 13 by 13.

Therefore, the perfect square number of $13 = 13 \times 13 = 169$

Note: $169 = 13 \times 13$ or $169 = 13^2$ is written. While reading this is read as thirteen squared.

Square root of a perfect square number

In the figure alongside, 64 cabbage plants are planted by arranging them in a square form. How many plants are planted in each row?



In the figure, 8 plants are planted in each row.

Therefore, $64 = 8 \times 8$.

Hence, the perfect square number is 64 and its perfect square root is 8. Out of two equal factors of a perfect square number, one of them is called the square root of that number.

For example, if perfect square number then, $a^2 = a \times a$

Square Root Table (From 1 - 1000)

×	1	2	3	4	5	6	7	8	9	10
1	1									
2		4								
3			9							
4				16						
5					25					
6						36				
7							47			
8								64		
9									81	
10										100

Study the above table and answer the following questions.

(a) if $4 \times 4 = 4^2 = 16$ then what is the square number of $9 \times 9 = 9^2$?
(b) What are the square numbers of 5 and 8 each?
(c) What are the square roots of 36 and 100 each?

Cube Number and Cube Root:

Let us find out the factors of 8 and 27.

Here, while finding the factors 8,

$$\begin{array}{r|l} 2 & 8 \\ \hline 2 & 4 \\ \hline & 2 \end{array}$$

$\therefore\ 8 = 2 \times 2 \times 2 = 23$

Here, 8 and 27 are cube numbers.

2 and 3 are respectively known as cube root of 8 and 27.

Now, discuss the following questions.

Is 1 a cube number?

What will be cube root of 1?

Exercise 2.11

1. Find the value.

   (a) 1^2 (b) 0^2 (c) 4^2 (d) 7^2
   (e) 9^2 (f) 3^2 (g) 6^2 (h) 10^2

2. What is the square number of each of the following numbers?

   (a) 1 (b) 2 (c) 3 (d) 4
   (e) 9 (f) 10 (g) 15 (h) 25

3. Find the square root (by factorization method)

   (a) 25 (b) 36 (c) 64 (d) 81
   (e) 121 (f) 144 (g) 324 (h) 625

4. By what number each of the following numbers must be multiplied to be a perfect square number ?

   (a) 72 (b) 108 (c) 125 (d) 192

5. While assembling soldiers in a square form having 64 persons in each row, a commande finds 219 soldiers extra then.

   a) How many total soldier are there?
   b) To arrange all in a square, how many minimum soldiers should be added?

6. How many plants would be required to plant them in a square to have 49 plants each, both length wise and breadth wise?

7. In an afforestation program, as many as participants were there each of them glanced the planting same number of plants then total 1225 plants were planted. How many persons had participated?

8. Write the number from 1 to 100 and encircle the cube numbers.

9. Find the cube root.

   (a) 64 (b) 125 (c) 1000 (d) 27

10. Find the cube numbers of the following numbers ?

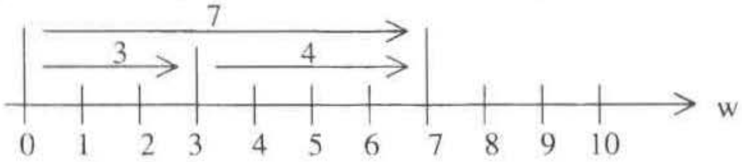
   (a) 3 (b) 4 (c) 6 (d) 7 (e) 9 (f) 10

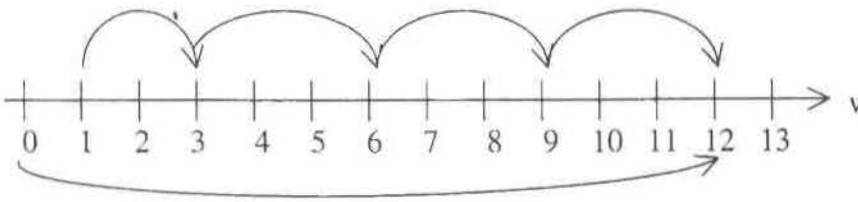
3. Integers

3.1 Introduction to Integers and Comparisons

Pick up any two numbers from the set of the whole numbers w = {0, 1, 2, 3, 4, 5, ...} . Let those numbers be 3 and 4. Now, sum of 3 and 4 is 7 and their product is 12.

Showing these two operations in number line,

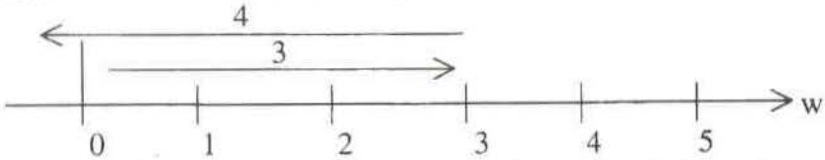




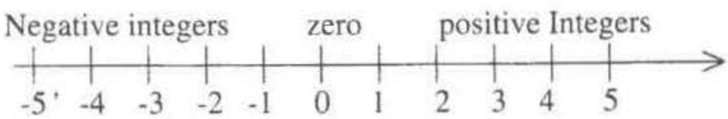
Here, the number showing the sum is 7 and the number Showing the product is 12 and both are whole numbers.

similarly, the numbers, obtained by addition or by multiplication of other members of the whole numbers, are also whole numbers. But, what would happen while subtracting?

Can you say 3-4 =? Let us see this by number line.



From the number line, 3 – 4 means, a number, 1 unit less than 0. Let us write this as -1. Similarly, 3 – 5 = -2 (two unites less then 0); 3 – 6 = –3 etc. while observing this way, the number line keeps extending towards left from 0.



This set of numbers z = { ....–2, –1, 0, 1, 2 ....} is called the set of integer and the subtraction operation is defined in the set of integer. In the number line, the place where 0 is written is called Point of Reference. The number towards right from the Point of Reference are positive (+). The set of these numbers, Z^+ = { +1, +2, +3, +4, ...} is called set of the Positive Integers. The numbers towards left from the Point of Reference are negative. The set of these numbers, Z^- = { –1, –2, –3, –4, –5,.........} are called set of the Negative Integers.

The set of integer indicates a set of such numbers which includes positive integers, negative integers and zero (0).

Exercise 3.1

1. Answer the following questions on the basis of number line.
   (a) Towards which side from the point of reference does a number less than 0 lie?
   (b) Towards which side from the point of reference does a number less than 0 lie?
   (c) Which side of the given number does a number unit less than the given number lie?
   (d) Which side of the given number does a number unit greater than the given number lie?
   (e) Which is greater in –6 and –5?
   (f) Which is smaller in –8 and –7?
   (g) How many integers are there in between –5 and 3?
2. With the help of number line, write the number 3 units left.
3. Put the sign > or < at the appropriate place between the following two numbers.
   (a) +7 □ –3 (b) +3 □ +5 (c) –3 □ –2
   (d) –5 □ –7 (e) –5 □ +2 (f) +5 □ –5
4. How many integers are there in between –13 and + 5?
5. Hari is situated at a place 4 km straight due east from a statue, Ram is at a place 2 km due west. Show this information in the number line using integers. Also, find the distance between Hari and Ram.

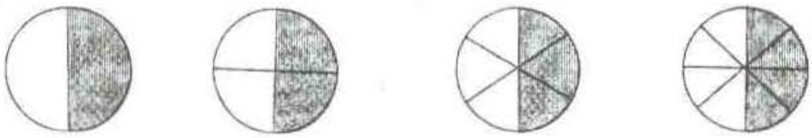
4. Fraction and Decimals

4.1. Review:

Equivalent fractions:

Let us review the things regarding fraction already studied in the previous classes.

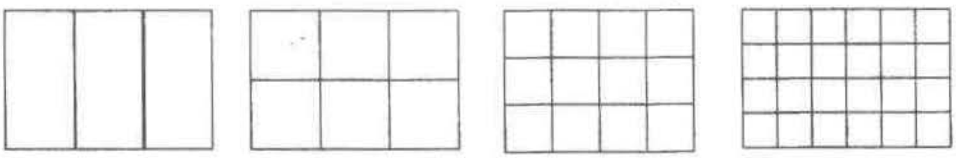
In the figures, the shaded portions denote $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$ and $\frac{4}{8}$ respectively.



$\frac{1}{2}$ $\qquad$ $\frac{2}{4}$ $\qquad$ $\frac{3}{6}$ $\qquad$ $\frac{4}{8}$

In each figure, the shaded portions are equal so the fractions $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$ and $\frac{4}{8}$ are all equal. Such fractions are called equivalent fractions.

The shaded portion shown in the figure denotes $\frac{2}{3}$, $\frac{4}{6}$, $\frac{8}{12}$ and $\frac{12}{18}$



$\frac{2}{3}$ $\qquad$ $\frac{4}{6}$ $\qquad$ $\frac{8}{12}$ $\qquad$ $\frac{12}{18}$

These all are equivalent fractions.

Lowest Term of a Fraction

$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$

Here, $\frac{2}{4}$, $\frac{3}{6}$ and $\frac{4}{8}$ all are fractions equal to $\frac{1}{2}$

Since, there is no common factor in numerator and denominator in the fraction $\frac{1}{2}$, therefore, it is called the lowest term of $\frac{2}{4}$, $\frac{3}{6}$ and $\frac{4}{8}$.

Similarly, $\frac{2}{3}$ is the lowest term of $\frac{4}{6}$, $\frac{8}{12}$, $\frac{12}{18}$, $\frac{16}{24}$.

Comparsion of Fractions:

$\frac{1}{2}$	$\frac{1}{2}$

$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

What are the numerators of these fractions?

Are the denominators of these fractions also same, if not denominators are on increase or decrease? How does it affect, if the numerator of a fraction remains the same whereas the denominator keeps increasing? How is a fraction is affected when its numerator remains the same but the denominator keeps decreasing?

In two or more than two fractions, if numerators are same then the fraction having smaller denominator is greater.

Again, let us see once the fractions denoted by these figures.

$\boxed{\frac{1}{4} < \frac{2}{4} < \frac{3}{4}}$

$\frac{1}{4} \rightarrow$	$\frac{1}{4}$			
$\frac{2}{4} \rightarrow$	$\frac{1}{4}$	$\frac{1}{4}$		
$\frac{3}{4} \rightarrow$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	

- What are the denominators in these fractions?
- then, numerators are on increase or decrease?
- How is a fraction affected if its denominator remains the same but the numerator keeps decreasing?

If two or more than two fractions have same denominator then the fraction having a greater numerators is greater.

Let us remember:

While comparing two or more than two fractions;

- If the denominator is same and comparing the numerator only, then the fraction which has a greater numerator is the greater fraction.
- If the denominators are different, then numerator and denominator are multiplied by a common factor to convert into equivalent fractions and they can be compared.

Example: 1

Compare $\frac{3}{5}$ and $\frac{2}{3}$.

Answer:

Here, the denominators of the fractions are different. so, to make the denominators same,

Multiplying the numerator and denominator of $\frac{3}{5}$ by 3, $\frac{3}{5} = \frac{3 \times 3}{5 \times 3} = \frac{9}{15}$

Mulitiplying numerator and denominator of $\frac{2}{3}$ by 5, $\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$

Now, the denominators of both the fractions are same (15) and in the numerators $9<10$.

Therefore, $\frac{9}{15} < \frac{10}{15}$

So, $\frac{3}{5} < \frac{2}{3}$ or $\frac{2}{3} > \frac{3}{5}$

Short and fast method of comparing fractions

Fractions to be compared $\frac{3}{5}$ and $\frac{2}{3}$

$\frac{3}{5} = \frac{3 \times 3}{5 \times 3}$ and $\frac{2}{3} = \frac{2 \times 5}{3 \times 5}$

$= \frac{9}{15}$ $= \frac{10}{15}$ (After multiplying the denominator of one fraction and the numerator of the next one)

therefore, $\frac{9}{15} < \frac{10}{15}$

or, $\frac{3}{5} < \frac{2}{3}$

Example: 2

Arrange the fractions $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ into descending order.

Answer:

Here, the denominators are different, therefore they should be converted into like fractions.

Now, multiplying the numerator and the denominator of each fraction by 2. 3. 4. ……… etc,

$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \frac{6}{12} = \frac{7}{14} = \ldots\ldots\ldots\ldots\ldots$

$\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15} = \frac{12}{18} = \ldots\ldots\ldots\ldots\ldots$

$\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$

Now, arranging the fractions having same denominators into descending order, we get

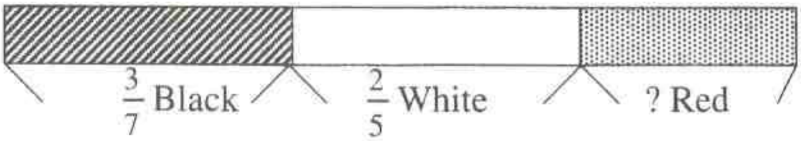
$\frac{9}{12}, \frac{8}{12}, \frac{6}{12}$ or $\frac{3}{4}, \frac{2}{3}, \frac{1}{2}$

Example: 3

A stick is marked $\frac{3}{7}$ part with black, $\frac{2}{5}$ part with white and the remaining part with red. Which part of the colour is more?

Answer:

Let us think in the figure.



From the whole part of the stick, after subtracting the black and white parts, what is the red part, can be found out.

Black and white part of the stick $= \frac{3}{7} + \frac{2}{5}$

$= \frac{3 \times 5}{7 \times 5} + \frac{2 \times 7}{5 \times 7}$ (making denominators same)

$= \frac{15}{35} + \frac{14}{35} = \frac{29}{35}$

Therefore, the red part of the stick = (whole part) - (black and white parts)

$= 1 - \frac{29}{35}$

$= \frac{35 - 29}{35} = \frac{6}{35}$

Therefore, black, white and red part respectively become $\frac{3}{7}, \frac{2}{5}$ and $\frac{6}{35}$

When these fractions are made equivalent fractions, respectively they become $\frac{15}{35}, \frac{14}{35}$ and $\frac{6}{35}$, so the black part is the most longest coloured part.

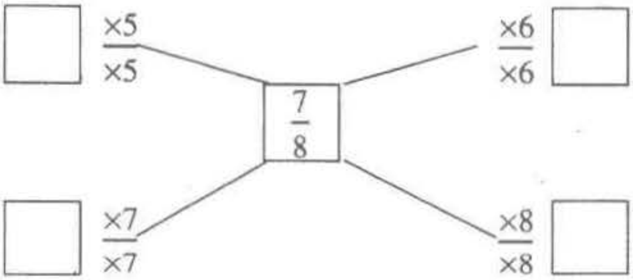
Exercise 4.1

1. Write the shaded portion of the following figures in fraction

(a) (b) (c) (d)

2. a) Write the equivalent fractions of $\frac{3}{5}$ multiplying its numerators and denominator by 2, 3, 4 and 5.

(b) Make equivalent fractions of $\frac{7}{8}$ by filling up the following blank boxes.



3. Study the following table and write the suitable numbers in the blank boxes.

$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

(a) $\frac{1}{5} = \frac{\square}{10}$ (b) $\frac{\square}{5} = \frac{6}{10}$ (c) $\frac{2}{\square} = \frac{4}{10}$

(d) $\frac{5}{5} = \frac{\square}{10}$ (e) $\frac{3}{5} = \frac{6}{\square}$ (f) $\frac{2}{\square} = \frac{1}{10}$

4. Which of the following are equivalent fractions?

(a) $\frac{3}{4}$ and $\frac{12}{15}$ (b) $\frac{6}{7}$ and $\frac{12}{13}$ (c) $\frac{5}{9}$ and $\frac{25}{45}$ (d) $\frac{2}{3}$ and $\frac{18}{27}$

5. Convert into lowest term.

(a) $\frac{27}{108}$ (b) $\frac{84}{96}$ (c) $\frac{126}{396}$ (d) $\frac{52}{76}$ (e) $\frac{208}{312}$ (f) $\frac{150}{250}$

6. Compare the following fractions and put the sings <, = or > in the blank boxes.

(a) $\frac{1}{3} \square \frac{2}{3}$ (b) $\frac{3}{5} \square \frac{6}{10}$ (c) $\frac{1}{3} \square \frac{1}{4}$

(b) $\frac{2}{5} \square \frac{2}{6}$ (e) $\frac{3}{4} \square \frac{9}{12}$ (f) $\frac{1}{5} \square \frac{4}{5}$

7. Arrange the following fractions into ascending order.

(a) $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ (b) $\frac{3}{4}, \frac{4}{5}$ and $\frac{9}{10}$

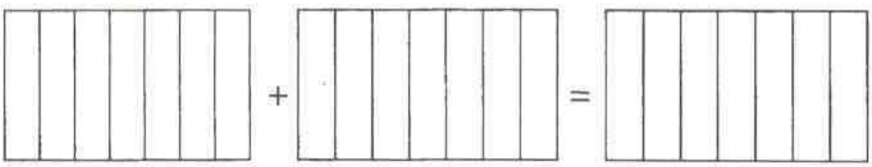
(b) $\frac{1}{6}, \frac{2}{9}$ and $\frac{5}{12}$ (d) $\frac{3}{10}, \frac{11}{30}$ and $\frac{7}{20}$

8. "Mala" gave Sheela and Samina a loaf of bread to each. Sheela ate $\frac{3}{8}$ part and Samina ate $\frac{5}{7}$ part of their bread, then who ate more bread?

9. Kailash, while going home covered $\frac{3}{7}$ part by bus, $\frac{1}{2}$ part by taxi and the remaining on foot, of the whole journey then how did he cover the longest distance?

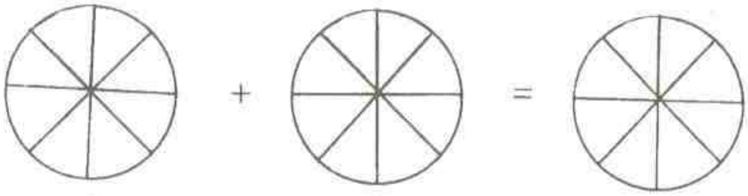
4.2 Addition and Subtraction of Fractions:

Look at the following figures and study the process of adding fractions.



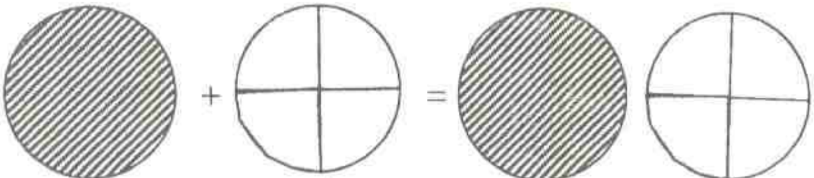
$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$

$\frac{2}{7}$ $\frac{3}{7}$ $\frac{5}{7}$



$\frac{1}{8}$ + $\frac{2}{8}$ = $\frac{3}{8}$

$\boxed{\frac{1}{8}+\frac{2}{8}=\frac{3}{8}}$



1 + $\frac{1}{4}$

$\boxed{1+\frac{1}{4}=1\frac{1}{4}}$

While adding the above fractions, sum of numerators is divided by the common denominator.

Example: 1

Add: $\frac{5}{9}+\frac{2}{9}+\frac{1}{9}$

Answer:

$$\frac{5}{9}+\frac{2}{9}+\frac{1}{9} = \frac{5+2+1}{9} = \frac{8}{9}$$

Example: 2

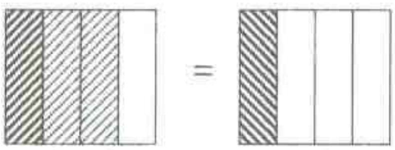
add: $2\frac{1}{3}+1\frac{1}{3}+\frac{2}{3}$

Answer:

$$2\frac{1}{3}+1\frac{1}{3}+\frac{2}{3}=\frac{7}{3}+\frac{4}{3}+\frac{2}{3}=\frac{7+4+2}{3}=\frac{13}{3}=4\frac{1}{3}$$

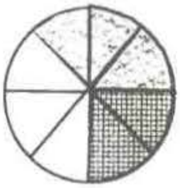
Subtraction of fraction

Look at the following figures and study the method of subtraction.

1. 

$\frac{3}{4}-\frac{2}{4}$ = $\frac{1}{4}$

$\boxed{\frac{3}{4}-\frac{2}{4}=\frac{1}{4}}$

2.  =  $\boxed{\frac{5}{8}-\frac{2}{8}=\frac{3}{8}}$

$\frac{5}{8}-\frac{2}{8}$ $\qquad$ $\frac{3}{8}$

Hence, while subtracting the above fractions, the difference of the numerator should be divided by common denominator.

Example: 3

Subtract: $\frac{7}{10}-\frac{3}{10}$

Answer:

$$\frac{7}{10}-\frac{3}{10}=\frac{7-3}{10}=\frac{4}{10}=\frac{2}{5}$$

Example: 4

Subtract : $2\frac{5}{9}-1\frac{2}{9}$

Answer:

$$2\frac{5}{9}-1\frac{2}{9}=\frac{23}{9}-\frac{11}{9}=\frac{23-11}{9}=\frac{12}{9}=\frac{4}{3}=1\frac{1}{3}$$

Addition and Subtraction of Unlike Fractions:

Study the following problems carefully and learn the methods of adding and subtracting unlike fractions.

Example: 5

add: $\frac{1}{2}+\frac{2}{5}+\frac{3}{4}$

Answer:

$$\frac{1}{2}+\frac{2}{5}+\frac{3}{4}=\frac{1\times 10}{2\times 10}+\frac{2\times 4}{5\times 4}+\frac{3\times 5}{4\times 5}$$ (Making the fractions, multiplying the numerators and the denominators by a common number)

$$=\frac{10}{20}+\frac{8}{20}+\frac{15}{20}=\frac{10+8+15}{20}=\frac{33}{20}=1\frac{13}{20}$$

Alternative method:

$$\frac{1}{2}+\frac{2}{5}+\frac{3}{4}=\frac{1\times 10+4\times 2+5\times 3}{20}=\frac{10+8+15}{20}=\frac{33}{20}=1\frac{13}{20}$$

Example: 6

Simplify:

$$1\frac{3}{10}+2\frac{2}{5}+4\frac{1}{20}$$

Answer:

$$\begin{aligned}1\frac{3}{10}+2\frac{2}{5}+4\frac{1}{20}&=\frac{13}{10}+\frac{11}{5}+\frac{81}{20}\\&=\frac{13\times 2}{10\times 2}+\frac{11\times 4}{5\times 4}+\frac{81}{20}\\&=\frac{26}{20}+\frac{44}{20}+\frac{81}{20}=\frac{26+44+81}{20}=\frac{151}{20}=7\frac{11}{20}\end{aligned}$$

Solve this problem yourself by short-cut method.

Example: 7

Subtract: $\frac{3}{10}-\frac{1}{8}$

Answer:

Here, $\frac{3}{10}$ and $\frac{1}{8}$ are unlike fractions. To subtract such fraction, let us convert both the fractions into like fractions.

$\frac{3}{10} = \frac{3 \times 4}{10 \times 4} = \frac{12}{40}$ and $\frac{1}{8} = \frac{1 \times 5}{8 \times 5} = \frac{5}{40}$

Now, $\frac{3}{10} - \frac{1}{8} = \frac{12}{40} - \frac{5}{40} = \frac{12-5}{40} = \frac{7}{40}$

Next method,

$\frac{3}{10} - \frac{1}{8} = \frac{3 \times 4 - 5 \times 1}{40}$ (Taking the L.C.M. 40 of 10 and 8)

$= \frac{12-5}{40} = \frac{7}{40}$

Example: 8

Subtract $1\frac{1}{2}$ from $2\frac{5}{8}$

Answer:

Here, $2\frac{5}{8} - 1\frac{1}{2} = \frac{21}{8} - \frac{3}{2} = \frac{21}{8} - \frac{3 \times 4}{2 \times 4}$

$= \frac{21}{8} - \frac{12}{8} = \frac{21-12}{8} = \frac{9}{8} = 1\frac{1}{8}$

Example: 9

Simplify: $\frac{2}{3} - \frac{1}{4} + \frac{5}{12}$

Answer:

Here, $\frac{2}{3} - \frac{1}{4} + \frac{5}{12} = \frac{8-3+5}{12} = \frac{13-3}{12} = \frac{10}{12} = \frac{5}{6}$

Exercise 4.2

1. Add:

(i) $\frac{2}{5} + \frac{1}{5}$ (ii) $\frac{3}{8} + \frac{1}{8}$ (iii) $\frac{1}{12} + \frac{5}{12} + \frac{3}{12}$

(iv) $1\frac{2}{5} + 2\frac{3}{5}$ (v) $3\frac{4}{7} + 2\frac{1}{7} + 3\frac{3}{7}$ (vi) $4\frac{1}{15} + 5\frac{1}{15} + 2\frac{2}{15}$

2. Subtract:

(i) $\frac{4}{5} - \frac{2}{5}$ (ii) $\frac{7}{18} - \frac{4}{18}$ (iii) $2\frac{3}{8} - 1\frac{1}{8}$

(iv) $5\frac{2}{7} - 3\frac{2}{7}$ (v) $12\frac{3}{10} - 10\frac{1}{10}$ (iv) $20\frac{7}{12} - 10\frac{1}{12}$

3. Add:

(i) $\frac{1}{2} + \frac{2}{3}$ (ii) $\frac{3}{4} + \frac{1}{8}$ (iii) $\frac{2}{9} + \frac{1}{6}$ (iv) $\frac{5}{12} + \frac{1}{6} + \frac{2}{3}$

(v) $1\frac{1}{2} + 2\frac{3}{4}$ (vi) $1\frac{2}{5} + 2\frac{3}{4}$ (vii) $1\frac{1}{3} + 2\frac{3}{4} + 2\frac{1}{2}$

(viii) $1\frac{1}{2} + 2\frac{3}{4} + 4\frac{1}{2}$

4. Subtract:

(i) $\frac{5}{3} - \frac{1}{2}$ (ii) $\frac{3}{5} - \frac{1}{4}$ (iii) $\frac{4}{9} - \frac{1}{6}$ (iv) $1\frac{3}{4} - \frac{1}{2}$

(v) $2\frac{7}{8} - \frac{5}{16}$ (vi) $3\frac{7}{10} - 2\frac{1}{5}$ (vii) $3\frac{2}{5} - 2\frac{1}{6}$ (vii) $10\frac{2}{5} - 3\frac{1}{6}$

(ix) $7\frac{2}{9} - 2\frac{3}{4}$

5. Simplify:

(i) $\frac{1}{2} + \frac{2}{3} - \frac{3}{4}$ (ii) $1\frac{1}{2} - 2\frac{3}{4} + 4\frac{1}{2}$ (iii) $3\frac{3}{6} - 1\frac{1}{4} - \frac{2}{3}$

(iv) $10\frac{2}{5} - 3\frac{1}{10} - 1\frac{1}{20}$

6. Rabin had a big register. If he wrote $\frac{1}{2}$ part of it, how much part is left to write?

7. Meera took cattle to graze in the forest. While returning home, she brought back $\frac{1}{2}$ part of them. Again her father brought back $\frac{1}{4}$ part. Now, how much part is to be brought back home?

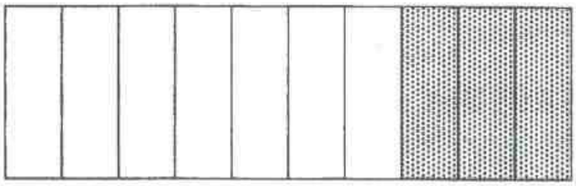
8. Reena, Meena and Deena read $\frac{1}{3}$ part, $\frac{2}{5}$ and $\frac{1}{6}$ part of a Ramayan book respectively. Now, What part of the book should Kalpana read so that she can finish reading the book?

4.3 Division and Multiplication of Fractions

Product of a Fraction and a Whole Number.

Let us observe the following examples:

$\frac{3}{10} \times 2 = 2 \times \frac{3}{10}$ (How?)



$2 \times \frac{3}{10}$ means collecting twice of $\frac{3}{10}$

while adding twice of $\frac{3}{10}$ from the figure, it is seen $\frac{6}{10}$ i.e. $\frac{3}{5}$

Hence, let us try to solve such problem directly.

$$\frac{3}{10} \times 2 = \frac{3 \times 2}{10} = \frac{6}{10} = \frac{3}{5}$$

Example:1

Multiply: $\frac{4}{9} \times 3$

Answer:

$$\frac{4}{9} \times 3 = \frac{4 \times 3}{9} = \frac{12}{9} = \frac{4}{3} = 1\frac{1}{3}$$

Example: 2

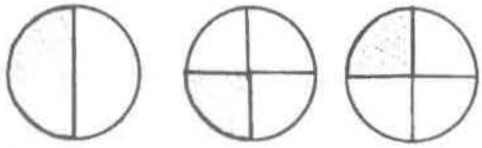
What is the $2\frac{3}{10}$ parts of 4?

Answer:

$2\frac{3}{10}$ parts of 4 means $4 \times 2\frac{3}{10} = 4 \times \frac{23}{10} = \frac{4 \times 23}{10} = \frac{92}{10} = \frac{46}{5} = 9\frac{1}{5}$

Product of Fractions

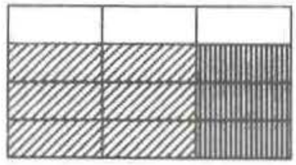
Geeta has $\frac{1}{2}$ bread. She gave $\frac{1}{2}$ (half) of it to her brother. Now, how much part of the whole bread did she give to her brother? Write in fraction.



It is known from the figure that only $\frac{1}{4}$ part of the bread she gave to her brother.

Hence, $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{2} \times \frac{1}{2} = \frac{1 \times 1}{2 \times 2} = \frac{1}{4}$

Again, let us observe another example: $\frac{3}{4} \times \frac{2}{3} \rightarrow$



How much is $\frac{3}{4} \times \frac{2}{3}$?

Here, $\frac{3}{4} \times \frac{2}{3} = \frac{3 \times 2}{4 \times 3} = \frac{6}{12} = \frac{1}{2}$

While multiplying a fraction by another fraction, a new fraction is formed by putting the product of the numerators in the numerator and the product of the denominators in the denominator.

Example: 3

Multiply: (a) $\frac{1}{3} \times \frac{4}{15}$ (b) $\frac{3}{10} \times \frac{5}{6}$

Answer:

(a) $\frac{1}{3} \times \frac{4}{15} = \frac{1 \times 4}{3 \times 15} = \frac{4}{45}$

(b) $\frac{3}{10} \times \frac{5}{6} = \frac{3 \times 5}{10 \times 6} = \frac{15}{60} = \frac{1}{4}$ (on reducing in the lowest term)

Example: 4

Find the value of:

(a) $\frac{9}{10}\times\frac{5}{3}$ (b) $\frac{3}{4}$ of $\frac{1}{2}$kg

(a) $\frac{9}{10}\times\frac{5}{3} \quad =\frac{9\times5}{10\times3} \quad =\frac{3}{2} \quad =1\frac{1}{2}$

(b) $\frac{1}{2}$ kg $\times\frac{3}{4} \quad =(\frac{1}{2}\times\frac{3}{4})$ kg $\quad =\frac{3}{8}$kg

$=\frac{3}{8}\times1000$ gm $\quad$ =375 gm

Example: 5

Out of $\frac{3}{4}$ part of a glass of milk given to Raju by mother, if he drank $\frac{2}{3}$ (two third) only,

(a) What part of the glass of milk did he drink?
(b) How much milk is left in the glass?

Answer:

(a) Milk drunk by Raju $=\frac{2}{3}$ part of $\frac{3}{4}=\frac{2}{3}\times\frac{3}{4}=\frac{1}{2}$ glass

(b) Remaining milk in the glass $=\frac{3}{4}$ glass – milk drunk by Raju

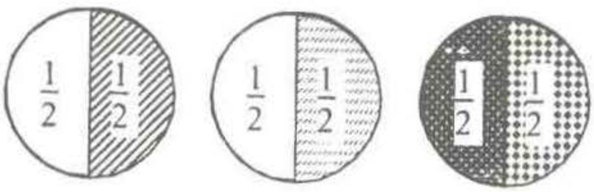
$=\frac{3}{4}-\frac{1}{2}=\frac{3-2}{4}=\frac{1}{4}$ glass.

Dividing a Whole Number by a Fraction

Let us observe the following example:

$3\div\frac{1}{2}$

How many $\frac{1}{2}$ are there in 3 is meant by $3 \div \frac{1}{2}$?



It is clear from the figure that there are six $\frac{1}{2}$ in 3 whole parts.

In a short cut way, $3 \div \frac{1}{2}$ can be shown in this way,

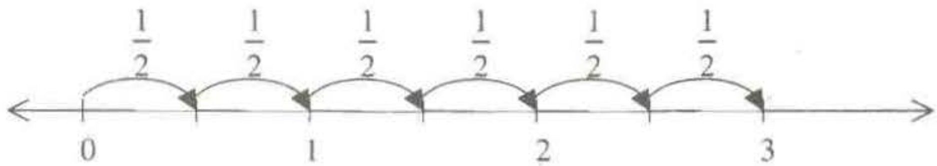
$3 \div \frac{1}{2} = 3 \times \frac{2}{1}$ ($\frac{1}{2}$ is made $\frac{2}{1}$ and multiplied by 3)

or (the reciprocal of $\frac{1}{2}$ is $\frac{2}{1}$

$= \frac{6}{1} = 6$

In the same way, $10 \div \frac{2}{5} = 10 \times \frac{5}{2} = \frac{10 \times 5}{2} = 25$ or (the reiprocal of $\frac{2}{5}$ is $\frac{5}{2}$)

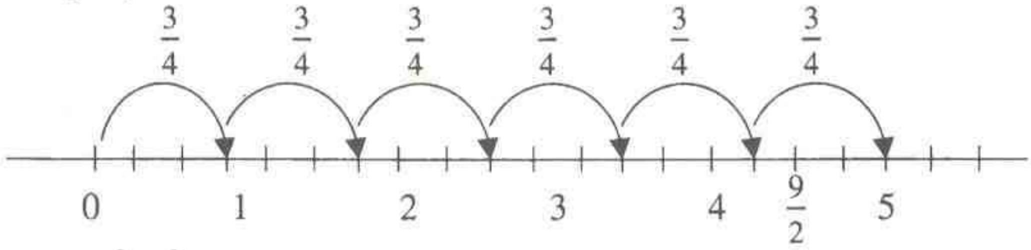
$3 \div \frac{1}{2}$ can be shown in the number line in this way.



Dividing a Fraction by a Fraction

For how many people will it be enough, When Ram divides $4\frac{1}{2}$ packets of biscuits at the rate of $\frac{3}{4}$ packet each?

How many $\frac{3}{4}$ are there in $4\frac{1}{2}$ can be said in the mathematical language i.e. $\frac{9}{2} \div \frac{3}{4} = 6$



Here, $\frac{9}{2} \div \frac{3}{4} = 6$

Thus, while dividing a fraction by another fraction, the required quotient if obtained when the inverted divider is multiplied with the fraction to be divided after the conversion of $\div$ into $\times$.

Example: 4

Divide:

(a) $6 \div \frac{3}{5}$ (b) $3 \div 1\frac{1}{5}$

Answer:

(a) $6 \div \frac{3}{5} = 6 \times \frac{5}{3}$

$= \frac{6 \times 5}{3}$

$= 10$

(b) $3 \div 1\frac{1}{5} = 3 \div \frac{6}{5}$

$= 3 \times \frac{5}{6}$

$= \frac{3 \times 5}{6}$

$= \frac{5}{2} = 2\frac{1}{2}$

Example: 5

Simplify:

(a) $\frac{2}{5} \div \frac{1}{2}$ (b) $3\frac{4}{5} \div 2\frac{1}{10}$

Answer:

(a) $\frac{2}{5} \div \frac{1}{2} = \frac{2}{5} \times \frac{2}{1}$

$= \frac{2 \times 2}{5 \times 1} = \frac{4}{5}$

(b) $3\frac{4}{5} \div 2\frac{1}{10} = \frac{19}{5} \div \frac{21}{10}$

$= \frac{19}{5} \times \frac{10}{21} = \frac{19 \times 10}{5 \times 21}$

$= \frac{38}{21} = 1\frac{17}{21}$

Example: 6

How many pieces of each $\frac{3}{4}$ m long cloth can be cut from a piece of cloth of 21m.

Answer:

Here, $21 \div \frac{3}{4} = 21 \times \frac{4}{3}$

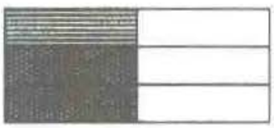
$= \frac{21 \times 4}{3}$

$= 28$

Hence, 28 pieces of each $\frac{3}{4}$ m. long cloth can be cut from a piece of cloth of 21m.

Exercise 4.2

1. Write the following double shaded parts of the figures in the product form of fraction.


(a)


(b)


(c)

2. Find the product of:

(a) $\frac{1}{5} \times \frac{1}{3}$ (b) $\frac{4}{3} \times \frac{1}{5}$ (c) $\frac{1}{10} \times \frac{5}{6}$

(d) $1\frac{2}{3} \times 2\frac{1}{6}$ (e) $\frac{9}{10} \times \frac{25}{30}$ (f) $3\frac{2}{4} \times 2\frac{3}{4}$

3. How much is ?

(a) $\frac{3}{5}$ of $\frac{1}{3}$ (b) $\frac{12}{35}$ of $\frac{5}{6}$

(c) $\frac{1}{3}$ of $\frac{3}{4}$ m cloth (d) $\frac{2}{5}$ of Rs. $2\frac{3}{4}$

4. Show the following problems by using a number line.

(a) $2 \div \frac{1}{2} = \boxed{}$

(b) $4 \div \frac{2}{3} = \boxed{}$

5. Simplify:

(a) $1 \div \frac{1}{2}$ (b) $12 \div \frac{2}{3}$ (c) $20 \div \frac{4}{5}$ (d) $\frac{32}{7} \div 2\frac{2}{7}$

(e) $\frac{3}{5} \div \frac{3}{8}$ (f)) $\frac{18}{13} \div \frac{9}{8}$ (g) $1\frac{1}{2} \div \frac{3}{4}$ (h) $3\frac{5}{9} \div 2\frac{2}{3}$ (i) $4\frac{4}{5} \div 2\frac{2}{15}$

6. If Shyam lends $\frac{3}{5}$ of his Rs. 125 to his friend and buys exercises books from $\frac{3}{10}$ of the remainder, how much money will be left with him?

7. The length of the road from Kathmandu to Muglin is 110 km. According to the contract, $\frac{3}{5}$ part of it was black-topped by a British company and $\frac{3}{4}$ part of the remainder was black-topped by a Chinese company. Now how many kilometer is left to be black-topped?

8. If a small rabbit can cover $\frac{2}{3}$ m distance at a jump, how many times should it jump to cover a distance of 16 m in a straight line?

9. If a small window needs a curtain of $\frac{3}{4}$ m length, for how many windows can the curtains be put from a bundle of cloth of length 30 m?

10. A man can carry $\frac{9}{10}$ quintal of sugar in one attempt. How many attempts should be make to carry 18 quintal of sugar?

11. How many $\frac{2}{3}$ parts of a right angle are there in a complete wheel? (there is $360°$ in one complete wheel)

12. How many bottles of capacity $1\frac{1}{4}l$ each can be filled by $20l$ of milk?

4.4 Simplification of Fractions

We will discuss about the solution of fractions containing the signs '+' '–' '×' and '÷'. Study the following examples for this purpose.

How long is the total length of the cloth formed by joining 4 pieces of cloth of length $\frac{1}{2}$ m each and a next piece of length $\frac{3}{4}$ m?

Here, how long is the length of the cloth obtained by joining 4 pieces of cloth of length $\frac{1}{2}$ m each and a next piece of length $\frac{3}{4}$ m?

Here, the total length of 4 pieces each $\frac{1}{2}$ m long means $\frac{1}{2}\times4=2$m cloth and again adding next $\frac{3}{4}$ m. the total length is 2m $+\frac{3}{4}$ m$=2\frac{3}{4}$ m long cloth. It can be written in mathematical language as follows:

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

Thus, the total length of the cloth is $2\frac{3}{4}$ m.

Let us study the following examples

Example: 1

Simplify: $2\frac{1}{3}+3\frac{1}{2}\times\frac{1}{14}-\frac{2}{3}$

Answer:

Here, $2\frac{1}{2}+3\frac{1}{2}\times\frac{1}{14}-\frac{2}{3}$ $=\frac{5}{2}+\frac{7}{2}\times\frac{1}{14}-\frac{2}{3}$

$=\frac{5}{2}+\frac{1}{2}\times\frac{1}{2}-\frac{2}{3}$ $=\frac{5}{2}+\frac{1}{4}-\frac{2}{3}$ (at first remove the sign of multiplication)

$=\frac{30+3-8}{12}$ (convert into a single fraction after taking L.C.M.)

$=\frac{33-8}{12}=\frac{25}{12}=2\frac{1}{12}$

Example: 2

Simplify: $\frac{3}{4}\times2\frac{1}{3}-\frac{1}{4}-\frac{1}{2}$

Answer:

Here, $\frac{3}{4}\times2\frac{1}{3}-\frac{1}{4}-\frac{1}{2}$

$=\frac{3}{4}\times\frac{7}{3}-\frac{1}{4}-\frac{1}{2}$

$=\frac{7}{4}-\frac{1}{4}-\frac{1}{2}$ (sign of multiplication is removed)

$=\frac{7-1-2}{4}=\frac{7-3}{4}=\frac{4}{4}=1$

Now, let us study the problems having '÷' '×'.

Example: 3

Simpligy: $\frac{4}{5}\div\frac{8}{9}\times\frac{1}{7}$

In words, it is said that how much is there when $\frac{4}{5}$ is divided by $\frac{8}{9}$ and the quotient is multiplied by $\frac{1}{7}$?

Answer:

On dividing $\frac{4}{5}$ by $\frac{8}{9}$,

$\frac{4}{5}\div\frac{8}{9}=\frac{4}{5}\times\frac{9}{8}=\frac{9}{10}$

Again, $\frac{9}{10}\times\frac{1}{7}=\frac{9}{10}\times\frac{1}{7}=\frac{9\times1}{10\times7} = \frac{9}{70}$

On sort, $\frac{4}{5}\times\frac{9}{8}\times\frac{1}{7}$ ('÷' sing is converted into '×'.)

$$=\frac{4\times9\times1}{5\times8\times7}=\frac{9}{70}$$

Example: 4

Simpligy: $\frac{1}{2}\div\frac{3}{4}\times1\frac{1}{4}+\frac{2}{3}$ (Try to write this in words)

Answer:

Here, $\frac{1}{2}\div\frac{3}{4}\times1\frac{1}{4}+\frac{2}{3} \quad =\frac{1}{2}\times\frac{3}{4}\times\frac{5}{4}+\frac{2}{3}$

$=\frac{1}{2}\times\frac{4}{3}\times\frac{5}{4}+\frac{2}{3}$(÷ Sign is removed)

$$=\frac{5}{6}+\frac{2}{3}=\frac{5+4}{6}=\frac{9}{6}=\frac{3}{2}=1\frac{1}{2}$$

Example: 5

Simplify: $3\frac{4}{5}-1\frac{1}{10}\div\frac{1}{6}+2\frac{1}{10}$

Answer:

Here $3\frac{4}{5}-1\frac{1}{10}\div\frac{1}{6}+3\frac{1}{10}$

$$=\frac{19}{5}-\frac{11}{10}\times\frac{6}{1}+\frac{31}{10}$$
$$=\frac{19}{5}-\frac{33}{5}+\frac{31}{10}$$
$$=\frac{38-66+31}{10}$$
$$=\frac{69-66}{10}$$
$$=\frac{3}{10}$$

Example: 6

How long cloth will be obtained if $7\frac{1}{2}$ m. long cloth is cut into 5 equal parts and a $2\frac{1}{2}$ m. piece of cloth is sewn/joined to one of the 5 pieces of the cloth?

Answer:

Here, $7\frac{1}{2} \div 5 + 2\frac{1}{2}$

$= \frac{15}{2} \div 5 + \frac{5}{2} = \frac{15}{2} \times \frac{1}{5} + \frac{5}{2}$

$= \frac{3}{2} + \frac{5}{2} = \frac{8}{2} = 4$

Hence, the total length of the cloth is 4 m.

Example: 7

Ram had an exercise book containing 100 pages. He has written $\frac{1}{5}$ part Nepali, $\frac{1}{4}$ part Maths and $\frac{1}{10}$ part Science. But, $\frac{1}{20}$ part is torn away. Now how much pages are left in it ?

Answer:

Part that written Nepali, Math and Science $= \frac{2}{5} + \frac{1}{5} + \frac{1}{10}$

$= \frac{4+5+2}{20} \quad = \frac{11}{20}$

Written pages $= \frac{11}{20}$ of 100 $= \frac{11}{20} \times 100 \quad = 55$

Torn pages $= \frac{1}{20}$ of 100 $= \frac{1}{20} \times 100 \quad = 5$

Remaining pages $= 100–55–5 \quad = 40$

It can be written in short in this way,

$$100 - \left(\frac{1}{5} + \frac{1}{4} + \frac{1}{10} + \frac{1}{20}\right) \text{ of } 100$$

$= 100 - \frac{12}{20}$ of 100

$= 100 - \frac{12}{20} \times 100$

$= 100 - 60 \qquad = 40.$

Exercise 4.2

1. Simplify :

(a) $\frac{1}{2} \div \frac{1}{3} - \frac{1}{4}$ (b) $\frac{1}{2} + \frac{2}{5} \times \frac{3}{10}$ (c) $\left[\frac{3}{4} - \frac{2}{5}\right] \div \frac{1}{3}$

(d) $1\frac{1}{4} + \frac{3}{40} + 1\frac{3}{5}$ (e) $\frac{1}{6} + 1\frac{1}{2} - \frac{3}{4}$ (f) $\frac{2}{3} + \frac{4}{5} \times \frac{3}{7}$

(g) $2\frac{1}{8} - \frac{2}{16} \div \frac{1}{32}$ (h) $1\frac{2}{3} \div 1\frac{5}{6} - \frac{1}{4}$ (i) $\frac{2}{3} \div \frac{4}{5} \times \frac{5}{6} \div \frac{15}{16}$

(j) $\frac{3}{4} \times \frac{21}{25} \div \frac{49}{50} + 2\frac{1}{3}$ (k) $15\frac{1}{3} - 2\frac{1}{4} \div \frac{1}{8} \times \frac{2}{3} + \frac{3}{4}$

2. Simplify:

(a) $\frac{1}{2} - \frac{1}{3} + \frac{1}{3}$ of $\frac{1}{2}$ (b) $2\frac{1}{2} \div \frac{1}{2} - 1\frac{1}{3} + 3\frac{1}{2}$

(c) $4 \div \frac{2}{3} \times \frac{8}{9} \times \frac{27}{32} + \frac{5}{6}$ (d) $\frac{1}{3} \times \frac{6}{7} - \frac{3}{14} \div 1\frac{2}{7} + 3\frac{1}{2}$

3. Solve the following problems:

(a) Out of 2 oranges, Shyam gets $\frac{1}{3}$ part of each. If he divides his part equally to three people including other two friends how much will be there in his part?

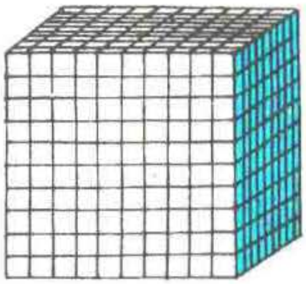
(b) Multiply the sum of $\frac{1}{2}$ and $\frac{1}{3}$ by 3 and then divide the result by 2.

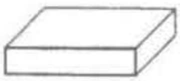
(c) Divide the sum of $1\frac{1}{2}$ and $\frac{2}{3}$ by 3 and then subtract $\frac{1}{2}$ from it.

(d) How much is there when the result obtained by subtracting $\frac{2}{5}$ from $3\frac{1}{4}$ is divided by $\frac{1}{2}$ and then multiplied by $1\frac{1}{2}$?

(e) Hari had Rs. 50. Mother added $\frac{1}{2}$ part of his money but he went to market after giving $\frac{2}{5}$ of his total money to his sister. If he spent $\frac{1}{2}$ part of his money that he took, how much money would be left with him?

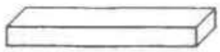
4.5 Conversion of Fractions into Decimals and Decimals into Fractions





$\frac{1}{10}=0.1$

Decimal one
(one part of a ten)



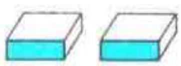
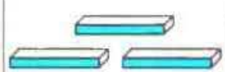
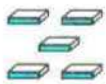
$\frac{1}{100}=0.01$

Decimal zero one
(one part of a hundred)

$\frac{1}{1000}=0.001$

Decimal zero zero one
(one part of a thousand)

Base ten block and the number upto three digits after decimal (2.315) can be shown in the place value table in this way.

Ten	One	Part of ten	Part of hundred	Part of thousane
				
	2	3	1	5

2.315 → The number is read as 'two decimal three one five'.

Conversion of fraction in decimal number

Example: 1

convert $1\frac{3}{4}$ into decimal number.

Answer:

$1\frac{3}{4} = \frac{7}{4}$

(a) Way of changing this in decimal number

$$\begin{array}{r} 1 \\ 4\overline{)7} \\ \underline{4} \\ 3 \end{array}$$

(on dividing the numerator 7 by 4)

(b)

$$\begin{array}{r} 1.7 \\ 4\overline{)7.0} \\ \underline{4} \\ 30 \\ \underline{28} \\ 2 \end{array}$$

(on supposing 7 as 7.0, it is divided by putting decimal after the quotient 1 and then converted into part of ten)

(c)

$$\begin{array}{r} 1.75 \\ 4\overline{)7.00} \\ \underline{4} \\ 30 \\ \underline{28} \\ 20 \\ \underline{20} \\ \times \end{array}$$

(on supposing 7 as 7.00, it is converted into part of hundred after dividing it)

Conversion of decimals into fractions.

Study the following examples once.

$0.2 = \frac{2}{10} = \frac{1}{5}$

$0.2 = \frac{2}{10}$ (There is 10 in the denominator if there is one digit after the decimal

$0.35 = \frac{35}{100}$ (There is 100 in the denominator it there are two digits after the decimal)

$0.675 = \frac{675}{1000}$ (There is 1000 in the denominator if there are three digits after the decimal)

Example: 3

Convert 3.285 in the lowest term and write in fraction.

Answer:

$3.285 = \frac{3285}{1000}$ (Decimal is removed)

$= \frac{657}{200}$ (Divided by 5)

$\therefore 3.285 = \frac{657}{200}$

Exercise 4.5

1. Convert the following fractions into decimal. (Three digits after decimal only)

   (a) $\frac{11}{8}$ (b) $\frac{5}{7}$ (c) $\frac{22}{9}$ (d) $12\frac{11}{12}$ (e) $3\frac{5}{16}$

2. Convert the following decimal numbers into fraction. (Also express the fraction into the lowest term)

   (a) 0.5 (b) 1.3 (c) 2.51 (d) 15.65 (e) 7.509 (f) 12.325

4.6 Addition and Subtraction of Decimal Numbers

For the additon and subtraction of decimal number, study the following examples.

Example: 1

Add:

$$\begin{array}{r} 5.474 \\ +8.450 \\ \hline \end{array}$$

Solution:

$$\begin{array}{r} 5.474 \\ +\ 8.450 \\ \hline 13.924 \end{array}$$

Arrange the number to be added according to the place value. Put zero after decimal as required. Now add the numbers.

Example: 2

Subtraact:

$$\begin{array}{r} 32.67 \\ -\ 12.881 \\ \hline \end{array}$$

Solution:

$$\begin{array}{r} 32.670 \\ -12.881 \\ \hline 19.789 \end{array}$$

Put zero after decimal as required. Subtract the number after arranging the numbers according to the place value.

On adding and subtracting, there must be same number of digits after decimal. If not, put zeros as required.

Exercise 4.6

1. Add:

(a) $\begin{array}{r} 3.05 \\ +2.79 \\ \hline \end{array}$ (b) $\begin{array}{r} 32.69 \\ +19.23 \\ \hline \end{array}$ (c) $\begin{array}{r} 1.405 \\ +\ 0.068 \\ \hline \end{array}$

(d) $\begin{array}{r} 6.374 \\ 18.966 \\ +\ 4.3 \\ \hline \end{array}$ (e) $\begin{array}{r} 13.54 \\ 2.689 \\ +3.28 \\ \hline \end{array}$ (f) $\begin{array}{r} 21.65 \\ 23.89 \\ +9.22 \\ \hline \end{array}$

(g) 18.00 + 9.099

2. Subtract:

(a) $\begin{array}{r} 5.67 \\ -3.09 \\ \hline \end{array}$	(b) $\begin{array}{r} 13.8 \\ -6.95 \\ \hline \end{array}$	(c) $\begin{array}{r} 21.081 \\ -14.069 \\ \hline \end{array}$
(d) $\begin{array}{r} 17.704 \\ -8.648 \\ \hline \end{array}$	(e) $\begin{array}{r} 14 \\ -12.836 \\ \hline \end{array}$	(f) $\begin{array}{r} 52.08 \\ -43.68 \\ \hline \end{array}$
(g) 1.9–0.999	(h) 12–8.6	(i) 13.07–6.894

3. Simplify:

(a) 6.97 – 13.543 + 8.695
(b) 1.1 – 20.976 + 25.68

4. How much money is returned from Rs. 50 when one dozen exercise books of Rs. 35.50 and a pen of Rs. 12 are bought?

5. If the length of a rectangle is 14.6 cm and its breadth is 1.8 cm less than its length,
(a) What will be its breadth?
(b) What will be its perimeter?

6. If Samina ate samosa costing Rs.1.75
jeri costing Rs. 3.50 and had a cup of tea costing Rs. 2.25, (a) how much did she spend in total? (b) If she had given a note of Rs. 10 to the shopkeeper, how much money would have been returned back to her?

7. While constructing a 30 km long road, if the public contribution is for 5.75 km and the rest from the government grant, how long road is constructed by the government grant?

8. A piece of wooden plank is 3.5 cm thick. While inserting a nail of length 4.25 cm into it, how much part will come out from the plank?

4.7 Division and Multiplication of Decimal Numbers by 10 and its Multiples

Lets us observe the following Examples:

(a) 0.1×10

$$\frac{1}{10}\times10=1 \qquad \frac{1}{10}\div10=\frac{1}{10}\times\frac{1}{10}=\frac{1}{100}$$

$$\boxed{0.1\times10=1.0} \qquad \boxed{0.1\div10=0.01}$$

(b) 0.01×10

$$\frac{1}{100}\times10=\frac{1}{10} \qquad \frac{1}{100}\div10=\frac{1}{100}\times\frac{1}{10}=\frac{1}{1000}$$

$$\boxed{0.01\times10=0.1} \qquad \boxed{0.01\div10=0.001}$$

(c) 0.001×10

$$\frac{1}{1000}\times10=\frac{1}{100} \qquad \frac{1}{1000}\div10=\frac{1}{1000}\times\frac{1}{10}=\frac{1}{1000}$$

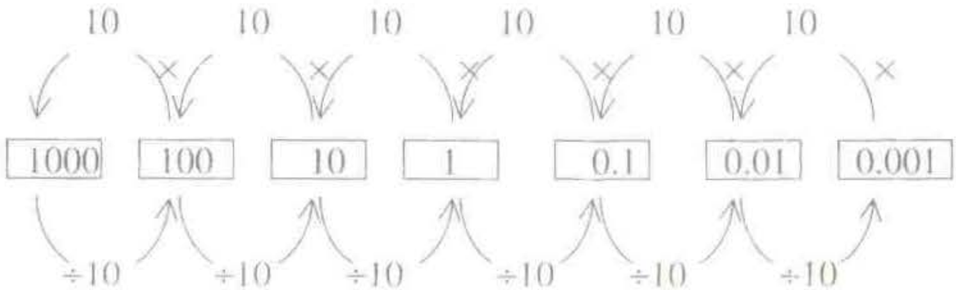
$$\boxed{0.001\times10=0.01} \qquad \boxed{0.001\div10=0.0001}$$

From these examples, it is clear that,

(i) The decimal shifts one step right, when a decimal number is multiplied by 10

(ii) The decimal shifts one step left, when a decimal number is divided by 10.

Let us try to understand this process by the following figure.



Let us observe the following examples also.

(a) $12.56 \times 10 = \frac{1256}{100} \times 10 = \frac{1256}{10} = 125.6$

The decimal shifts one step right, when a decimal number is multiplied by 10.

(b) $12.567 \times 100 = \frac{12567}{1000} \times 100 = \frac{12567}{10} = 1256.7$

The decimal shifts two step right, when a decimal number is multiplied by 100.

(c) $12.5678 \times 1000 = \frac{125678}{10000} \times 1000 \qquad = 12567.8$

The decimal shifts three step right, when a decimal number is multiplied by 1000.

(d) $12.2 \div 10 = 1.22$

The decimal shifts one steps left, when a decimal number is divided by 10.

(e) The decimal shifts two steps left, when a decimal number is divided by 100.

(f) $1234.5 \div 1000 = 1.2345$

The decimal shifts three step left, when a decimal number is divided by 1000

Example: 1

Multiply 0.537 by 10, 100 and 1000 respectively.

Answer:

$0.0573 \times 10 \qquad = 0.573$

$0.0573 \times 100 \qquad = 5.73$

$0.0573 \times 1000 \qquad = 57.3$

Example: 2

Divide 0.5 by 10,100 and 1000 respectively.

Answer:

$0.5 \div 10 \qquad = 0.05$

$0.5 \div 100 \qquad = 0.005$

$0.5 \div 1000 \qquad = 0.0005$

Example: 3

fill in the blanks.

Answer:

$$\boxed{1001} \xrightarrow{\div 10} \boxed{100.1} \xrightarrow{\div 10} \boxed{} \xrightarrow{\div 10} \boxed{} \xrightarrow{\div 10} \boxed{}$$

$$\boxed{1001} \xrightarrow{\div 10} \boxed{100.1} \xrightarrow{\div 10} \boxed{10.01} \xrightarrow{\div 10} \boxed{1.001} \xrightarrow{\div 10} \boxed{0.1001}$$

Exercise 4.7

1. Multiply each of the following numbers by 10,100 and 1000 respectively.
   (a) 1.2 (b) 10.5 (c) 0.12
   (d) 0.025 (e) 0.345 (f) 0.1

2. Divide each of the following numbers by 10,100 and 1000 respectively.
   (a) 1234 (b) 360.5 (c) 58.2
   (d) 48.5 (e) 0.05 (f) 1.5

3. Fill in the blanks by studying the pattern.

(a)

$$\boxed{100.1} \xrightarrow{\times 10} \boxed{10.01} \xrightarrow{\times 10} \boxed{} \xrightarrow{\times 10} \boxed{} \xrightarrow{\times 10} \boxed{}$$

(b)

$$\boxed{100.1} \xrightarrow{\div 10} \boxed{10.01} \xrightarrow{\div 10} \boxed{} \xrightarrow{\div 10} \boxed{} \xrightarrow{\div 10} \boxed{}$$

(c)

$$\begin{tikzcd}
\boxed{25} \arrow[r, bend left, "\times 10"] & \boxed{250} \arrow[l, bend left, "\div 10"] \arrow[r, bend right, "\div 10"'] & \boxed{} \arrow[r, bend left, "\times 10"] & \boxed{} \arrow[r, bend right, "\div 10"'] & \boxed{}
\end{tikzcd}$$

4. A 15 km. long road was to be constructed. If following people do the work equally, how many km long road will be constructed by each of them? (write in km)
   (a) 10 people (b) 100 people (c) 10,000 people

5. How many km are there in 22 m?

6. How many kilograms are there in 675 grams?

4.8 Multiplication and Division of Decimal Numbers:

Multiplication of decimal numbers.

0.3×6

$$0.3 \times 6 = \frac{3}{10} \times 6 = \frac{18}{10} = 1.8$$

$$\begin{array}{r} 0.3 \\ \times 6 \\ \hline 1.8 \end{array}$$

Here, Since there is one digit after decimal in 0.3, therefore put the decimal after one digit from the right side in the answer.

Again, 0.56×0.2

$$= \frac{56}{100} \times \frac{2}{10}$$

$$= \frac{112}{1000}$$

$$= 0.112$$

Here, Since there are two digits after decimal in 0.56 and there is one digit after decimal in 0.2, therefore put the decimal after three digits from the right in the answer.

Note: While multiplying 0.01×0.002, multipley 1×2 supposing that there is no decimal which results 2. Since there are total 5 digits after the decimals in 0.01 and 0.002, therefore it becomes 0.00002 after putting four zeros before 2.

Observe the following examples.

Example :1

$0.02 \times 0.03 \times 0.3$

Answer:

$$\begin{array}{r} 0.02 \\ \times 0.03 \\ \hline 0.0006 \\ \times 0.3 \\ \hline 0.00018 \end{array}$$

or, $2 \times 3 \times 3 = 18$

Since there are 5 digits after the decimal, therefore the required product = 0.00018

Example: 2

Multiply 0.8×2.35

Answer:

$$\begin{array}{r} 2.35 \\ \times 0.8 \\ \hline 1.880 \end{array} \quad \text{because} \quad \begin{array}{r} 135 \\ \times 8 \\ \hline 1880 \end{array}$$

Since the last 0 after decimal does not have any walue (why). therefore it is written 1.88 instead of 1.880.
There for $2.35 \times 0.8 = 1.88$

Division of Decimal Numbers.

On dividing: $2.4 \div 6 = \frac{24}{10} \div 6 = \frac{24}{10} \times \frac{1}{6} = 0.4$

therefore $2.4 \div 6 = 0.4$

While dividing a decimal number by a whole number, a decimal sign should keep immediately in the quotient after the division.

Example: 3

Divide $38.48 \div 8$

Answer:

$$
\begin{array}{r}
4.81 \\
8\overline{)\,38.48} \\
\underline{32} \\
64 \\
\underline{64} \\
8 \\
\underline{8} \\
\times
\end{array}
$$

At first divide whole number by the whole number. Then put the decimal in the quotient immediately after calling the number 4 which lies after decimal. Divide 64 By 8 and put the quotient afer decimal point.

Hence, $38.48 \div 8 = 4.81$

Exercise 4.8

1 Multiply:

(a) 2.3×6 (b) 8×0.6 (c) 9×1.5

(d) $\begin{array}{r} 0.07 \\ \underline{\times 12} \end{array}$ (e) $\begin{array}{r} 8.25 \\ \underline{\times 1.2} \end{array}$

(f) 8.25×1.2 (g) 5.56×1.6 (h) 0.94×6.2

2. Divide:

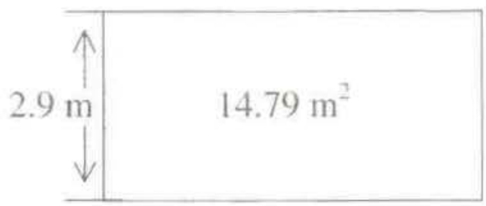
(a) $6.4 \div 8$ (b) $1.21 \div 11$ (c) $14.4 \div 6$

(d) $1.95 \div 5$ (e) $7.29 \div 9$ (f) $0.927 \div 3$

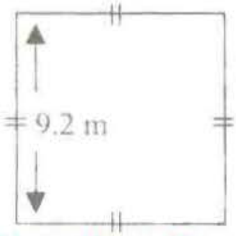
3. (a) $(1.3+0.2) \times 0.2$ (b) $0.2 \times (0.7+0.07)$ (c) $(5.5-3.2) \times 1.2$

(d) $3.5 \times (1.9-0.7)$ (e) $(1.1 \times 1.5) \times 0.7$ (f) $8.18-(12.5 \times 1.05)$

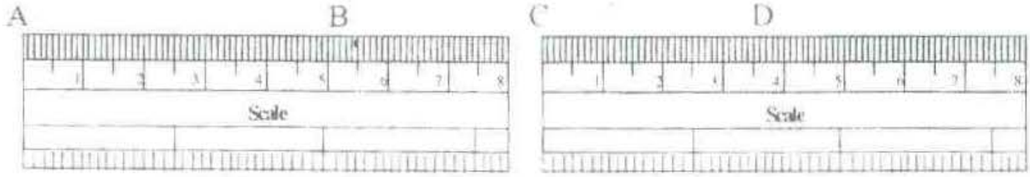
4. If the area of the rectangular is $14.79\ m^2$ and its breadth is 2.9 m, what will be the length?



5. The perimeter of a square field is 9.2 m. Find the length of its side and area.



4.9 Rounding off



Here, while taking the length of AB and CD more accurately,

AB=5.2 cm CD=3.6 cm

On expressing in a whole number, the length of AB and CD becomes approximately 5 cm and 4 cm respectively.

In this way, the process for expressing in the nearest unit is known as 'Rounding off'.

Here, 5.2 lies nearer to 5 than 6.

Hence, it becomes 5, while rounding off 5.2.

Thus, $5.2 \approx 5$, or 5.2 is approximaely 5
In this way, rounding off towards left is called 'Rounding down'.
Similarly, while rounding off 3.6,
$3.6 \approx 4.0$

In this way, rounding off towards right is called 'Round up'.

Hence, while rounding off, round down is done for the numbers 0, 1, 2, 3, or 4 and round up is done for the numbers 5, 6, 7, 8, or 9.

For example:

On rounding off 5.024 at the third place after decimal.

$5.024 \approx 5.02$

and on rounding off 3.6918 at the fourth place after decimal,

$3.6918 = 3.692$

Express $\frac{22}{7}$ in decimal.

$\frac{22}{7} = 3.143$ (upto three digits after decimal)

$= 3.14$ (upto two digits after decimal)

$= 3.1$ (upto one digit after decimal)

$= 3$ expressing to the nearest digit while dividing directly

$\frac{22}{7} = 3.1428571$

By direct division

$$
\begin{array}{r}
3.1428571 \\
7\overline{)\,22} \\
\underline{21} \\
10 \\
\underline{7} \\
30 \\
\underline{28} \\
20 \\
\underline{14} \\
60 \\
\underline{56} \\
40 \\
\underline{35} \\
50 \\
\underline{49} \\
10
\end{array}
$$

(It is non terminating. This process goes on and on.)

In this way, it is sufficient to put three or four digits after the decimal, if the division of numerator of a fraction by its denominator is non-terminating.

Example: 1

Round off : 6.02527

(i) At the fifth place after the decimal
(ii) At the fourth place affter the decimal
(iii) At the third place after the decimal.

(i) Here, the number to be rounded off is 7
This number is nearer to 10, out of 0 and 10
Thus, adding 1 on 2 after rounding off 7.

$6.02527 \approx \boxed{6.0253}$

(ii) $6.02527 \approx \boxed{6.025}$

Because the number 2 is nearer to 0 out of 0 and 10.

(iii) $6.02527 \approx \boxed{6.03}$

Because the number 5 which is to be rounded off lies exactly at the middle, out of 0 and 10. In such condition5 is rounded off towards the bigger unit 10.

Exercise 4.9

1. Round off at the first digit after the decimal.
   (a) 2.62 (b) 3.59 (c) 15.47 (d) 27.63
2. Round off at the second digit afer the decimal.
   (a) 36.27 (b) 12.592 (c) 17.418 (d) 13.025
3. Round off at third digit after the decimal.
   (a) 5.3247 (b) 6.5432 (c) 6.4153 (d) 17.343
4. Express each of the following fractions in decimal after rounding of at the third digit after the decimal.
   (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $2\frac{12}{23}$
5. Round off to the nearest cm.
   (a) 6.3 cm (b) 12.5 cm (c) 16.8 cm (d) 55.5 cm
6. Round off to the nearest rupee.
   (a) Rs. 5.35 (b) Rs. 12.50 (c) Rs. 25.73 (d) Rs. 24.26
7. Round off to the nearest km or kg.
   (a) 45.6 km (b) 147.5 km (c) 15.4 kg (d) 17.46 kg.

5. Measurement

5.1 Length, Weight, Capacity and Time

According to the metric system of measurement meter, kilogram, liter and second are taken as the measuring units of length, weigth, capacity and time respectively. The units in metric measurement used in daily life and their relation are (given) shown in the following table.

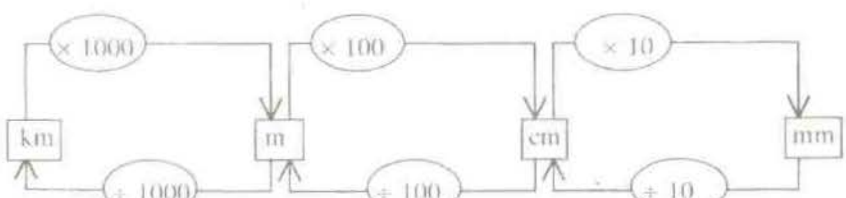
Metric measurement table

Length	10 mm 100 cm 1000 m	= 1 cm = 1 m = 1 km
Weight	1000 mg 1000 g 100 kg 1000 kg	= 1g = 1 kg = 1 quintal = 1 ton (t)
Capacity	1000 ml 1000 l	= 1 l = 1 kl
Time	60 seconds 60 minutes 24 hours 30 days 365 days	= 1 minute = 1 hour = 1 day = 1 month = 1 year

On the basis of above table, the system of metric measurement can be easily converted from one unit to another unit.

Observe the following examples for such type of conversion.

Comversion of units of length



Example: 1

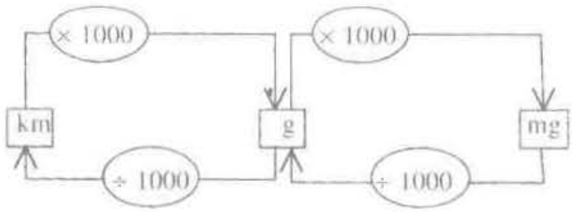
Convert 3 km 500 m into mm.

3 km $= 3\times10{,}00\times100\times10$ mm
$= 30{,}00{,}000$ mm

and 500 m $= 500\times100\times10$ mm
$= 5{,}00{,}000$ mm

Hence, 3 km 500 m $= 30{,}00{,}000$ mm $+ 5{,}00{,}000$ mm
$= 35{,}00{,}000$ mm

Conversion of Units of Weight



Example: 2

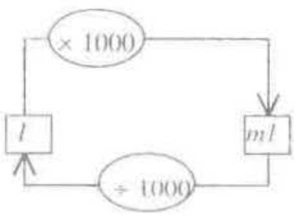
How many mg are there in 5 kg 250 gm?

Answer:

5 kg $= (5 \times 1{,}000 \times 1{,}000)$ mg $= 50{,}00{,}000$ mg
and 250 gm $= (250 \times 1{,}000)$ mg
$= 2{,}50{,}000$ mg

Hence, 5 kg 250 gm $= 50{,}00{,}000$ mg$+2{,}50{,}000$ mg$=52{,}50{,}000$ mg

Conversion of Units of Capacity



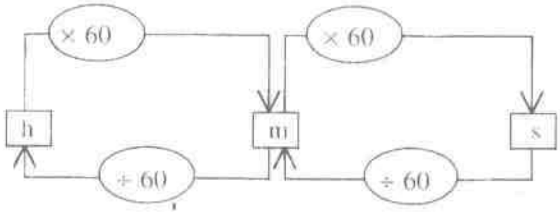
Example: 3

How many *ml* are there in 3.572 *l* ?

Answer:

$3.572\ l = 3.752 \times 1000\ ml$
$= 3{,}572\ ml$

Conversion of Units of Time



Example: 4

How many seconds are there in 3 hours. 45 minutes?

Answer:

Here, 3 hours $= 3 \times 60 \times 60$ seconds
$= 10800$ seconds
and 45 minutes $= 45 \times 60$ seconds
$= 2700$ seconds

Hence, 3 hours 45 minutes $= (10800 + 2700)$ seconds
$= 13500$ seconds.

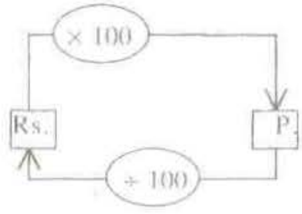
Exercise 5.1

1. Convert each of the following units as indicated in the brackets.
   (a) 1 m (mm)
   (b) 1.3 m (mm)
   (c) 12.1 m (cm)
   (d) 3000 mm (cm)
   (e) 3 kg (g)
   (f) 0.368 kg (mg)
   (g) 1350 g(kg)
   (h) 0.075 g (kg)
   (i) 21 *l* (*ml*)
   (j) 3.751 *l* (*ml*)
   (k) 2756 *ml* (*l*)
   (l) 3 hours (second)
   (m) 3 hours 16 m (seconds)
   (n) 5.15 hours (second)
   (o) 365 seconds (hours)
   (p) 720 days (months)
   (q) 1460 days (year)

2. The length and the breadth of a rectangle are 8.9 cm and 4.2 cm respectively. What is its perimeter (a) in meter? (b) in centimeter?
3. The thickness of a stove washer is 0.7 cm. What is the length of a column made by such 100 washer putting one after another?
4. If the length of a column comes to be 4 cm high, when 10 coins of Re 1 are placed one after another, what is the thickness of each coins?
5. The weight of one pocket of tea is 250 mg. What is the weight of 100 such pockets of tea in kg?
6. If the weight of 17 pieces of butter is 3.4 kg, what is the weight of one piece? Find in gram.
7. The weight of 300 apples came to be 37.5kg. when the apples were weight putting them in a bag weighing 1.5 kg. Now, find the weight of an apple.
8. The volume of a tank is calculated by using the formula, volume = length × breadth × height. How much water will a tank having 0.8 m length, 60 cm breadth and 37.5 cm height hold? ($1000cm^3 = 1$ liter).
9. If the length, breadth and height of a rectangular can are 18.5 cm, 8 cm and 6cm respectively, find the capacity of the can in mm^3.
10. How many bottles of capacity each 250 *ml* can be filled by the water in a bottle of capacity 1 litre 500 ml?
11. There is 300 *ml* of cough syrup in a bottle. For how many days does it last, while taking 10 *ml* as a single does thrice a day?
12. How far does a bus reach in 6 hours, while travelling 40 km per hour? Write in meter.
13. A bus takes 4 hours to cover 240 km. What is the speed of bus per minute?

5.2 Measurement of Currency

There are 100 paisas in 1 rupee. Hence the following table can be used to convert rupee into paisa and paisa into rupee.



Example: 1

(i) How many paisas are there in Rs. 1.05?
(ii) How many rupees are there in 250 paisas?

Answer:

(i) Rs. 1.05 = 1.05×100 P
= 105 P

(ii) 250 P

= 200 P+ 50 P
= Rs. 2 and 50 paisa
= Rs. 2.50

Example: 2

Parmesh bought 4 exercise books costing Rs. 15 each, one pen costing Rs. 18 and 1 dozen pencils costing Rs. 1.50 each. If he gave Rs. 100 to the shopkeeper, how much money would he get back?

Answer:

Expenditure of Pramesh,

While buying copies	= Rs. 15×4 = Rs. 60
While buying a pen	= Rs. 18×1 = Rs. 18
While buying pencils	= Rs. 1.50×12 = Rs. 18
Total expenditure	= Rs. 60 + Rs. 18+Rs. 18
	= Rs. 96

The money returned back to him = Rs. 100 - Rs. 96
= Rs. 4 Ans.

Exercise 5.2

1. Convert the following units of currency as indicated units in the brackets.

(a) Rs. 1.65 (P) (b) Rs. 3.06 (P) (c) Rs. $3\frac{1}{2}$ (P)

(e) 80 P (Rs.) (d) 2146 P (Rs.) (f) 24 P (Rs.)

2. Find the total cost of the items in the following conditions.

   (a) Find the cost of 4 books at the rate of Rs. 15 each?
   (b) Find the cost of 12 pencils at the rate of Rs. 2.75 each.
   (c) Find the cost of 18 copies at the rate of Rs. 6.25 each.
   (d) Find the cost of 25 apples at the rate of Rs. 2.50 each.

3. Bishal bought 2 books costing Rs. 12.75 each, 3 pencils costing Rs. 3.05 each and a rubber costing 4.25 from a stationery. If he gave Rs. 50 to the shop-keeper, how much would he get back?

4. Kiran bought 10 stamps costing Rs. 2 each, 8 stamps costing Rs. 5 each and 10 envelops costing Rs. 4.75 each. If he has Rs. 100 only, how much money is insufficient?

5. Jivan earns Rs. 20 per hour and Pramod earns Rs. 18 per hour. If they work 8 hour per day, what is their (net income) total income in a week?

6. If Pramesh earns Rs. 75.25 per day and he spends Rs. 250.75 from the collected money in a week, how much does he save in a whole week?

7. While spending Rs. 43.25 per day by making the income of Rs. 75 per day, what is his saving in a month?

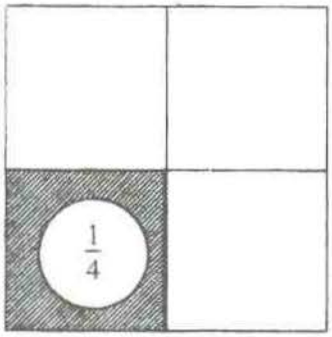
8. The income of Suman's family per month from the service is Rs. 5550 and the expenditure is as follows,

   (a) for the food Rs. 1275
   (b) for the cloth Rs. 682
   (c) for the medicine Rs. 300
   (d) for the education Rs. 875 and
   (e) for miscellaneous Rs. 400

   What is the saving of Suman's family in a whole year?

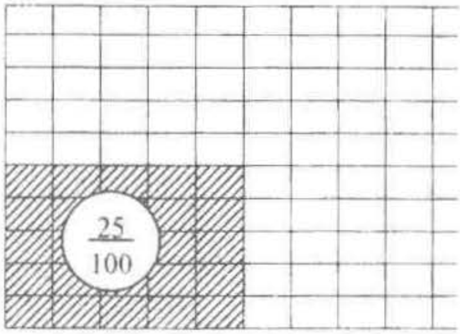
6. Percentage, Ratio and Proportion

6.1 Fraction and Percentage



In the figure, the shadowed part represents one fourth or $\frac{1}{4}$

While dividing the same figure in 100 equal parts,
The shadowed parts represents 25 parts out of 100 parts.



This is written as $\frac{25}{100}$

This means, since there are 25 parts in each 100, therefore $\frac{25}{100}$ can be said 25 percentage in another way and written as 25%. Here the shadowed parts in both figures are equal.

Thus, $\frac{1}{4} = \frac{25}{100} = 25\%$

Following two facts are found from this example:

(i) If there is 100 in the denominator, the number denoting numerator represents the percentage.
$\frac{25}{100} = 25\% = \frac{17}{100} = 17\%$

(ii) Fraction can be expressed in percentage and percentage can be expressed in fraction.
$\frac{1}{4} = \frac{25}{100} = 25\%$ and $25\% = = \frac{25}{100} = \frac{1}{4}$

Example: 1

If Bishal has secured 18 marks out of 20 marks in geography, write his secured marks in percentage.

Answer:

Here, $\frac{marks\ secured}{full\ marks} = \frac{18}{20}$

$= \frac{18 \times 5}{20 \times 5}$ (The numerator and the denominator are multiplied by 5 to make the denominator 100)

$= \frac{90}{100}$

$= 90\%$ Ans.

Exercise 6.1

1. Express each of the following percentage in the fraction having 100 in the denominator.
   (a) 20% (b) 75% (c) 84% (d) 68% (e) 100%

2. Convert each of the following percentage in the lowest term after expressing them in the fraction having 100 in the denominator.

   Example: $75\% = \frac{75}{100} = \frac{3}{4}$

   (a) 12% (b) 25% (c) 42% (d) 85% (e) 16%
   (f) 45% (g) 65% (h) 90% (i) 20% (j) 35%

3. Express each of the following fractions in percentage.

   Example: $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$

   (a) $\frac{2}{5}$ (b) $\frac{1}{20}$ (c) $\frac{12}{25}$ (d) $\frac{27}{20}$
   (e) $\frac{37}{50}$ (f) $\frac{1}{10}$ (g) $\frac{4}{5}$ (h) $\frac{1}{4}$

4. There were 50 students in a class. If 8 were absent out of them. Write (express) the number of absent students in (a) fraction and (b) percentage.

5. In an examination, Ramesh secured 35 marks out of 50 in maths. What percentage of marks did he secure?

6. Shila bought 10 oranges and she gave 3 oranges to her brother Kamal,
   (a) What percentage of the oranges is left with her?
   (b) What percentage of the oranges did Kamal get?
7. If Binaya scored 3 goals out of 5 goals scored by his football team, what percentage of the goals did Binaya score?
8. Out of 20 students coming to school, 8 came by bicycle and the rest used the school bus. What percentage of the students ride the bus?
9. If 16 students failed out of 50 students of a class, what percentage of the students passed?

6.2 Ratio and Proportion

In a football tournament, team A has scored 2 goals and team B has scored 4 goals. To express this statement in a mathematical way, it can be used any one way out of the following two ways.

(a) The goals scored by team A is half of that scored by B.

or, $\dfrac{\textit{Goals scored by team A}}{\textit{Goals scored by team B}} = \dfrac{2}{4} = \dfrac{1}{2}$

Here, the ratio of goals scored by team A and team B $= \dfrac{1}{2}$ This ratio $\dfrac{1}{2}$ is written as 1:2

(b) Team B scored two times the goals scored by A

or, $\dfrac{\textit{Goals scored by team B}}{\textit{Goals scored by team A}} = \dfrac{4}{2} = \dfrac{2}{1}$

Here, the ratio of the goal scored by team B to team A $= \dfrac{2}{1}$

This ratio $\dfrac{2}{1}$ is written as 2:1.

Facts should be known.

(i) While expressing the ratio of two quantities, the units of quantities should be same.
(ii) The ratio of quantities of different nature cannot be found. Such as 1 kg and 5m are different quantities. Ratio of such quantities cannot be calculate/determined.
(iii) Unit is not included in the ratio.

Example: 1

What is the ratio of 1cm and 1m?

Answer:

1cm and $1m$ are expressed in different units.

Thus,

Since, $1m = 100$cm therefore the ratio of

1m and 1cm = $\frac{1\ cm}{100\,\text{cm}} = \frac{1}{100}$

Example: 2

Express the following ratio in the lowest term

(a) $\frac{3}{4}:2$ (b) $1\frac{1}{4}:\ 1\frac{2}{3}$ (c) 50 P: Rs. 1.5

Answer:

(a) $\frac{3}{4}: 2 = \frac{3}{4} = \frac{3}{4} \times \frac{1}{2} = \frac{3}{8} = 3.8$

5

(b) $1\frac{1}{4}:\ 1\frac{2}{3} = \frac{4}{5} = \frac{5}{4} \times \frac{3}{5} = \frac{3}{4} = 3:4$

3

(c) 50 P: Rs. 1.5 = $\frac{50}{150} = \frac{1}{3} = 1:3$

Example: 3

The ratio of money that Shyam has to the money that Ram has is 3:8. If Ram has Rs. 56, how much money does Shyam have?

Answer:

While supposing x for the money that Ram has or (Let the money Ram has be x)

$3:8 = x:56$

or, $\frac{3}{8} = \frac{x}{56}$

or, $x = \frac{3 \times 56}{8} = 3 \times 7 = 21$

$\therefore\ x = 21$ Hence, Shyam has Rs. 21.

Proportion

Let us take four numbers 2, 3, 4 and 6.

Here, $\frac{2}{3}=\frac{4}{6}$. Since the ratio of 2 and 3 is equal to the ratio of 4 and 6, therefore 2, 3,4 and 6 are in proportion.

In the same way, 1m, 4m, 5m, 20m, 2kg, 6kg, 8kg, 16kg, etc. are the proportional quantities.

Let us observe one example:

If 3.5m, 14m, 16m and x, are proportional quantities, what is the value of x ?

Here, $\frac{3.5\ m}{14\ m}=\frac{16\ m}{x}$

Or, $\frac{3.5}{14}=\frac{16\ m}{x}$

Or, x = $\frac{16\ m\times 14}{3.5}=64\ m.$

If the quantities are in proportion and the value of one quantity is not given, that quantity can be found as in above examples:

Example: 4

If 3, 4, 6 and a are in proportion, what is the value of a?

Answer:

$\frac{3}{4}=\frac{6}{a}$

Or, a = $\frac{6\times 4}{3}=8$

Example: 5

Rama and Sita hav 12 apples and 15 apples respectively and Sunita has 24 apples. If the ratio of the apples with Rama and Sita and that of Sunita and Sujata is equal, how many apples are there with Sujata?

Answer:

Suppose, Sujata has x apples.

Here,

$$\frac{\text{Number of apples that Rama has}}{\text{Number of apples that Sita has}} = \frac{\text{Number of apples that Sunita has}}{\text{Number of apples that Sajata has}}$$

or, $\frac{12}{15} = \frac{24}{x}$

or, $x = \frac{24 \times 15}{12} = 30$

Hence, Sujata has 30 apples.

Exercise 6.2

1. Express each of the following ratios in the lowest term

(a) 20:30	(b) 115:60	(c) 25:75	(d) 49:245
(e) 350:400	(f) $1\frac{1}{2}:3$	(g) $2\frac{2}{4}:4\frac{1}{8}$	(h) 25 P: Re 1
(i) 15cm:1m	(j) 20cm:5m	(k) 250gm:1kg	(l) 500ml:5l

2. If the length of a rectangle is 4 cm and its breadth is 3cm,
   a) What is the ratio of length to breadth?
   b) What is the ratio of breadth to length?

3. If the length of a rectangle is 4cm and its breadth is 3cm and the length of another rectangle is 6cm and its breadth is 2cm,
   a) Find the ratio of length of the first rectangle to that of the second rectangle.
   b) Find the ratio of breadth of the first rectangle to that of the second rectangle.
   c) What is the ratio of the area of first rectangle to that of second rectangle?

4. If each of the following ratios are equal, which number is to be kept in the space?

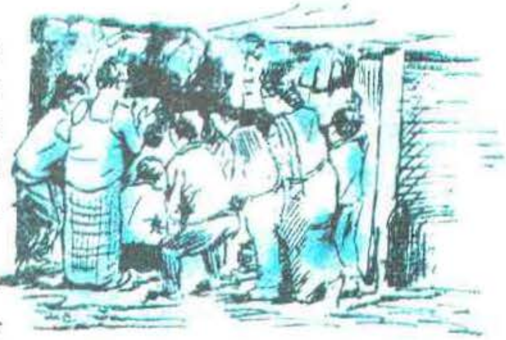
   $\frac{4}{6} = \frac{8}{\dots} = \frac{\dots}{36} = \frac{\dots}{60}$

5. Out of 35820 population of a village, there are 18900 female,
   a) Find the ratio of number of the female to the number of male.
   b) Find the ratio of number of the male to the number
   c) What is the ratio of the female population to the total population?
6. The ratio of length to breadth of a room is 5:4. If its length is 15m, what is its breadth?
7. If the ratio of length to breadth of a room is 3:2 and its length is 7m, what is its

   (a) breadth (b) perimeter and (c) the area?
8. If 5, 8, x and 16 are in proportion, find the value of x.
9. If x:y=1: 2 and a:b=x:y. If the value of a is 6, find the value of b?
10. Ram, Hari, Shyam and Ramesh have some oranges. Ram, Hari and Shyam have 10, 15 and 30 oranges respectively. If the ratio of oranges that Ram has to the oranges that Hari has is equal to the ratio to the oranges that Shyam has to the oranges that Ramesh has, find the number of oranges that shyam has?

7. Profit and Loss

Introduction



Ram is a merchant. He deals in readymade garments. He conducts his livelihood by this trade. While trading sometimes he earns much and sometimes he earns little. Sometimes he is in loss also.

The words "earning" and "losing" used here means profit and loss. If Ram sold a shirt for Rs. 200 by buying it for Rs. 150, what is his profit or loss? Consider about it. In fact, it has been profit for him because the cost price is less than the selling price. This profit is Rs. 50. Like wise if same shirt has to sold for Rs. 120, what would have been to his profit or loss? Here he bears loss because the selling price is less than the cost price of (C.P).

The cost that paid while buying any articles is called cost price or C.P. and the cost that obtained while selling is called selling price or S.P. If the selling price of any article has been mosre than its cost price, there is profit.

If the selling price of any artıcle has been more that its cost price, the profi can be calculated by using the following formula.

Profit = S.P. - C.P.

Example: 1

How much is the profit while selling a dozen of exercise books costing Rs. 50 are sold at the rate of Rs. 72 per 1 dozen?

Answer:

Here, cost price of 1 dozen of copy (C.P.) = Rs. 50
And selling price of 1 dozen of copy (S.P.) = Rs. 6×12 = Rs. 72

Since the selling price is more than cost price, it comes to be profit.

Thus, Profit = S.P. - C.P.
= Rs. 72 - Rs. 50
= Rs. 22

Similarly, if the selling price is less than cost price, it comes to be loss.

Such loss is calculated by the following formula.

Loss = Cost price (C.P.) - Selling Price (S.P.)

Example: 2

Seema is a grocer marchent, if she sells 2 pockets of biscuits at the rate of Rs. 5. 25 each after buying them at the rate of Rs. 6.25 each, what will be her profit or loss?

Answer:

Here, cost price of 2 pockets of biscuits $= 2 \times$ Rs.6.25=Rs. 13
Selling price of 2 pockets of biscuits $= 2 \times$ Rs. 5.25 = Rs. 10.50

Since the S.P. is less than C.P. $\therefore$ Loss = C.P. – S.P.
$\therefore$ Loss = Rs. 13 - Rs. 10.50 = Rs. 2.50

Exercise: 7.1

1. Find the profit in each of the following conditions.

   a) C.P. = Rs. 50, S.P. = Rs. 75
   a) C.P. = Rs. 2504, S.P. = Rs. 2910
   a) C.P. = Rs. 365, S.P. = Rs. 387
   a) C.P. = Rs. 3333, S.P. = Rs. 3460

2. Find the profit of loss in each of the following conditions.

   a) S.P. = Rs. 350 C.P. = Rs. 395
   b) C.P. = Rs. 3514 S.P. = Rs. 3720
   c) S.P. = Rs. 7590 C.P. = Rs. 8350
   d) S.P.= Rs. 980 C.P. = Rs. 795

3. Praveen has sold exercise book for Rs. 20 bought for Rs. 25. What did he make profit or loss? Find it.

4 A marchent sold 50 kg Rice to Jamuna for Rs. 980 bought for Rs. 585. How much profit did he make from Jamuna?

5. While selling 4kg of apples at the rate of Rs. 40 per kg bought at the rate of Rs. 35 per kg, how much will be the profit?

6. Ram bought 2 pens for Rs. 50 and then sold one for Rs. 22.50 and another for Rs. 21. Find his profit or loss.

7. While selling 1 dozen of oranges at the rate of Rs. 1.60 each bought for Rs. 18 a dozen, what will be profit or loss?

8. If Sujan bought a volley-ball for Rs. 750 and football for Rs. 825 and then he sold the volley-ball for Rs. 650 and the football for Rs. 985, how much would be his profit or loss?

7.2 Simple Problems Including Profit and Loss

Study the following examples.

Example: 1

If fruit seller wants to make the profit of Rs. 20 while selling 4 kg oranges costing Rs. 15 per kg, in how many rupees will be have to sell the oranges?

Answer:

Here, Total C.P. = Rs. 15×4 = Rs. 60

Money that he wanted to make profit = Rs. 20

S.P. should be greater than C.P. to make profit and this S.P. comes to be greater than C.P. by the amount that to be taken as profit.

Total required Sp = Rs. 60+ Rs. 20
= Rs. 80

Hence, in the condition of profit, the formula becomes as follows

S.P. = C.P+Profit

Let us consider the another example again

Example: 2

If a shopkeeper had to sell an article cost Rs. 450 by bearing the lost of Rs. 125, what is the selling price?

Answer:

Here, C.P. = Rs. 450
Loss = Rs. 125

In the condition of loss, cost price becomes greater than selling price or the selling price is less than cost price by the lost amount.

S.P. = Rs. 450 - Rs. 125
= Rs. 325

While considering in this way the following formula gets formed

S.P. = C.P. - Loss

Example: 3

If a man wants to make the profit of Rs. 5 by selling a dozen of bananas after buying.them for Rs. 20, what must be the selling price?

Answer:

Here, C.P. = Rs. 20 Profit = Rs. 5
∴ According to the formula, S.P. = C.P. + Profit
= Rs. 20+ Rs. 5
= Rs. 25

Example: 4

A marchant buys 4 meters of cloth at the rote of Rs. 35 per meters and wants to make a total profit of Rs. 60. At price should be sell the 4 meters of cloth?

Answer:

Here, total C.P = Rs. 35×4 = Rs. 140
Profit = Rs. 60

According to the formula, S.P. = C.P. + Profit
= Rs. 140 + Rs. 60
= Rs. 200

Example: 5

Rajan bought a dozen of pencil at the rate of Rs. 3.50 each, while selling those pencils to his friends, he bore the loss of Rs. 3. At what total price did he sell all the pencils? Find it.

Answer:

Here, total C.P. $= \text{Rs. } 3.50 \times 12$
$= \text{Rs. } 42$
Loss $= \text{Rs. } 3.00$
According to the formula, S.P. = C.P. - Loss
= Rs. 42-Rs. 3
= Rs. 39

Example: 6

If Hari bought 50 chocolates for Rs. 30 and made the profit of Rs. 0.50 in each, what is the total S.P.?

Answer:

Here, C.P. = Rs. 50
Total Profit $= \text{Rs. } 50 \times 0.50$
= Rs. 25

According to the formula, S.P. = C.P. + profit
= Rs. 50+ Rs. 25
= Rs. 75

Exercise 7.2

1. Find S.P.
   a) C.P. = Rs. 35, Profit = Rs. 5
   b) C.P. = Rs. 63, Profit = Rs. 10
   c) C.P. = Rs. 800, Loss = Rs. 50
   d) C.P. = Rs. 450, Loss = Rs. 75
2. What is the selling price of a watch costing Rs. 250, when it is sold by gaining Rs. 30?
3. What will be the selling price of an article costing Rs. 310, when it is sold at the loss of Rs. 125?
4. What will be the total selling price of one quintal rice costing Rs. 18 per kilogram, when it is sold to gain Rs. 150?
5. A merchant about 50kg. of onions at the rate of Rs. 12 per kg.. During the time price of the onions per kg. came to redı ce by rupee. Then find his total loss.
6. What is the total selling price of 4 bags costing Rs. 160 each, when they are sold by gaining Rs. 20?
7. What will be selling price of a radio costing Rs. 1850 when a person sells it at the loss of Rs. 175?

8. Unitary Method

8.1 Problem if Finding Unit Cost and Total Cost

Four pens are shown in the figure. If a person wants to buy all these pens, how much cost is to be paid? If the cost of one pen is known, total cost that is to be paid by him can be calculated. If the cost of one is Rs. 10, how much money is to be paid to buy all these four pens?

Total cost = Number of articles × cost of one article

Hence, the total cost of 4 pens $= 4 \times$ Rs. 10
$=$ Rs. 40

Example: 1

If Ram wants to buy 20 note copies costing Rs. 15 each from a stationery. How much cast is to be paid by him?

Answer:

Here, cost of one note copy = Rs. 15
Number of note copies = 20

Thus,
Cost of 20 copies $= 20 \times$ Rs. 15
= Rs. 300
Total cost to be paid = Rs. 300

Example: 2

If the cost of one pencil is Rs. 3.50, how much money is to be paid to buy 2 dozen of pencils?

Answer:

Here, The cost of one pencil = Rs. 3.50

Number of pencil to be bought = 2 dozen

= 2 12

= 24

Cost of 2 dozen of pencil = 24 Rs. 3.50

= Rs 84

Hence, the cost to be paid to buy 2 dozen of pencils is Rs. 84

From the above examples, it is found that, if the cost of one article is known, the cost of such many article can be found.

Again, let us consider that if the cost of many articles are known, how to find out the cost of one article under this condition.

If the cost of 2 books is Rs. 200, how much will be the cost of one book? Think about it. Similarly, if the cost of 8 apples is Rs. 24, how much will be the cost of one apple? Think about it.

The following rule can be applied to find the cost of one article under this condition.

The cost of one article = $\frac{Total\ \ cost\ \ of\ \ articles}{Number\ \ of\ \ articles}$

In the above example, the cost of one book = Rs. $\frac{200}{2}$ = Rs. 100

And the cost of an apple = Rs $\frac{24}{8}$ = Rs. 3

Example: 3

If the cost of 20 balls is Rs. 120, what will the cost of one ball be ?

Answer:

Here, number of balls = 20

Total cost = Rs. 120

The cost of one ball = $\frac{Rs.\ 120}{20}$ = Rs 6.

Example: 4

If the cost of 15 sacks of cement is Rs. 5250, what is the cost of one sack of cement ?

Answer:

Here, total number of cement sacks=15

Total cost = Rs. 5250

$\therefore$ Cost of 1 sack of cement $= \text{Rs. } \frac{5250}{15}$

$= \text{Rs. } 350$

Exercise 8.1

1. Find the total cost under the following conditions.

Unit cost	Number of articles
a) Rs. 25	15
b) Rs 45.50	22
c) Rs. 350	65
d) Rs. 250.50	57

2. Find the unit cost under the following conditions.

Number of articles	Total cost
a) 12	Rs 240
b) 32	Rs. 576
c) 70	Rs. 2170
d) 232	Rs 5800

3. It the cost of one packet of biscuits is Rs. 7.50, what is the cost of 8 packets of biscuits?
4. If one dozen of exercise book is to be bought at the rate of 12 each, what is the total cost to be paid?
5. It the cost of 1kg of rice is Rs. 19, what is the cost of 50kg of rice?
6. If a man paid Rs. 180 while buying 10 dozen of bananas, what is the cost to be paid for only one dozen?

7. If the cost of two dozen of pencils is Rs. 120, what is the cost of one pencil?
8. Shyam has 25 Chinese pens, while selling them at the rate of Rs.45 each, how much total money does he get?
9. While buying a packet of 100 chocolates, it costs Rs. 25 what is the cost of each chocolate?
10. If the cost of a packet containing 12 dozen biscuits is Rs. 1152, what is the cost of one biscuit?

8.2 Problem Based on Direct Variation

Let us observe the following examples

Unit cost	Cost of two items	Cost of 4 items	Cost of 10 items
a) Rs. 5	Rs. 10	Rs. 20	Rs. 50
b) Rs. 20	Rs. 40	Rs. 80	Rs. 200
c) Rs. 50	Rs. 100	Rs. 200	Rs. 500

It is known from this table that the cost increases as the number of items increases. Likewise it is known that the cost decreases as the number of items decreases.

Again, let us observe other examples:

Cost of 2 Items	Unit Cost	Cost 5 Items	Cost of 10 Items
a. Rs. 10	Rs. $\frac{10}{2}$ = Rs. 5	Rs. 5 5 = Rs. 25	Rs. 10 5 = Rs. 50
b. Rs. 50	Rs. $\frac{50}{2}$ = Rs. 40	Rs. 5 25 = Rs. 125	Rs.10 25 = Rs. 250
c. Rs. 80	Rs. $\frac{80}{2}$ = Rs.40	Rs. 5 40 = Rs. 200	Rs. 10 40 = Rs. 400

In this table, the cost of one item is found from the cost of 2 items. After that the cost of 5 items and 10 items are determined respectively. Hence if the cost of some items is known, cost of one item has to befound out first to find out the cost of more items then the given items.
After that, the cost of required number of items can be found out.

Example: 1

If the cost of 10kg of rice Rs. 175, what is the cost of 6kg of rice?

Answer:

Here, the cost of 10kg of rice = Rs. 175

the cost of 1kg of rice = Rs. $\frac{175}{10}$

= Rs. 17.50

Hence the cost of 6kg of rice =6 Rs. 17.50

= Rs. 105.00

Thus, the cost of 6kg of rice is Rs. 105

Example: 2

If a fruit seller sells 1 dozen bananas for Rs. 18, how much money is to be paid to buy 50 bananas?

Answer:

Here, the cost of 1 dozen bananas = Rs 18

Or, the cost of 12 bananas = Rs. 18

Or, the cost of 1 bananas = Rs $\frac{18}{12}$ = Rs. 1.50

Or, cost of 50 bananas = Rs. 1.50 50

= Rs. 75

Hence, the total cost of 50 bananas is Rs. 75

Example: 3

If the cost of one packet of Rahar pulse containing 5kg is Rs. 160, how much money is needed to buy a packet containing 25 kg at the same rate?

Answer:

Here, the cost of 5kg pulse = Rs. 160

the cost of 1kg pulse = Rs.$\frac{160}{5}$ = Rs. 32

the cost of 25kg pulse = 25 Rs. 32 = Rs. 800.

Hence, to buy a packet containing 25kg pulse. it needs Rs. 800.

Exercise 8.2

1. Complete the following table

	Cost of 2 items	Cost of 6 items	Cost of 10 items
a.	(i) Rs 8	(ii)	(iii) ....
b.	(iv)	(v) Rs. 30	(vi)..............
c.	(vii).........	(viii)	(ix) Rs. 100

2. If the cost of 5 bags is Rs. 400, how much is the cost of 3 bag ?
3. If the cost of 15 pens is Rs. 450, how much is the cost of 7 pens ?
4. If the cost of 22 exercise books is Rs. 176, find the cost of 15 exercise books?
5. It needs Rs. 480 to buy 80 apples. How much money is needed to buy 45 apples?
6. If the cost of 5 pairs of shoes is Rs. 2225, how much money is needed to buy such 3 pairs of shoes only?
7. It the cost of 25kg rice is Rs 425, how much is the cost of 80kg of rice?
8. If the cost of 35 books is Rs. 7000, how much is the cost of such 12 books?
9. If the cost of 1 quintal of pulse is Rs. 3100, find the cost of 175kg of pulse? (1 quintal = 100 kg)
10. It the cost of 75 bags of cement is Rs. 24375, find the cost of 80 bags of cement.

9. Simple Interest

Suppose you deposit Rs. 8000 in a saving account of a bank and it returns you Rs. 8400 adding Rs. 400 after 1 year.

Here,

(a) The money deposited in the bank is called principal (P). Here Rs. 8000 is principal.

(b) The money that added by the bank is called interest (I). Here Rs. 400 is the interest.

(c) Every bank provides the interest with a certain rate. Here on the sum Rs. 8000 deposited in the saving account of the bank, it provided Rs. 400 as interest.

Thus, the rate of interest (R) = $\frac{Rs\ 400}{Rs\ 8000} \times 100\% = 5\%$

The time provided up to which the money is deposited is called time (T). Here, the time is 1 year.

Observe another example

Ajay's mother had borrowed Rs. 50000 from the Banijya Bank at the rate of 12% to start a grocery shop. How much money had to be paid by her to the bank as interest after three years?

Here, at the rate of 12% per year

Interest on Rs. 100 in 1 year = Rs 12

Interest on Rs. 1 in 1 year = Rs. $\frac{12}{100}$

Interest on Rs. 50,000 in 1 year = Rs $\frac{12}{100} \times 50{,}000$

Interest on Rs. 50,000 in 3 year = Rs. $\frac{12}{100} \times 50{,}000 \times 3$

= Rs. $6{,}000 \times 3$

= Rs. 18,000

Hence, Ajay's mother had to pay Rs. 18,000 as interest after 3 years.

Example: 1

How much interest will be obtained on Rs. 250 at the rate of 5% per year for 4 years ?

Answer:

Here, 5% per year means

The interest on Rs. 100 in year $= \text{Rs. } 5$

The interest on Rs. 1 in 1 year $= \text{Rs. } \frac{5}{100}$

the interest on Rs.1 in 4 year $= \text{Rs.} \frac{5 \quad 4}{100}$

The interest on Rs. 250 in 4 year $= \text{Rs. } \frac{5 \quad 4 \quad 250}{100}$

$= \text{Rs } \left(\frac{5 \quad 4 \quad 250}{100} \right)$

$= \text{Rs. } \frac{250}{50}$

$= \text{Rs. } 50$

Hence the interest becomes Rs. 50

Example: 2

Find the interest on Rs. 500 at the rate of 10% per year for 9 months.

Answer:

Here, 10% per year means

The interest on Rs. 100 in 1 year $= \text{Rs. } 10$

The interest on Rs. 1 in 1 year $= \text{Rs. } \frac{10}{100}$

The interest on Rs. 1 in 12 months $= \text{Rs } \frac{10}{100}$

The interest on Rs 1 in 1 months $= \text{Rs. } \frac{10}{100 \quad 12}$

The interest on Rs. 500 in 1 months $= \text{Rs. } \frac{10 \quad 500}{100 \quad 12}$

The interest on Rs. 500 for in 9 months $= \text{Rs. } \frac{10 \quad 9 \quad 500}{100 \quad 12}$

$= \text{Rs. } \frac{90 \quad 5}{100 \quad 12}$

$= \text{Rs. } \frac{90 \quad 5}{12}$

$= \text{Rs } 37.50$

Hence, the interest on Rs. 500 for 9 months is Rs. 37.50

Exercise 9

Find the interest by unitary method.

	Principal	Time	Rate of interest
1.	Rs. 300	5 years	5% per year
2.	Rs. 500	3 years	4% per year
3.	Rs. 800	2 years	10% per year
4.	Rs. 900	5 years	10% per year
5.	Rs. 250	8 months	2% per year

Find the simple interest by unitary method

	Principal	Time	Rate of interest
6.	Rs. 350	3 years	7% per year
7.	Rs. 500	2 years	5% per year
8.	Rs. 800	9 months	12% per year

9. Find the interest on Rs. 5000 at the eate of 10% per year for 8 months.
10. If Krishna deposited Rs. P at the rate of R% per year for T years in a bank, how much is the interest (I) that he will get?

10. Statistics

10.1 Collection of Data

Among the 40 students of Class 6, a teacher wanted to know that which subject is more interesting. For this, the teacher told each of the students to name their favourite (interesting) subject. The teacher kept on writing the favourite subjects of the students on the blackboard. The information obtained by the teacher was like this.

Maths, Maths, Science, English, Maths, Science, Science, English, Nepali, English, Maths, English, Science, Nepali, Maths, Nepali, English, Maths, Science, science, Nepali, Maths, Science, English, Nepali, Nepali, Maths, English, Science, Maths, Nepali, Nepali, Maths, Science, English, Nepali, English, Science.

Now the teacher asks the following questions.
(a) Which is the most favourite subject?
(b) How many of them liked Nepali?
(c) Which subject is the least liked subject?
(d) What is the total number of the students?

Ram said that it is quite difficult to get answer to these questions from the above information. If so, how can the answer be known easily? The teacher represented above information by making a table as shown below. He wrote the name of favorite subjects in the column and he kept on putting the tally bar for each the respective subject by reading above information. The table was like this.

Frequency table

Subject	Tally bar	Frequency
Maths	~~||||~~ ~~||||~~ |	11
Science	~~||||~~ ~~||||~~	10
English	~~||||~~ ||||	9
Nepali	~~||||~~ ~~||||~~	10
Total		40

Now, the answer of above questions can be given easily. Here, the collected information is called data. The data collected by the teacher in the beginning is called 'Raw data'. Such data gives the limited information. It becomes easy to read and to get information, while representing this data in a tabular form by using tally bars and frequencies. How is the tally bar written here? Discuss it. This table is called the frequency table.

Exercise 10.1

1. The height of 27 students of a class is given in cm scale. Represent this raw data in frequency table by using tally bars.

120	122	121	120	123	120	122	122
123	121	121	120	120	122	121	123
122	123	123	122	121	120	120	120
121	123	122					

2. Besides those who come on foot, following means are used by the students of a school.

   bicycle, bus, bus, bus, taxi, bus, taxi, bicycle, bicycle, bus, bus, taxi, motorcycle, bus, motorcycle, bus, bicycle, bus, taxi, bus, motorcycle, bicycle, bus, motorcycle, bus, bicycle, bus, bicycle, bus.
   Show the above data in a frequency table by using tally bars.

3. Nepal family planing organization took an interview with 30 couples to know the number of children that they want, from which the following date is obtained.
   1, 2, 3, 1, 2, 2, 1, 3, 2, 1, 2, 2, 2, 3, 1
   2, 3, 1, 2, 3, 2, 2, 1, 2, 1, 2, 3, 3, 2, 1

   Make a frequency table by using tally bars and answer the following questions
   (i) How many couples are there who do not want any children?
   (ii) How many couples want 1 baby?
   (iii)How many couples want two children?

(iv) How many couples want three children?

(v) Are there those couples who want more than 3 children?

4. A milk distributing project distributes milk to the families of a particular village in the following ways

500 *ml*	500 *ml*	1000 *ml*	500 *ml*	2000 *ml*
1000 *ml*	1500 *ml*	1500 *ml*	1000 *ml*	500 *ml*
500 *ml*	500 *ml*	500 *ml*	1000 *ml*	1000 *ml*
500 *ml*	500 *ml*	700 *ml*	1000 *ml*	500 *ml*
1000 *ml*	500 *ml*	1000 *ml*	1500 *ml*	500 *ml*

Answer the following questions by making a frequency table using tally bars.

(i) What is the number of families using 500 ml of milk?

(ii) What is the number of families using more than 500 ml of milk?

(iii) What is the number of families using maximum milk i.e. 2000 ml of milk?

(iv) How much ml of milk is used by the maximum number of families?

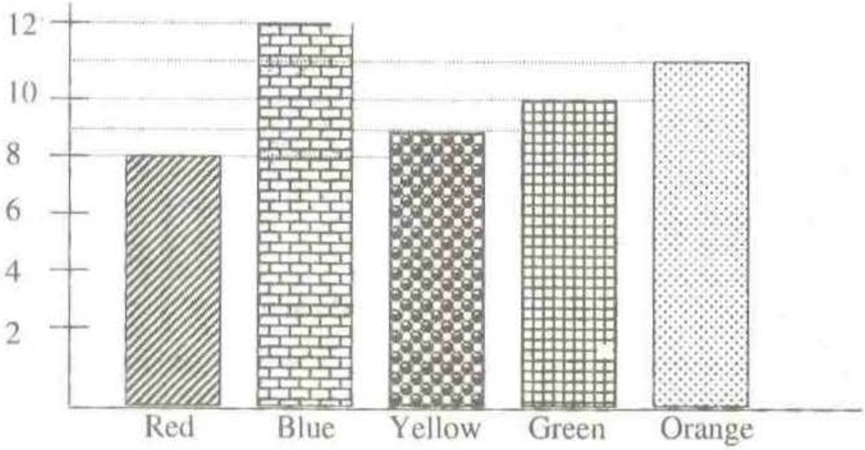
10.2 Bar Graph

Obtained notice and data are represented by making a graph so that the maximum information can be understood at a first sight. Among such graphs the bar graph is widely used. Have a look at the following examples.

"Which colour is your most favorite colour?", while asking this question to 50 students of class 6, the following data is obtained.

Favourite colour	Red	Blue	Yellow	Green	Orange
Number of students	8	12	10	9	11

When this information was represented in a bar graph by plotting the favourite colour of the students in the horizontal lines and the number of the students in the vertical line taking 1 student = 1 square, the following bar graph was formed.



Now, on the basis of colours in the above graph, answer the following questions

a) which one is the most favourite colour? Blue
b) Which one is the least favourite colour? Red
c) How many students liked orange colour? 11
d) What is the percentage of students who liked yellow colour?20%
e) How many parts of the total students liked red colour? (Express in a fraction) $\frac{8}{50} = \frac{4}{25}$
f) What is represented by the height of the bar? Number of students.

Now, discuss about the advantages of expressing the data in bar graph with your teacher.

Exercise 10.2

1. The following data is obtained while measuring (recording) the temperature of main 5 cities of Nepal on 7^{th} Chaitra.

Dhankuta	Kathmandu	Pokhara	Nepalgunj	Dipayal
32 C	28 C	30 C	33 C	35 C

Now draw a bar graph on a sheet of graph paper plotting the place in the horizontal line and the temperature in the vertical line.

2. 50 students are told to write the name of their favourite fruits. The answer obtained from them is shown in the table.

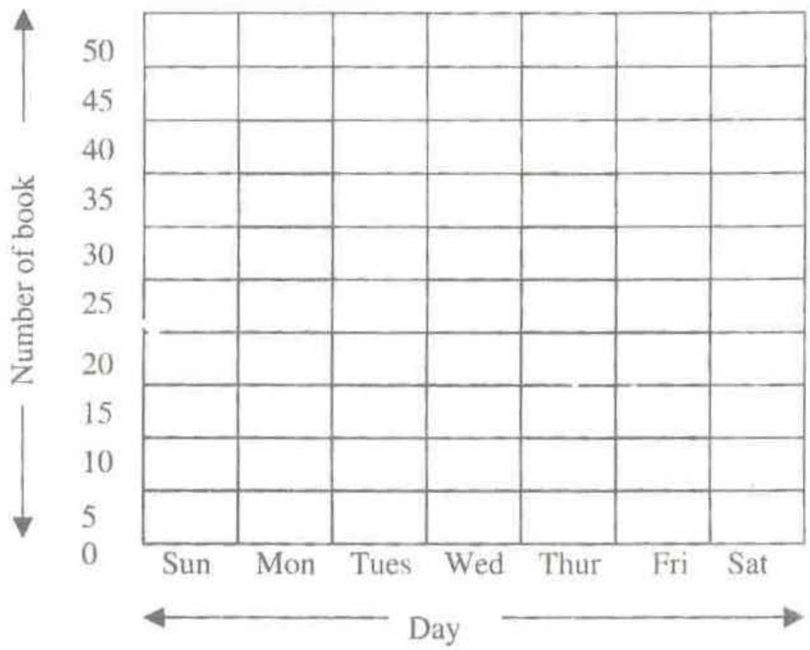
Favourite	Orange	Apple	Banana	Grape	Anar
Number of students	12	9	8	11	10

Make a bar graph from this data.

3. The description of animals in an animal farm is given below. Draw a bar graph in a sheet of graph paper taking 1 unit in the vertical line as 5 animals.

Animals	Sheep	Goat	Cow	Dog	Pig
Number	35	50	25	10	15

4. The sales of books in a week of a shop is shown in the following bar graph. Have a look at the graph and answer the following questions.



(i) On which day, the maximum number of books are sold?

(ii) On which day, not even a single book is sold?

(iii) Out of Sunday and Friday, on which day more number of book are sold?

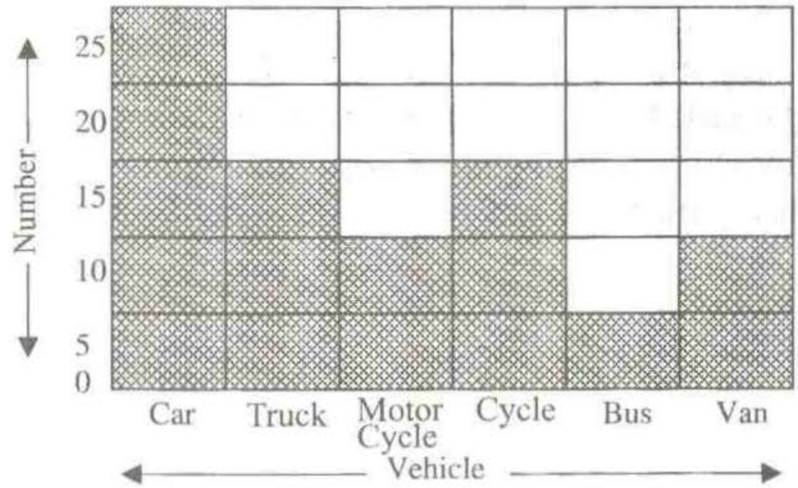
(iv) Out of selling days, on which day there is the least sale?

(v) How many books have been sold in total?

(vi) What is the percentage sales on Monday with resect to the total sales?

(vii) By what percentage is the sales on Tuesday less than that on Monday?

5. Following number of vehicles went towards Naubise from the police check post at Thankot within 2 hours. Read the bar graph and answer the question given below.



(i) Which vehicles had gone in maximum number and which had gone in minimum number from Thankot towards Naubise ?

(ii) Which vehicles had gone in equal number ?

(iii) How many vehicles had gone to Naubise at that time ?

(iv) If $\frac{3}{5}$ of the total cars were red, how many cars were red ?

(v) If $\frac{2}{5}$ of the total motorcycles were double loaded, how many motorcycles were double loaded ?

(vi) If $\frac{2}{5}$ of the bicycle riders were girls, how many girls were there ?

11. Algebraic Expression

11.1 Description of variables and constants

Letters of symbols can be used to represent the number in algebra Read the following statements and write the value of symbol or letter.

a) $\square$ represents the counting numbers more than 5 and less than 10. Here, the value of $\square$ may be any one out of 6, 7, 8, 9.

b) x represents the prime numbers less than 10. Here, the value of x may be any one out of 2, 3, 5 and 7.

c) a represents the counting number more than 5 but less than 7. Here the value of a is 6 only.

- In this way if a symbol or letter has a fixed value, that letter or symbol is called constant. 'a' is a constant in the above exampl-.
- If a letter or symbol has more than one value, that letter or symbol is called a variable. $\square$ and x are variables in the above examples.

Exercise 11.1

1. In each of the following conditions x, y, z, a, b, c, etc. are variables or constants. Separate them.
   (i) x represents the names of districts of Bagmati zone.
   (ii) y represents the students of a school.
   (iii) z represents the whole numbers more than 10 but less than 12.
   (iv) The value of a is 5.
   (v) b represents 2 or 3.
   (vi) c represents the sum of 2 and 3.

2. Write all possible values of x and y in the following conditions.
   (i) x represents the counting numbers from 5 to 8.
   (ii) The counting number between 3 and 5 is x.
   (iii) y represents all the even numbers greater than 20 but less than 30.
   (iv) y represents the difference of 10 and 6.

3. In question no. 2, x and y are variables or constants, separate them.

4. If x represents the counting numbers less than 10 but more than 8 and y represents only 10, then

   (i) Are x and y variables or constants?
   (ii) Which one is greater in y and x?
   (iii) What is the difference of y and x?
   (iv) What is the sum of y and x?

5. (a) If 3 times of x is 21, is x a variable or a constant?
   (b) If it becomes 6 while adding 2 to x, is x a variable or a constant?

11.2 Algebraic Expressions

Read the following statements

(a) Bishal had x marbles, 2 marbles were lost, This statement is written in mathematical sentence as x-2.

(b) Suresh had Rs. y. If he found Rs. 5, his total money becomes y+5.

(c) Binaya ate y biscuits, Binaya's brother ate twice the number of biscuits than that eaten by Binaya. His brother ate altogether $2y$ biscuits.

(d) If z chocolates that Rupesh has are equally divided between Suresh and Rupesh, each of them get $\frac{z}{2}$ chocolates.

(e) Out of x students in the Suryodaya Primary School, y students are absent. This means x-y students are present in Suryodaya Primary School.

All these above statements written in mathematical symbols are algebraic expressions. Algebraic expressions may be monomial, binomial or multinomial. $2x$, $3x$,133 $\frac{z}{4}$, etc. are monomial expressions. $x+y$, $2+x$, $3x+2y$, etc. are binomial expressions. $x+y+z$, $2x+3y+4z-3yz$, etc. are multinomial expressions.

Exercise 11.2

1. Use the given operation between each of the following two terms and make algebraic expressions.

Term	Term	Operation
x	2	+
y	2	-
a	b	×
3	z	÷

2. Express each of the following problems in terms of algebraic expressions.
   (i) Shyam had 5 apples, he ate x apples, Now how many apples are left with Ram?
   (ii) Bimal had 5 exercise books, he added other y exercise books Now, how many exercise books are there with him?
   (iii) x km journey is to be completed, If 15 km is completed how long is left.
   (iv) How much does it become, when 5 is added to 4 times of y?
   (v) How much does is become, when 3 times of z is divided by y?
   (vi) The age of Ram is x year. Ram's father's age is two times the age of Ram. What is the age of Ram's father?
   (vii) There were x plants in the garden. y plants are diseased. Now how many plants are healthy?
   (viii) How much does it become when z is added to the number 6 times bigger than y?
   (ix) How much does it become when p is added to the quotient obtained by dividing m by n ?

3. Match the following

(i) 5 times the sum of x and y	a) $\frac{x}{y} + z$
(ii) 2 times the difference of x and y	b) $2x-3y$
(iii) The difference of z in the product of x and y	c) $xy - (x + y)$

(iv) The difference obtained when the sum of x and y is subtracted from the product of x and y — d) $3x+4y$

e) $xy - z$

f) $5(x+y)$

(vi) obtained by the division of x and y — g) $2(x - y)$

(vii) The difference obtained by extracting 3 times of y from 2 times of x — h) $\frac{5x+7y}{2}$

4. How much money is to be paid, when x pens costing Rs. 8 each and y exercise books costing Rs. 12 each are brought ? Write in the algebraic expressions.

5. Make statements from each of the following algebraic expressions
   (i) $2xy - y$ (ii) $xy + 15$

11.3 Value of the Algebraic Expressions

In the expression 2x+3, x is a variable. Value of x may be any. The value of the expression $2x+3$, is different with respect to the values of x, for Example.

If, $x = 1$, $2x+3 = 2 \ 1+3 = 2 + 3 = 5$

If, $x = 2$, $2x+3 = 2 \ 2+3 = 4 = 3 = 7$

If, $x = 3$, $2x+3 = 2 \ 3+3 = 6 + 3 = 9$

Here 5, 7, 9 are called the numerical values of the expression $2x+3$

The value (number) obtained by putting the given value in the place of a variable in any expression is the numerical value of the expression.

Exercise 11.3

1. If $x = 2$, what is the value of $4x$?
2. If $z = 3$, what is the value of $2z+5$?
3. If $p = 9$, what is the value of p+3?
4. If $a = 2$, and $b = 3$, what is the value of $2a+3b$?
5. If $y+4 = 5$, what is the value of $5(y+4)$? What is the value of y ?
6. If $p = 2$, what is the value of $3p^3$?

7. If $x = 5$ and $y = 6$ what is the value of x^2+y^2 ?

8. If $m = 4$ and $n = 3$, what is the value of $3m^2 - 4n^2$?

9. If $l = 3$ and $b = 2$, what is the value of $2(l+b)$?

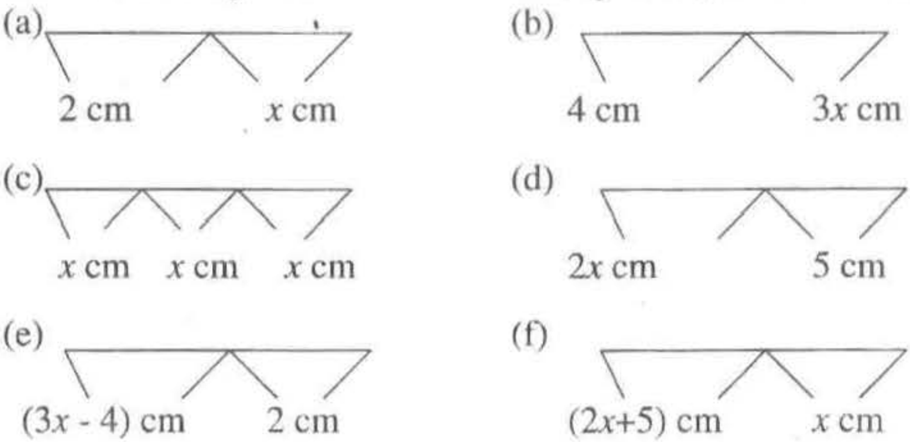
10. If $\pi = \frac{22}{7}$ and $r = 7$ what is the value of πr^2 ? (π is called pai)

11. If s = 6, what is the value of $6s^2$?

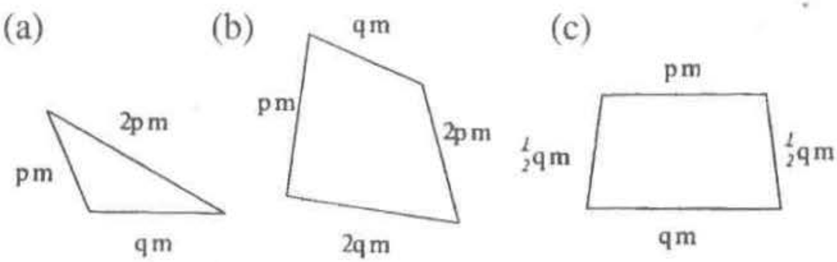
12. If a = 2, b = 3 and c = 4, find the value of the following expression.

(a) a+b-c	(b) b–a+c	(c) c+a–b
(d) 2a+5b–4c	(e) 3a–2b+4c	(f) 5a–b–c
(g) $2a^2+3b^2$	(h) $5c^2-4b^2+a^2$	(I) $3ab^2+2bc^2$
(j) $\frac{(5a+2b)}{c}$	(k) $\frac{(3c-2b)\quad a}{2a}$	(l) $\frac{(5a-2b)c}{4}$

13. What is the length of each of the line segments, when $x = 4$ cm ?

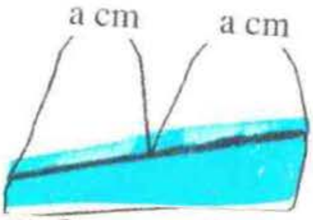


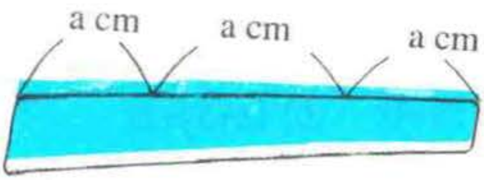
14. Write the expressions denoting the perimeter of the following figures. If $p = 3$, and $q = 4$, find the measurement of the perimeter of each of the figures. (in the figure m denotes meter)



11.4 Addition and Subtraction of Like Terms and Unlike Terms.

How long will be the total length of the sticks while connection 2 sticks each a cm ling and 3 sticks of same length as shown in the following figure.

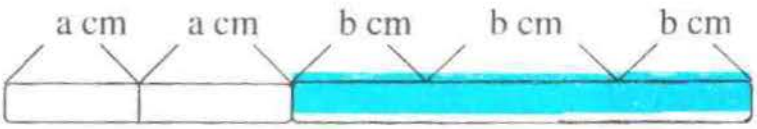




Here, 2a cm + 3a cm = 5a cm

In this way, while adding the like terms, the variable is written only one chance after adding the coefficients.

What is the total length of the stick, while connection 2 sticks each a cm long and 3 sticks each b cm long as shown in the following figure.



Here, $a\times2+b\times3 = (2a+3b)$ cm.

In this way, the stick of length a cm and that of b cm are different, so they cannot be added into one term.

Example: 1

Differentiate the following pair of terms as like term and unlike term.

(a) a^2 and $3a^2$ (b) $5a^2$ and $5b^2$
(c) a^3 and a^2 (d) $7x^3$ and $9x^3$

Answer:

(a) a^2 and $3a^2$ are like terms because both contain the same variable a^2
(b) $5a^2$ and $5b^2$ are unlike terms because the variable of the first term is a^2 and the variable of the second term is b^2 there different.

(c) In a^3 and a^2, the first variable is a^3 and the second variable is a^2 are they unlike terms.

(d) In $7x^3$ and $9x^3$ are like terms because both contain the same variable x^3.

Example: 2

Find the sum of:

(a) $3x+4x$ (b) $7x+3y+2x$

Answer:

(a) $3x+4x$
$= 7x$ (sum of 3 and 4 is 7 and both contain the same variable x)

(b) $7x+3y+2x$
$= 9x+3y$
($7x+2x = 9x$ but in $9x$ and $3y$, x and y are different variables)

Example: 3

Find the difference of:

(a) $13m^2-9m^2$ (b) $5m^2-3n^2-2m^2$

Answer:

(a) $13m^2-9m^2$ (Because $13-9 = 4$ and m^2 is a variable)
$= 4m^2$

(b) $5m^2-3n^2-2m^2$ (Since m^2 and n^2 are different variables)
$= 3m^2-3n^2$

Exercise 11.4

1. Differential each of the following expressions as like and unlike terms.

(a) $3a$ and $7a$ (b) $3m$ and $4m$ (c) $5m^2$ and $7m$
(d) $3m^2n$ and $5mn^2$ (e) $5p^2q$ and $6p^2q$

2. Find the sum of:

(a) $3m+2n+5n$

(b) $2xy^2+8x^2y+11xy^2$

(c) $2xy$, $4yz$ and $8xy$

(d) $2a+b+3c$, $a+4b+2c$, $7a+5b+7c$

(e) $ab+bc+ca$, $3ab+2bc+3ca$, $ab+bc+ca$

(f) $5x^2+2x+3+3$, $3x^2+4x+5$, $2x^2+3x+1$

3. Find the difference of:

(a) $2a - 4b - (4a - 4b)$

(b) $7a - 5b - 7c - (a - 2b - 3c)$

(c) $x^2 - xy + y^2 - (x^2 - xy + 2y^2)$

4. Simplify:

(a) $2x+5y-8y$

(b) $8a-17b+10a$

(c) $2(2x-y) - 5(x+y)$

(d) $x^2+y^2 - 2xy - (x^2-y^2+2xy)$

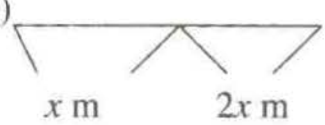
(e) $5a^2+ab - (2a^2+8ab - 7b^2)$

(f) $2a-2b+7c - (2a+3b-c)$

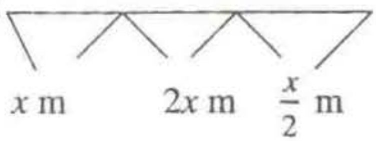
(g) $a+2b+3c - (5a+4b+3c)$

5. Find the total length of the following line segments.

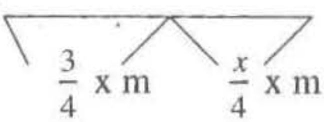
(a)



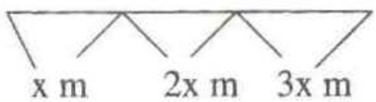
(b)



(c)



(d)

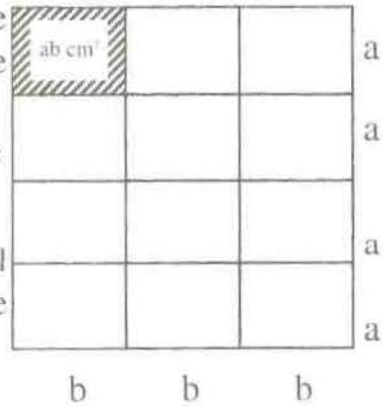


6. If $x = 3m$, find the actual length of each of the line segments in question number 5.

11.5 Multiplication of Algebraic Expressions

Multiplication of Monomial Algebraic Expressions.

Let us consider a problem of finding the area of a rectangle with length 4a cm and breadth 3b cm.



How many times is the area of the rectangle with respect to the area of another rectangle of length a cm and breadth b cm?

Area of this rectangle $=12\times$Small rectangle

$=12\,ab.$

Likewise, in the multiplication of monomial expressions, the calculation should be done as shown on the right side.

Here, the coefficient of a is 4 in $4a$, Similarly 3 in $3b$ and 12 in 12 ab are the coefficients of b and $a\,b$ respectively.

In this way, the product of coefficients should be multiplied by the product of alphabets in the multiplication of monomial expressions.

Note:

1. There is a provision of writing coefficient before the variable.
2. Do not write it, if the coefficient is, like, $1.a = a$
3. Alphabets should be arranged according to the order.

Example: 1

Multiple

(a) $7m\times8n$ (b) $3x\times8y\times\frac{1}{2}\times x$

Answer:

(a) $7m\times8n$ (b) $3x\times8y\times\frac{1}{2}\times x$

$= 7\times8\times m\times n$ $= 3\times8\times\frac{1}{2}\times x\times y \quad x$

$= 56$ mn $= 12x^2y$

1. Express each of the following expressions in the form in which there is on sign of multiplication.

   (a) $a \times b$ (b) $2a \times c$ (c) $3a \times y$ (d) $1 \times y$ (e) $o \times k$

2. Multiply

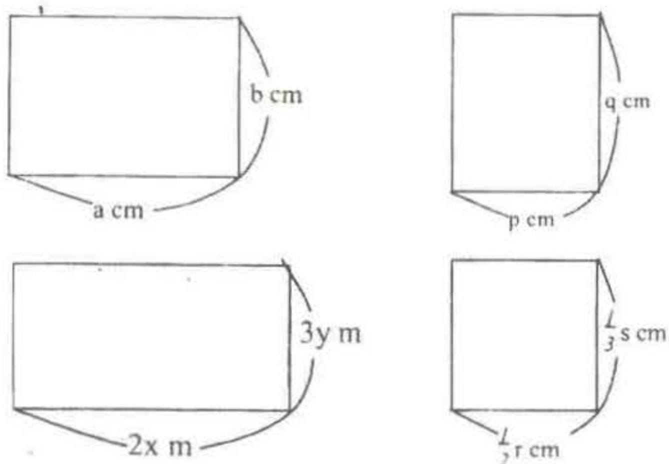
   (a) $2 \times 3a$ (b) $3 \times 4b$ (c) $7c \times 5c$ (d) $9d \times 8$

   (e) $a \times 5b$ (f) $b \times 3c$ (g) $2c \times 3$ (h) $3p \times 2q$

   (i) $8 \times r \times s$ (j) $a \times 6 \times 5a$ (k) $b \times 3c \times d$ (l) $2b \times 3c \times 4d$

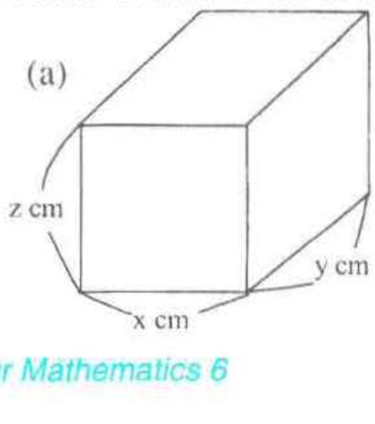
   (m) $5a \times 5b \times 3c$ (n) $6a \times 3c \times 2$ (o) $\frac{1}{2} \times 3y \times 2z$ (p) $\frac{1}{4} \times 4y \times 6z$

3. Area of a rectangle = length× breadth. Find the area of each of the following rectangles.

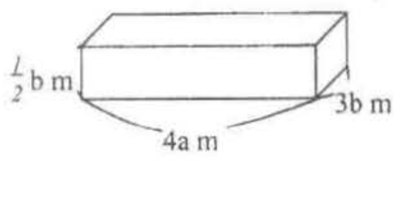


4. Area of a rectangle object = length×breadth×heigth. Find the volume of each of the following figures.

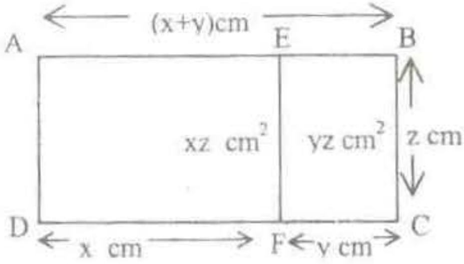
(a)



(b)



11.6 Multiplication of Binomial Expression by the Monomial Expression



In the given figure, the length of the rectangle is $(x+y)$ cm and its breadth is z cm. This rectangle is divided into two rectangles, one ADFE having length x cm and breadth z cm and the other rectangle BCFE having length ycm and breadth z cm.

Area of rectangle ADFE $= \text{length} \times \text{breadth}$
$= x \text{ cm} \times z \text{ cm}$
$= xz \text{ cm}^2$

Similarly, area of rectangle BCFE $= \text{length} \times \text{breadth}$
$= y\text{cm} \times z \text{ cm}$
$= yz \text{ cm}^2$

Area of rectangle ABCD = Rectangle ADFE + Rectangle BCFE
$= xz \text{ cm}^2 + yz \text{ cm}^2$
$= (xz + yz) \text{ cm}^2$

But the area of the rectangle ABCD $= \text{length} \times \text{breadth}$
$= (x+y) \text{ cm} \times z\text{cm} = (x+y)\, z \text{ cm}^2$
$\therefore (x+y)\, z = (xz+yz)\text{cm}^2$

In this way, the distributive law of multiplication is applied during the multiplication of binomial expression by monomial expression.

This process of multiplication can be shown in the following way.
$xz+yz = (x+y)z$

Example: 1

Multiply: $2a$ and $(3b+4c)$

Answer:

$2a\times(3b+4c) = 2a\times3b + 2a\times4c$
$= 6ab + 8ac$

Example: 2

Multiply: $2x$ and $(4x+3xy)$

Answer:

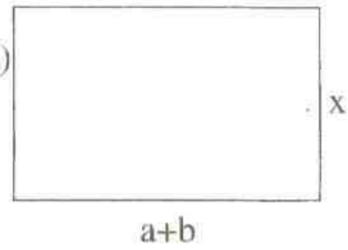
$$
\begin{aligned}
&2x \times (4x+3xy)\\
&= 2x \times 4x + 2x \times 3xy\\
&= 8x^2 + 6x^2y
\end{aligned}
$$

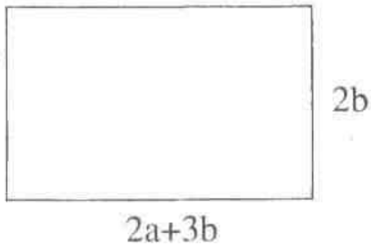
Exercise 11.6

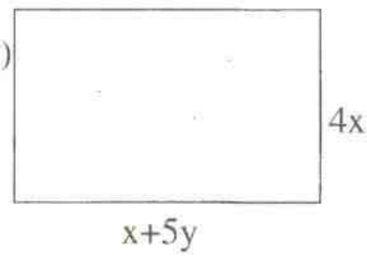
1. Multiply

(a) $a+b$ and a (b) $2a+b$ and b (c) $x+3y$ and $2y$
(e) $4a+7a$ and $3b$ (f) $4x+5y$ and $4y$ (g) $10a+7b$ and $8a$

2. Using the formula, area of the rectangle = length breadth, find the area of the following rectangles.

(a)


(b)


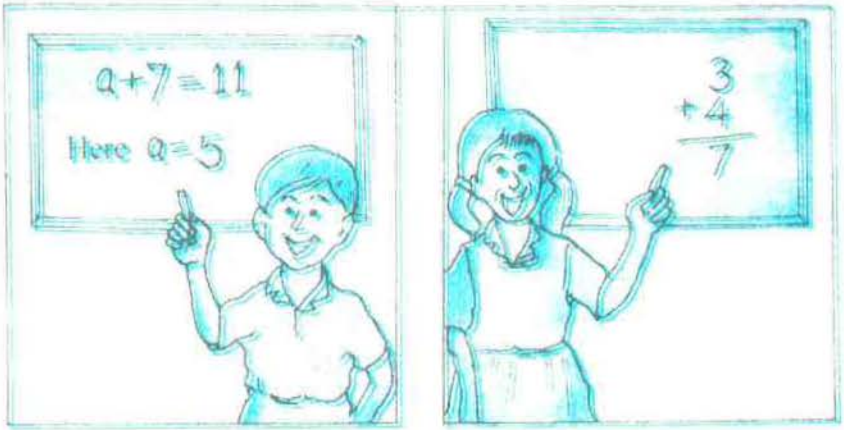
(c)


3. Find the product

(a) $2a \times (7a+b)$ (b) $5a \times (4a+6b)$
(c) $20x \times (4x+12y)$ (d) $7a \times (9a+20)$

12. Equation Inequality and Graph

12.1 Mathematical statements



If a = 5, a+7 = 11 This is a false statement	3 + 4 = 7 is a true statement

The mathematical sentence having the operations addition, subtraction, multiplication and division are called 'Mathematical statement.' "The product of 7 and 3 is 21" is a mathematical statement. The mathematical statement may be true or false but a single statement cannot be true and false both as the same time. "2 is a prime even number" is a true statement where as the statement "all the prime numbers are even numbers" is a false statement.

Mathematical statements can be made by using the sings of inequality $>$, $<$, $\geq$ or $\leq$ For Example: the sum of 2 and 3 is less than 6. i.e. $(2+3)<6$. This is a true statement. But the value obtained by subtraction 4 from 5 is greater than 3 i.e.$(5-4)>3$. This is a false statement. That is why, it can be written as $(5-4) \ngtr 3$. That is $(5-4)$ is not greater than 3. Here, $\ngtr$ represents "is not greater than."

Note: The mathematical statement including the signs $<$, $>$, $\geq$ or $\leq$ etc. is called inequality or in equation and $<$, $>$, $\geq$, $\leq$ etc. are know as signs of inequality.

Exercise 12.1

Differentiate each of the following mathematical statements as false or true.

1. $1+2+3 = 1\times2\times3$
2. The difference of 15 and 12 is 3.
3. All the acute angles are smaller than the obtuse angles.
4. The area of a square of a side 2 cm is 8 sq. cm.
5. There are 3 prime numbers between 10 to 20.
6. 125 is a multiple of 35
7. There are only two factors, 9 and 4, of 36.
8. $a\times b = b\times a$ is always true.
9. The minute hand of a watch makes 1 rotation in 12 hours.
10. $x+3 = 6$ where $x = 4$.
11. $(2 + 3) < 4-3$
12. $x+3 \geq 4$ where $x = 1, 2, 3$.

12.2 Mathematical Open Statements

Read the following sentences.

(a) x is a square number.
(b) p is exactly divisible by 3.
(c) $z+3 = 11$

It cannot be decleared that whether these statements are true or false, why?

If $x = 4$, the statement (a) is true.

How many values of x are there which make the statement (a) true? When $x = 5$, is the statement (a) true or false?

Similarly, if $p = 0, 3, 6, 9$......etc, the statement (b) is true otherwise this is false statement.

If $z = 8$ only, then the statement (c) becomes true, but in other conditions, it is a false statement.

Observe the following examples:

Open statement	True statement	False statement
$c+4 = 11$	$7+4 = 11$	$8+4 = 11$
$x \in$ {even number}	$2 \in$ {even number}	$3 \in$ {even number}
y is greater than 7	8 is greater than 7	6 is greater than 7

The statement which cannot be said true or false confidently is called an open statement.

Exercise 12.2

1. Separate whether the following mathematical statements are true, false or open sentences.
   a) Two times 3 is equal to x
   b) $y+y = 2y$
   c) 5 is a prime number.
   d) It becomes 8 when y is added to 5.
   e) $x \in$ {odd number}
   f) If $z = 8$ then $z^2 = 16$
   g) $2 \times p = 60$
   h) 1195 is exactly divisible by 25.
   i) $2z$ is always less than 10.
   j) c is a number which exactly divides 10.

2. Which number is to be kept in □ in each of the following open sentences to make them true sentence (Such numbers may be one or more than one but it is enough to write one number).

   a) □ represents one fourth of 16.
   b) 10 is exactly divisible by □ and it is an odd number.
   c) □ is more than 5.
   d) □ $\div 7 = 7$
   e) □ $- 8 = 0$
   f) □ is an odd number.
   g) □ is greater than 7.
   h) □ is a multiple of 5.

i) The sum of $\square$ and 1, it forms a square number.
j) There are $\square$ months in one year.
k) $\square$ is a whole number between 15 and 17.

3. In which values of the symbols used in each of the following open statements, the statement becomes true statement ? Write all the possible values.
a) There are x days in February in a leap year.
b) x divides 5 leaving no remainder.
c) p represents the prime numbers from 10 to 20.
d) $S = 1^2+2^2+3^2+4^2$
e) $a+13 = 13$

12.3 Equation

The mathematical open statements like $\square - 5 = 2$, $x = 3 + 12$ in which there is '=' sign are called equations.
$\square$ and alphabets x, y, z etc used in the equation are called variables.

Solving the equation means, to find the value of the variable in the equation which makes the open statement a true statement. In the equation $\square - 5 = 2$, when $\square = 7$, the open sentence becomes a true statement. Hence, the solution of $\square - 5 = 2$ becomes 7. Similarly, in the equation $x+3 = 12$, $x = 9$ is the solution of the equation.

Example: 1

Solve (a) $x+10 = 12$ (b) $15 - x = 3$

Answer:

(a) Here, $x+10 = 12$
We know that, $2+10 = 12$

Hence, $x = 2$

(b) Here, $15-x = 3$
$x = 12$

Exercise 12.3

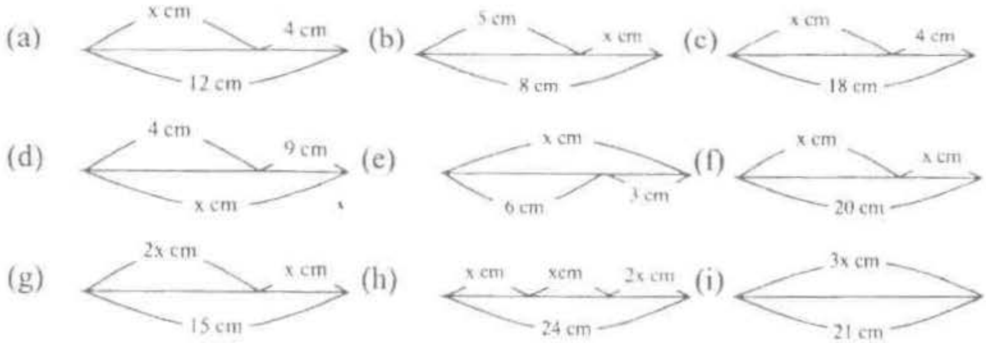
1. Solve every equation by inspection.

   (a) $x + 6 = 14$ (b) $3m = 21$ (c) $13 - y = 9$

   (d) $3 - x = 0$ (e) $p+7 = 11$ (f) $15+r = 20$

   (g) $\frac{1}{2}x = 10$ (h) $\frac{1}{3}y = 7$

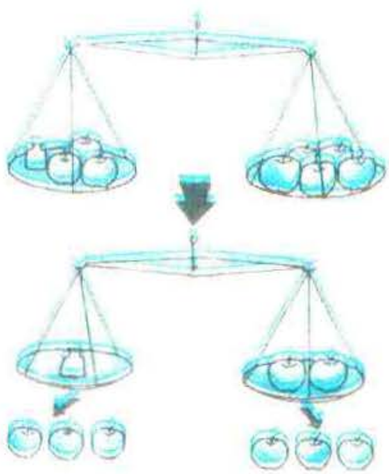
2. Form an equation of each of the following problems and find the value of x.



12.4 Equality axioms and equation

Look the adjoining figure

The weight of one "Dhak" and 3 apples are equal to 5 apples. Likewise, the weight of each apple is also equal. While taking out 3 from each side, on one side of the balance 'Dhak' is left while on one other side two apples are left.



If equal quantity is taken out from both side of the balance, it is balanced again. Therefore, the weight of on 'Dhak' is equal to 2 apples.

On translating this problem in Mathematical language, the 'Dhak' is denoted by a variable x and apples by numbers, we have

In 1st step $x+3 = 5$

In second step $x + 3-3 \quad = 5-3$ (Sustracting 3 from both side)

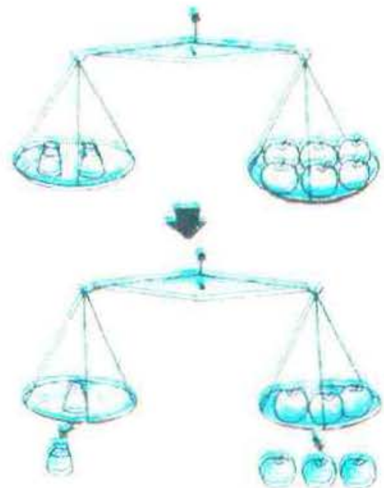
$\therefore x \quad = 2$

In this way, if equals are subtracted from equals the remainders are also equal.

In the adjoining figure, the weight of 2 'Dhak' and 6 apples are equal and equal in weight.

Now divide 'Dhak' and apples into 2 parts.

In this way, if one 'Dhak' from one side and three apples from another side are taken out from the balance, then one 'Dhak' and 3 apples were left in the balance and the balance is again balanced. Therefore, one 'Dhak' is equal to 3 apples.



$2x \quad = 6$ (In first step)

$\frac{2x}{2} \quad = \frac{6}{2}$ (dividing both side by 2)

$\therefore x \quad = 3$

If equals are divided by equals, the quotients are also equal.

In this way, if equals are added to equals, the sum are equal and if equals are multiplied by equals, the products are equal.

Example: 1

Solve: (a) $x + 6 = 13$ (b) $x-5 = 7$ (c) $3x = 15$

(d) $\frac{x}{4} = 4$ (e) $3x-9 = 15$ (f) $\frac{4}{x} = 2$

Answer:

(a) $x + 6 = 13$

Here, $x+6 = 13$

or, $x+6-6 = 13-6$ [Subtracting 6 from both side.]

or, $x = 7$

Here, 6 is added to x so 6 is subtracted while solving in solving equation, unnecessary numbers are removed by reverse operation.

Check, $x+6 = 13$ put $x = 7$ then $7+6 = 13$

or, $13 = 13$ which is true.

(b) $x-5 = 7$

Here, $x-5 = 7$ [5 is subtracted from x]

or, $x-5+5 = 7+5$ [Adding 5 on both side]

or, $x = 12$

Here, the reverse operation of subtraction is addition. Hence 5 is added to both side.

(c) $3x = 15$

Here, $3x = 15$

or $\frac{3x}{3} = \frac{15}{3}$ [Diving both side by 3]

or, $x = 5$

Here. x is multiplied by 3. The reverse operation of multiplication is division. So both sides are divided by 3.

(d) $\frac{x}{4} = 4$

Here, $\frac{x}{4} = 4$

or $\frac{x}{4} \times 4 = 4 \times 4$ [Diving both side by 4]

or $x = 16$

Here, the reverse operation of division is multiplication. So both sides are multiplied by 4.

(e) $3x-9 = 15$

Here, $3x-9 = 15$

or, $3x-9+9 = 15+9$ [why ?]

or, $3x = 24$

or $\frac{3x}{3} = \frac{24}{3}$ [why ?]

or, $x = 8$

(f) $\frac{4}{x} = 2$

Here, $\frac{4}{x} = 2$

or, $\frac{4}{x} x = 2x$

or, $4 = 2x$

or, $\frac{4}{2} = \frac{2x}{2}$

or, $x = 2$

Example: 2

If 7 is added to 4 times of a number the sum is 19. Find the number.

Answer:

Let the required number be x

Thus, 4 times of $x = 4x$

According to the question,

or, $4x+7 = 19$

or, $4x+7-7 = 19-7$

or, $4x = 12$

or $\frac{4x}{4} = \frac{12}{4}$

or, $x = 3$

Check, observing by putting $x = 3$ in

$4x+7 = 19$

or, $4\ 3+7 = 19$

or $12+7 = 19$

or, $19 = 19$

which is true.

Exercise 12.4

1. Solve each of the following questions by equality axioms.

a) $x+7 = 16$	b) $12+x = 17$	c) $x-3 = 18$
d) $8-y = 3$	e) $8y = 96$	f) $\frac{x}{7} = 3$
g) $3x-17 = 46$	h) $15+2z = 19$	i) $3y-7 = 2$
j) $27-2m = 3$	k) $12-8n = 4$	l) $\frac{1}{8}x-8 = 1$
m) $22-8y = 14$	n) $20+16z = 100$	o) $2\frac{p}{3}+4 = 8$
p) $= \frac{100}{q}$ 10	q) $\frac{100}{z} = 4$	r) $\frac{3}{x}+4 = 7$

2. Form the equation to solve each of the following conditions.

   (a) If 4 is added to x, the sum is 12.
   (b) If 6 is added to y, the sum is 16.
   (c) If z is subtracted from 17, the remainder is 2.
   (d) If x is multiplied by 4, the product is 36.
   (e) If p is multiplied by 6 and added to 6, the result is 18.
   (f) If x is divided by 2, the quotient is 12.
   (g) If one fourth of x is added to 3, the sum is 6.
   (h) If 21 is subtracted from the product of 7 and x, the remainder is 0.

3. Form the equation to solve the following word problems.

   (a) If x number of sweets are equally divided among 4 students, each will get 6 sweets. Find the number of sweets distributed.
   (b) If x students were absent among 350 students form a school, 300 were left. Find the number of absent students.
   (c) A student has 20 marbles. His friend gave x marbles to him. Now he has 30 marbles altogether. Then how many marbles his friend has given to him ?
   (d) In a school, there are altogether 175 students of which there are x boys and 50 girls then find the number of boys.

(e) A stick x m long measures 36 m in 6 times, how long is the stick ?

(f) A basket contains x rotten and 50 good apples. If there are 75 apples, find the number of rotten apples.

(g) Ram and Shyam have altogether Rs. 50. How much money does Ram have, if Shyam has Rs. 35 ?
(suppose that Ram has Rs. x, from an equation and solve.)

12.5 Laws of Trichotomy

Introduction

In 3 and 4, $3 < 4$ similarly in 2 and -3, $2 > -3$

Again, $3 = 3$, $4 = 4$, $-3 = -3$.

If a and b are any two integers, only is true among the following three relations.

$a > b$, $a < b$ and $a = b$.

For example, if $a = 4$ and $b = 7$ then $a < b$ or $4 < 7$is true. $4 > 7$ and $4 = 7$ or $a > b$ and $a = b$ are false.

This property of integers is called, 'Trichotomy property'. Symbols >, < and = are called Trichotomy symbols.

Negation of Tricotomy Propriety of integer.

"+ 3 is smaller than + 4". This mathematical true statement is written as $4 > 3$ by using the symbol of Tricotomy. (+) symbol is not in practice.

While writing the negation of the symbol used "is greater than >" of this same statement, we have

a) $4 \not> 3$ whose meaning is 4 is not greater than 3, this is not true.
b) $3 \not> 4$ whose meaning is 3 not greater than 4, this is true.

Here, the symbol $\ngtr$ is called negation of the symbol '>'. Likewise the negation of the symbols $<$ and $=$ are 'is not less than' $\nless$ and $\neq$ 'is not equal to' respectively.

Example: 1

Write the negation statement of the following.

a) 2 is an even number.
b) Kathmandu is not the capital of Nepal.
c) 287 is not divisible by 7 without leaving remainder.

Answer:

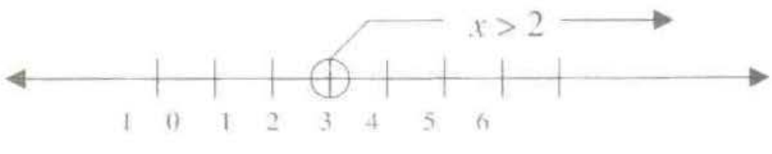
a) 2 is not an even number.
b) Kathmandu is the capital of Nepal.
c) 287 is divisible by 7 without leaving remainder.

Tricotomy Properties of Number in a Number line.

Kamal writes the number greater than +2 by using the symbol of Tricotomy. The list prepared by her is like this.

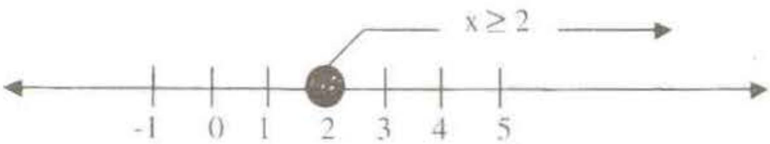
$3 > 2$
$4 > 2$
$5 > 2$
$6 > 2$
$7 > 2$
$8 > 2$

Kamal tried to solve this question by using the number line. She encircled two as a doesn't lie in the set of the numbers greater than 2. Numbers greater than 2 lie in the right side of 2 in the number line, so she coloured dark the line segment right side of 2.

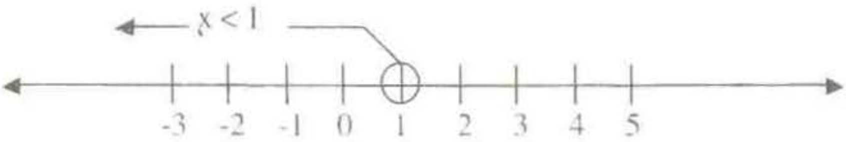


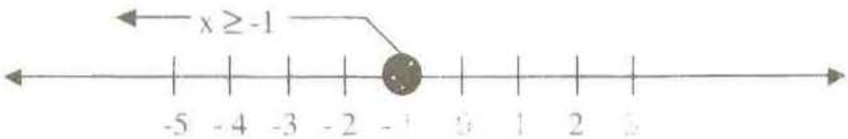
She used a variable 'X' to denote any number lying in the coloured part of the number line. She wrote the solution to this problem as $X > 2$.

Similarly, to denote 2 or greater than 2, Raman wrote $X \geq 2$ and while reading he read as "X is greater or equal to 2" and encircled the place where 2 is written and coloured dark the line segment right side of 2.



What does the coloured line segment of the following number line denote if it is written by the method of Kamala?





In the first figure, 1 is encircled and excluding the circle, left side of 1 is coloured. Thus, while denoting the number less than 1 by X the coloured portion of the number line segment represents $X < 1$.
Like wise in the next figure, the coloured portion of the number line denotes $x \leq -1$.

Laws of Tricotomy

Look at the following examples.

(a) -5 and 7 are two numbers and let's take another number 3.

Here, $-5 < 7$ or $7 > -5$ Adding 3 to each side

$-5+3 < 7+3$
or, $-2 < 10$

This is true

or, $7+3 > -5+3$
or, $10 > -2$.

This is also true

Multiplying both sides by 3

$-5 \times (3) < 7 \times (3)$
or, $-15 < 21$

This is true

or, $7 \times 3 > -5 \times 3$
or, $21 > -15$

This is also true

Dividing both the sides by 3

$\frac{-5}{3} < \frac{7}{3}$
or, $-1\frac{2}{3} < 2\frac{1}{3}$
This is true

or, $\frac{7}{3} > \frac{-5}{3}$
or, $2\frac{1}{3} > -1\frac{2}{3}$
This is also true.

(b) -5 and 7 are two integers and -3 is another integer.
Here, $-5 < 7$ or, $7 > -5$
Multiplying both sides by -3 (both the sides)

$(-5) \times (-3) < 7 \times (-3)$ or, $7 \times (-3) > (-5) \times (-3)$
or, $15 < -21$ or, $-21 > 15$

This is not true   This is also not true

Here, the symbol of tricotomy must be changed to make these statements true.

or, $15 > -21$ or, $-21 < 15$

This is true   This is also true

(c) Let one integer be +5 and another integer be -3.

Here,	$5=5$	always true (known fact)
Or,	$5+(-3) = 5+(-3)$	adding 3 to both the sides.
Or,	$2=2$	this is true
Or,	$5 \times (-3) = 5 \times (-3)$	multiplying both the sides by – 3
Or,	$-15 = -15$	this is also true.

From the above examples,

(a) If a and b are two integers in which a > b and c is another integer then, additional axiom $(a+c) > (b+c)$

subtraction axiom $(a-c) > (b-c)$

multiplication axiom $ac > bc$, where c is positive
$ac < bc$, where c is negative.

Division axiom $\frac{a}{c} > \frac{b}{c}$ $c \neq 0$, where c is positive

$\frac{a}{c} < \frac{b}{c}$ $c \neq 0$, where c is negative.

Therefore, the mathematical statements including Tricotomy's > or < sign is changed to > or < respectively when each side is multiplied or divided by the negative integer

(b) If a and be are two integers in which a = b and c is another integer, then

$(a+c) = (b+c)$	equal additional axiom
$(a- c) = (b-c)$	equal subtraction axiom.
$ac=bc$	equal multiplication axiom.
$\frac{a}{c}=\frac{b}{c}$ where $c \neq 0$	equal division axiom.

Exercise 12.5

1 Insert the write symbol (>, < or =) between each of the following integers.

a) 3....5	b) 3....-5	c) -3 ....-5
d) 3....3	e) -7 ....-8+1	f) -7 ....-6
g) -6 ..... -7	h) -5 2	i) -8 ..... -1

2. Distinguish whether the following relation of tricotomy statements are true or false.

a) $3 > 2$	b) $7 < 4$	c) $-7 > -6$
d) $-5 < -2$	e) $5 > 6$	f) $7 > -7$
g) $-6 > -2$	h) $-6 < -4$	i) $-7 < -9$

3. Write the negation statement of each of following statemen

a) 3 is an odd number.

b) Pokhara is the capital of Nepal.

c) 281 is a prime number.

d) 120 is divided by 5 with out leaving a remainder

e) The earth is a star.

f) 16 is the square of 4.

g) If a, b and c are three sides of a triangle then $(a+b) > c$

h) If a, b and c are three integers and $a > b$ then

(i) $a+c > b+c$ (ii) $a-c > b-c$ (iii) $ac < bc$ (iv) $\frac{a}{c} < \frac{b}{c}$

j) 8 is a factor of 123

j) Every number divisible by 2 is even.

4. Draw a number line separately for each of the following inequalities and show it in a number line by colouring.

a) $x > 1$ b) $x > 5$ c) $x > -3$ d) $x < -5$ e) $x < -2$
f) $x < 5$ g) $x \geq 2$ h) $x \geq -2$ i) $x \geq 7$ j) $x \leq -5$
k) $x \leq -10$ l) $x \leq 4$

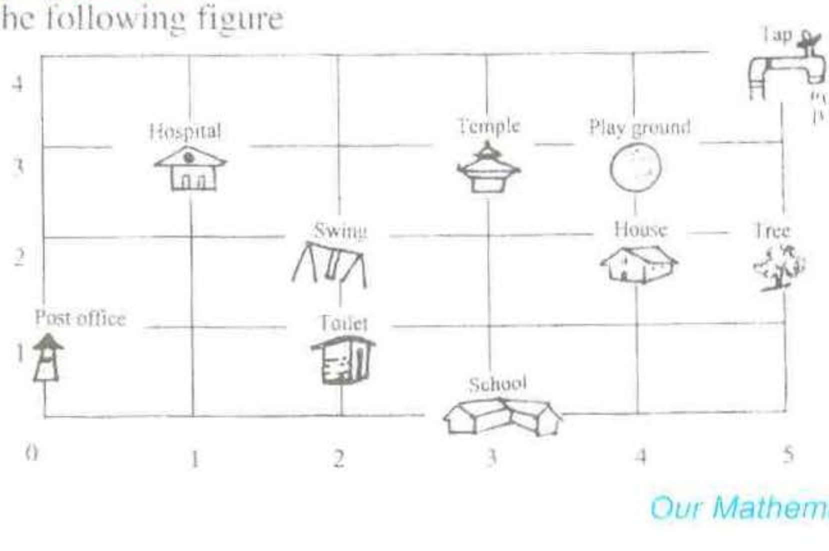
5. Distinguish whether the following statements are true or false by the laws of tricotomy.

If 3 and 5 are two integers and -7 is another integer then,,

a) $3+(-7) = 5+(-7)$ b) $3-(-7) = 5-(-7)$
c) $3 \times (-7) = 5 \times (-7)$ d) $3+(-7) > 5+(-7)$
e) $3-(-7) > 5-(-7)$ f) $3 \times (-7) > 5 \times (-7)$
g) $5 \times (-7) < 3 \times (-7)$ h) $3 \div (-7) > 5 \div (-7)$
i) $3 \div (-7) < 3 \div (-7)$ j) $3+(-7) < 5+(-7)$

12. 6 Coordinates

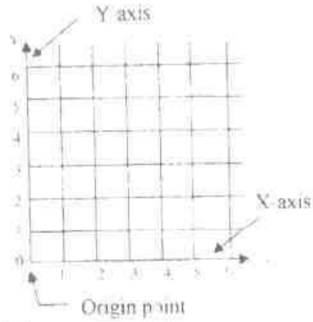
Look at the following figure



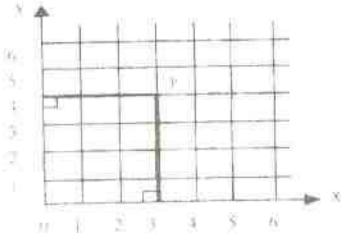
In the figure, from O, moving 5 units right and 2 units up a 'tree' is found, to say this, first it is read horizontally and then vertically, the tree is at (5, 2). As per this statement it can be said that the temple is at (3,3) and th post office is at (0,1) In this way, how are other objects represented in the figure?

Let us think of it.

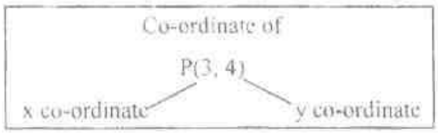
Let us see the figure at the right.



Here, two number lines meet at 0 perpendicularly Here the horizontal line is called X axis, the vertical line is called Y-axis and the point of intersection o is called the origin.



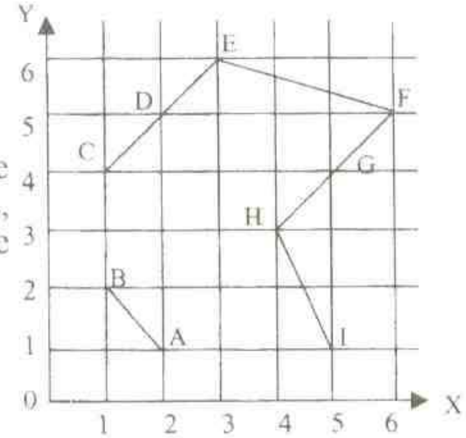
In the right figure, to represent the position of point P, draw perpendicular to the X-axis and Y-axis through the point P. which cut X-axis and Y-axis at 3 and 4 respectively, Now, it is written as (3,4) where 3 is x-co-ordinate and 4 is y-co-ordinate of the point P and (3,4) is called the co-ordinates of the point P.P. is written as P (3 4) P (3, 4) means point P is 3 units right and 4 units above the origin O



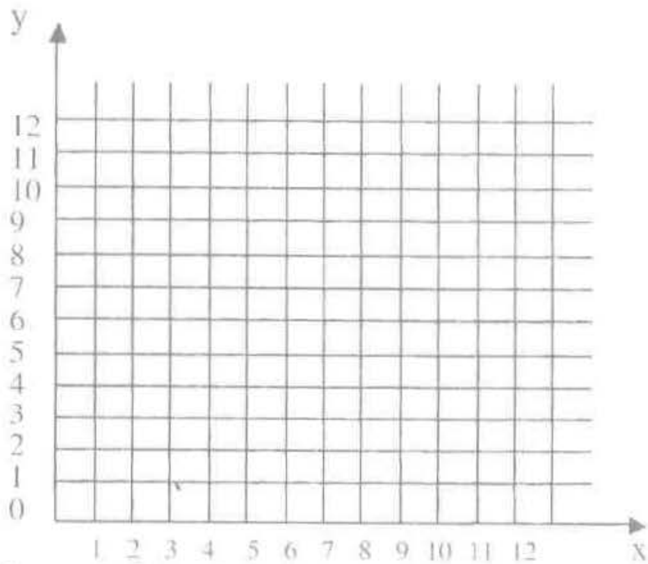
Hence, the position of the points can easily be found out with the help of the axes in the plane.

Exercise 12.6

1. Find the co-ordinates of the following points A B, C D E, F, G, H and I given in the squared paper below.

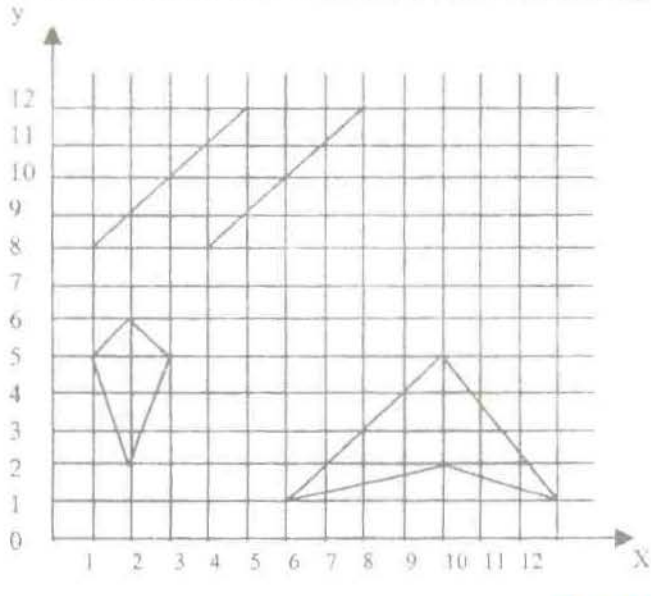


2. Plot the following points in the squared paper and join each points respectively. What figure is formed ?



a) (2, 6); (3, 2) and (5, 4)
b) (3, 1); (6, 1) and (6, 4)
c) (4, 4); (7, 2) and (7, 6)
d) (0, 0); (4, 0); (6,4) and (3, 5)
e) (3, 3); (7, 3); (7, 7) and (3, 7)
f) (4, 6); (8, 2); (7, 6) and (8, 9)
g) (4, 4); (4, 10), (8, 7), (6, 7) and (8, 4)

3. Write the co-ordinates of the vertices of each of the following



4. P(6,6), Q (6,10) and R (10,10) are three vertices of a square. Point S is the fourth vertex and points P, Q, R and S lie on the first quadrant. Plot these points and find the co-ordinate of S.

5. What is the co-ordinate of midpoint of a line joining the points P (3,2) and Q (7, 6) use squared paper.

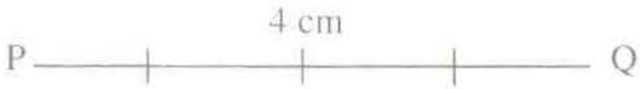
13. Line and line segment

13.1 Introduction and Measurement.

Let us discuss for a while about the questions.

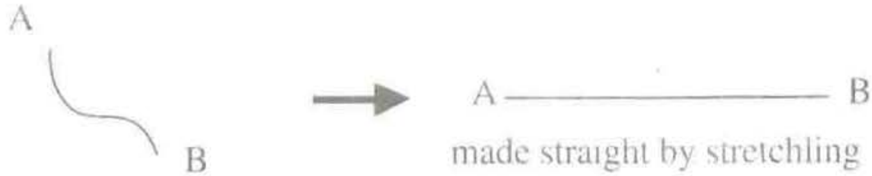
a) How can you represent the distance of the school from your home by a figure?
b) How can the distance of 400 km from Kathmandu to Biratnagar be represented by a figure?

In each of the above problems, two points can be used to denote a place or an object. Distance between these two points can be joined by a ruler using a fixed length. If two points are joined with a ruler, a line segment is formed. The length of a line segment is fixed.

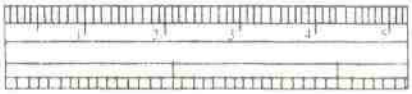


The length of line PQ is 4 cm. Generally a straight line is infinitely long. A straight line extends infinitely in both sides.

The length of left and right edges of a book are examples of line segment. Opposite edges of a ruler can be represented by line segment Make a list of such objects which can be represented by straight line segment and measure the line segments.



In the figure, a not stretched thread is an example of a curve line and a stretched thread is an example of a line segment. Take out the instrument from your instrument box and answer the following questions.

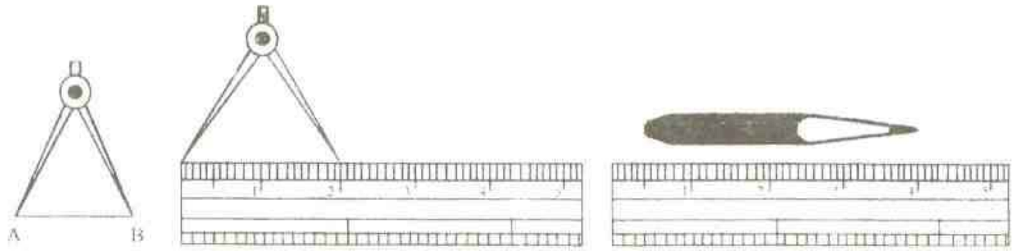


Ruler

Pencil

A pair of dividers

1. What are the objects shown in the figure?
2. How long is the ruler?
3. How far are the tips of the dividers?
4. Which unit will be used to measure the length?
5. How long is the pencil in the figure?

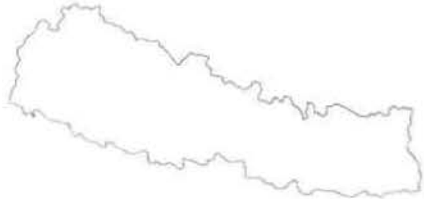


Estimated length of a line segment   Real length of a line segment   Length of pencil

Centimeter (cm) can be the unit of a line segment. A line segment can be measured with a ruler.

Exercise 13.1

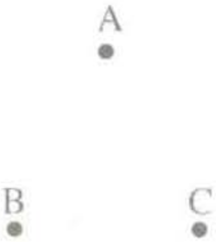
1. In the given map of Nepal, where does your district lie? Represent it with a point.



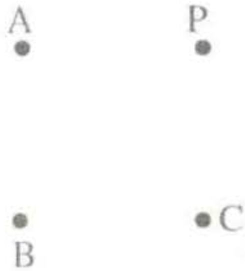
2. In the class room, represent you and your favorite friend's position by points and estimate the distance between two.

3. Join the following points A, B, C, D, E, ... etc. respectively. Join last point and first point also. What figure will form?

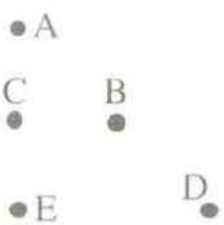
(a)



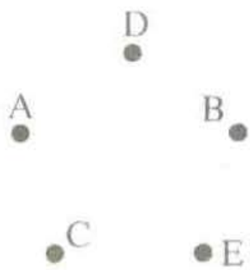
(b)



(c)



(d)



4. Find the length of each of the following line segments with a ruler.

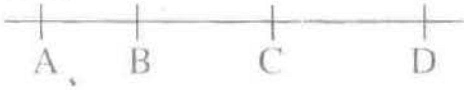
(a)

(b)

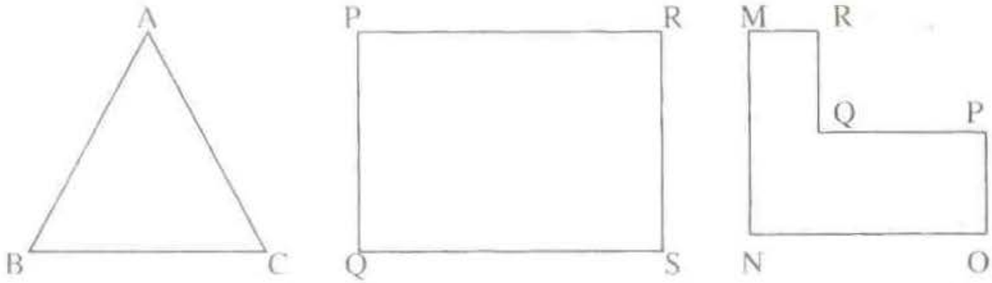
c)

5. In question number 4, what is the difference between the longest and the shortest line segment?

6. How many line segment are there in the figure ? Measure the length of each.



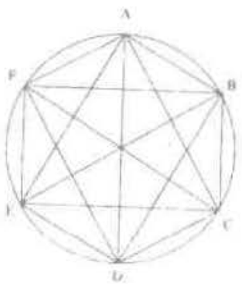
7. Measure each side of the following figures and find the perimeter.



8. Using scale measure the length and breadth of
(a) table (b) copy
(c) math book in your class room and find the perimeter.

9. Draw the line segment of the following length.
(a) 3 cm (b) 5 cm (c) 6.5 cm (d) 7.5 (e) 8.2

10. Can you do this also?

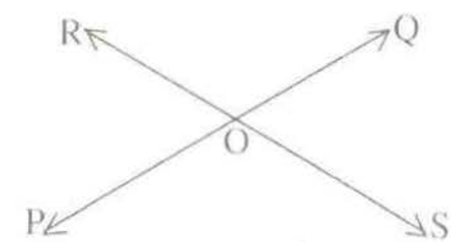


How many line segments are there in the figure? How much long line segments will be formed while adding all the line segments at one place ?

13.2 Types of straight lines

1. Intersecting lines

Two lines intersecting each other are called intersecting lines. PQ and RS intersect each other at O. O is the point of intersection.



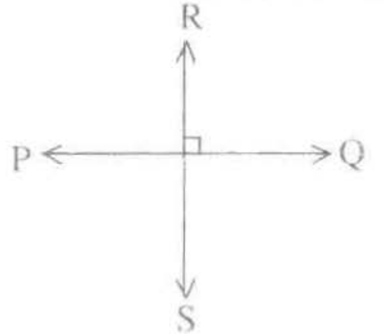
2. Paralledl lines

Lines which lies on the same plane and do not intersect when they are produced in either direction are called parallel lines. PQ and RS do not intersect with each other, so they are parallel. In short, PQ is parallel to RS and is written as PQ//RS.

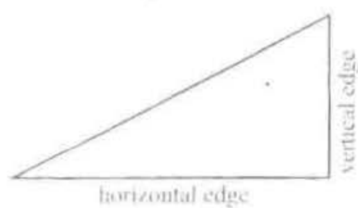
Some examples

(i) The lines of your exercise books are parallel.
(ii) The opposite edges of a ruler are parallel.
(ii) The opposite edges of text books are parallel.
(iv) Collect some more examples of parallel lines from the class room.

3. Perpendicular Lines



When two lines intersect each other and formed a right angle, they are said to be perpendicular lines. PQ and RS intersect each other at O and? POR = ? QOR = 90, so PQ and RS are perpendicular to each another. In short we write RS is perpendicular to PQ as RS ⊥ PQ. The vertical edge of the set square is perpendicular to the horizontal edge. Find the

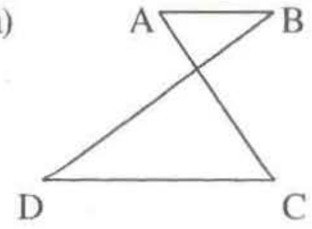


examples of similar perpendicular line segment in your classroom.

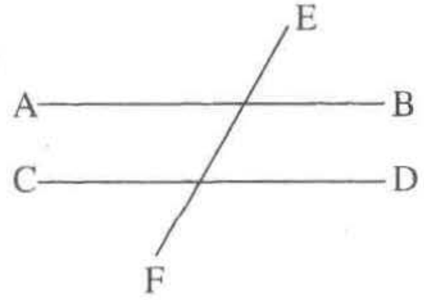
Exercise 13.2

1. Differentiate the intersection and non intersection line segments of each of the following figures.

(a)

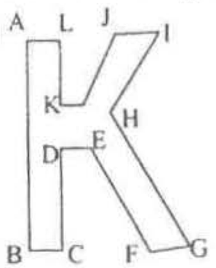


(b)

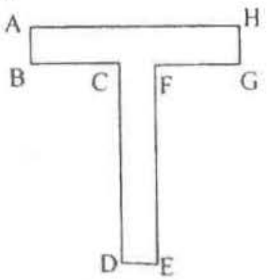


2. Differentiate the perpendicular and parallel line segments in each of the following figures.

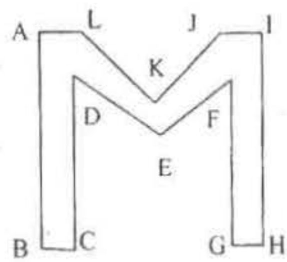
a)



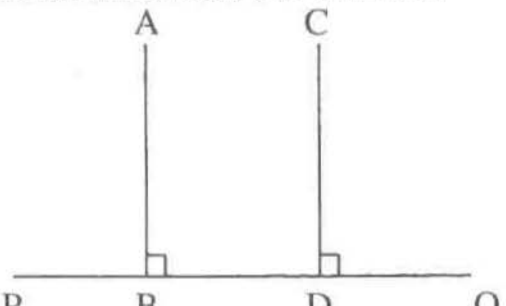
b)



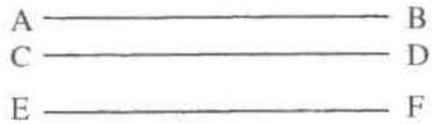
c)



3. In the figure, AB and CD both are perpendicular to PQ. Now, what is the relation between AB and CD?



4. If AB//CD, CD//EF, what can you say about AB and EF?



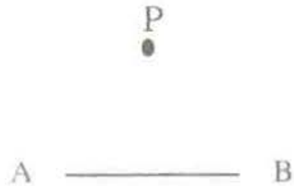
5. (a) How many lines can be drawn parallel to QR through point P?

   (b) How many perpendiculars can be drawn to QR through P?

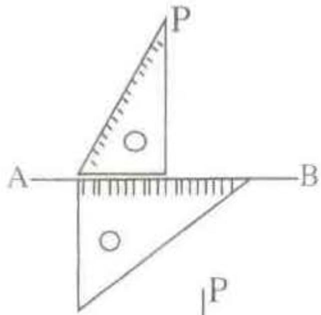
13.3 Construction of Perpendicular and Parallel Lines

1. To construct a perpendicular to a given line from a point outside it.

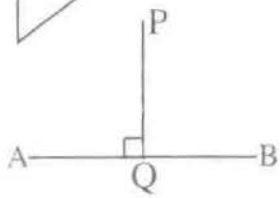
Draw a perpendicular to a line AB form the point P outside AB.



Arrange a pair of set squares as shown in the figure and draw a line with a pencil from P to AB.



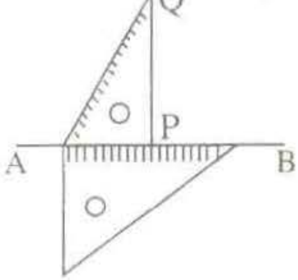
The line segment PQ is perpendicular to the line AB at Q.



2. To construct a perpendicular to a given point of a given line.

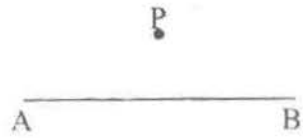
A perpendicular is to be drawn to a line AB at a point P on the line AB.

Arrange a pair of set squares as shown in the figure and draw a vertical line at the given point P. PQ is perpendicular to the line AB at the point P.

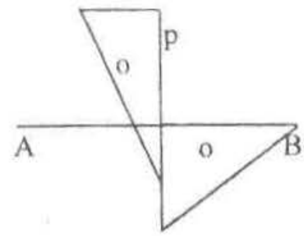


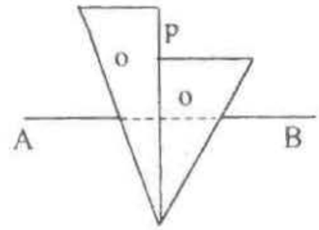
3. To draw a line parallel to a given line through the given point outside it.

Here, a line has to be drawn through the point P making it P parallel to the line AB.



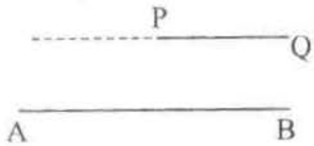
Arrange a pair of set squares as shown in the figure Keeping the left side set square fixed, move the right side set square up to the point P as shown in the other picture and drawn a horizontal line from the point P.





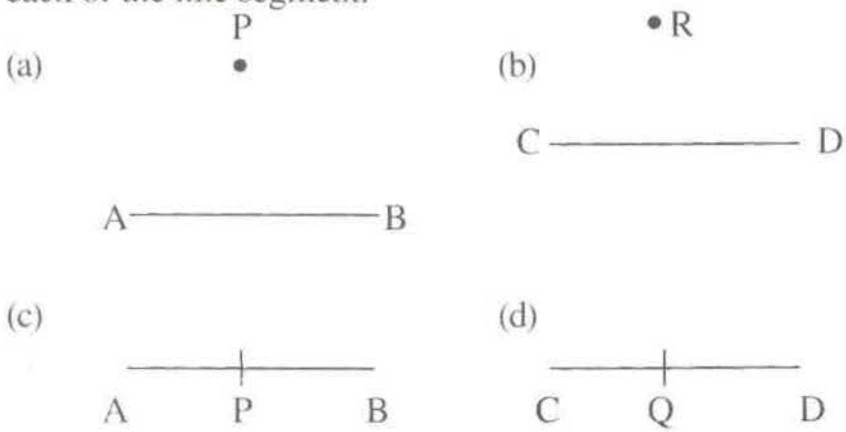
Now, remove the set squares,

PQ is parallel to AB.



Exercise 13.3

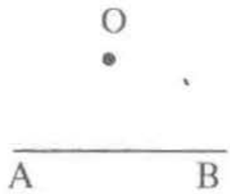
1. Construct the perpendicular passing through the given point to each of the line segment.



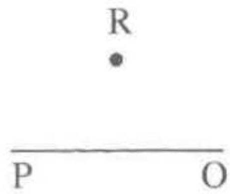
2. Draw a line segment PQ in your exercise book and at its points P and Q draw perpendiculars SP and RQ of 3 cm each what figure will from when RS are joined?

3. Construct the line segment passing through the given point and are parallel to each of the given line segment.

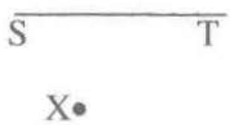
(a)



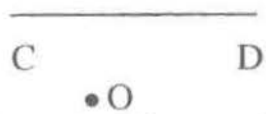
(b)



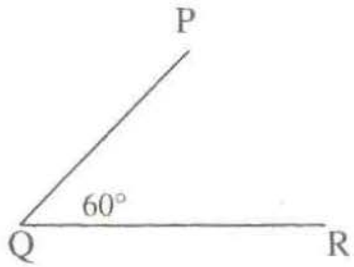
(c)



(d)



4. Draw a line parallel to QR through P. Draw another line parallel to PQ through R. Name the point where the lines drawn in this way meet as S. What types of figure is formed?



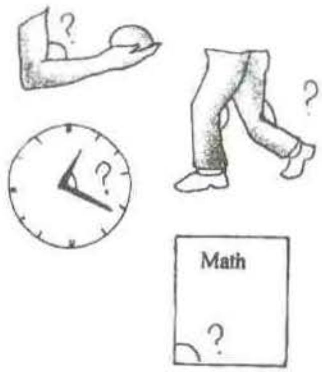
The figure so formed is called a parallelogram PQRS.

14. Angle

14.1 Introduction

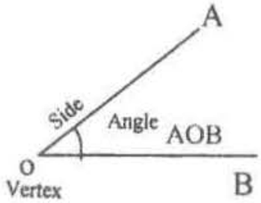
Discuss the statements and figures regarding the angles given along - side.

(a) An angle is formed when an abject is lifted with a hand.
(b) Angles keep forming by the legs while walking.
(c) Angles keep forming when the hands of a clock's keep moving.
(d) The horizontal and vertical edges of a book make an angle.
(e) Can you give other examples related to such angles?

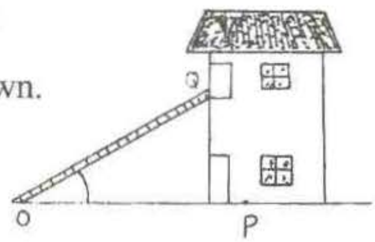


When two lines meet at a point, an angle is formed.

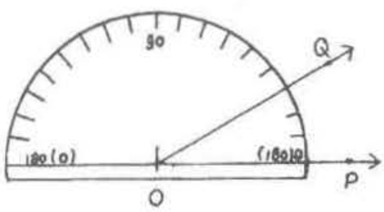
In the figure, AO and BO meet at a point O and AOB is formed. O is called the vertex of the angle, OA and OB are called sides or arms of the angle. We name an angle in such a way that the vertex is always in the middle as $\angle AOB$ or $\angle BOA$. An angle is denoted by the symbol $\angle$.



Here, a figure of a ladder is shown. Now estimate the angle formed by the ladder with the ground.



We use a protractor to measure an angle. An angle is measured in degree unit. In the figure, the degree measured of $\angle POQ$ is 30°. This is denoted by $\angle POQ = 30^\circ$

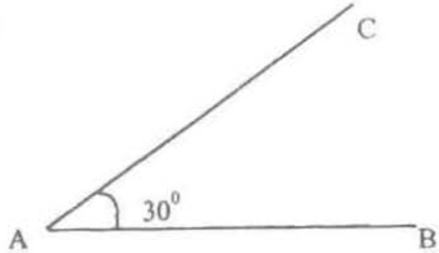


Example: 1

To construct and angle of 30°

Method of construction of angles.

Draw a line AB. At the line point A of AB, place the point where the vertical and horizontal lines of the protractor meet so that it makes 0° with AB and looking at the circumference of the protractor, mark C where 30° is written. Now remove the protractor and join A and C with ruler.

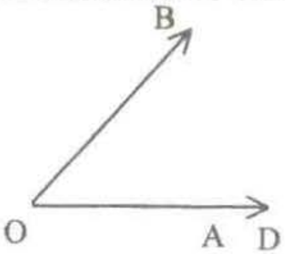


$\therefore \angle CAB = 30°$ is the required angle.

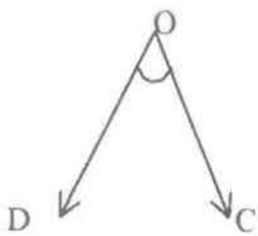
Exercise 14.1

1. Write the name of each of the following angle.

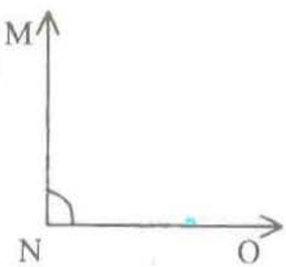
(a)



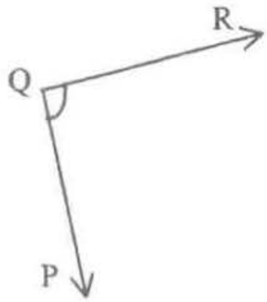
(b)



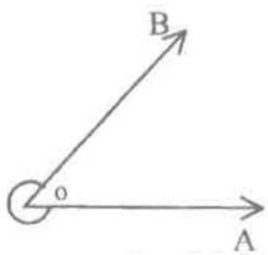
(c)



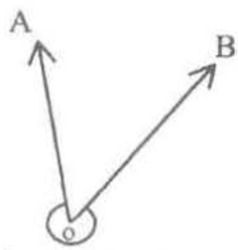
(d)



(e)

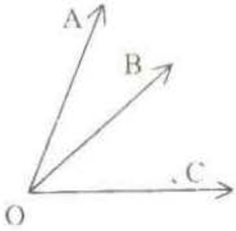


(f)



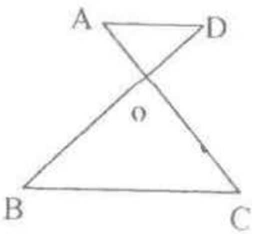
2. Measure each of the angles of Q.N.1 with a protractor.

3. How many angles are there in the adjoining figure? Measure each of them with a protractor and name them.

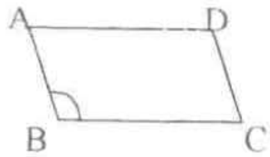


4. Measure each of the following marked angles in degree. (write the name and measure of each angle)

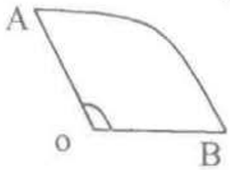
(a)



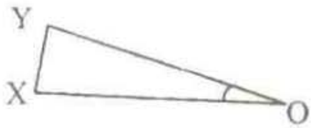
(b)



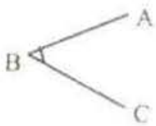
(c)



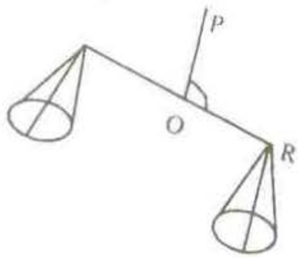
(d)



(e)



(f)

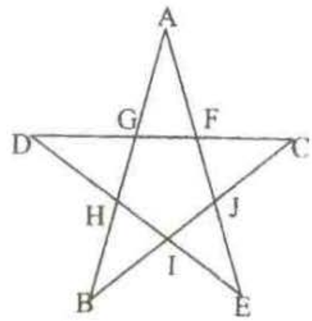


(g)

5. Construct each of the following angles using a protractor.

a) 20°	b) 25°	c) 30°	d) 40°
e) 63°	f) 45°	g) 55°	h) 79°
i) 120°	j) 135°	k) 150°	l) 177°

6. Can you do this also?



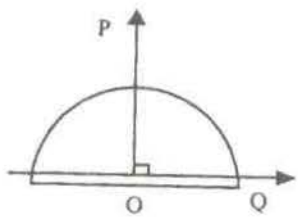
How many angles are there altogether in the given figure of this star? Measure each angle in degrees.

7. Can you construct the following angles with the help of a protractor?

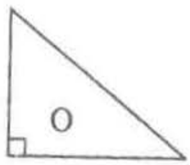
a) 200° b) 270° c) 300° d) 360°

14.2 Classification of angles.

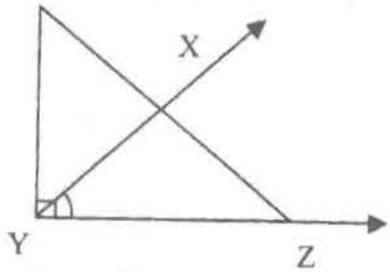
a) Right angle



An angle whose measure is 90° is called a right angle. ∠POQ = 90°. So ∠POQ is a right angle. One angle of a set square is a right angle. Therefore, to estimate an angle greater than or smaller than right angle a set square can be used.

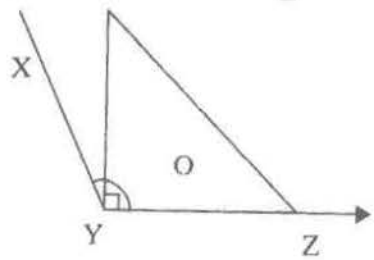


b) Acute angle



An angle greater than 0° and less than a right angle (less than 90°) is called an acute angle. ∠XYZ is less than a right angle, so it is called an acute angle.

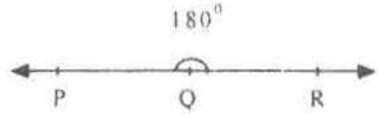
c) Obtuse angle



An angle greater than 90° but less than 180° is called an obtuse angle. ∠XYZ is greater than 90°, so ∠XYZ is an obtuse angle.

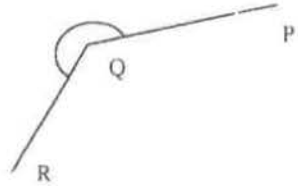
d) Straight angle

An angle measured exactly 180° is called a straight angle. ∠PQR = 180°, so ∠PQR is a straight angle.



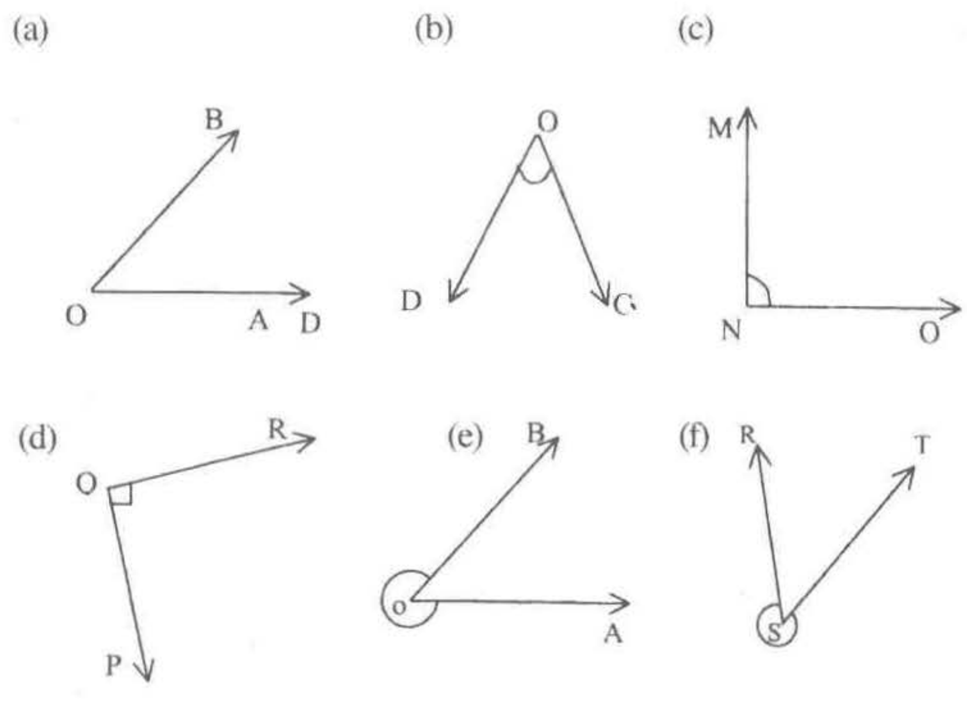
e) Reflex angle

An angle greater than 180° and less than 360° is called a reflex angle. ∠PQR is greater than 180°, so ∠PQR is a reflex angle.

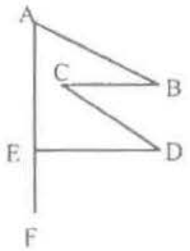


Exercise 14.2

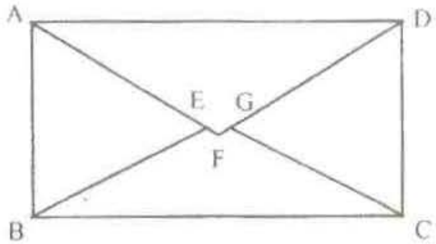
1. Distinguished the following angles as right angle, acute angle, obtuse angle, straight angle or reflex angle.



2. In the outlines of the flag of Nepal, distinguish obtuse angle, acute angle, right angle, straight angle and reflex angle.



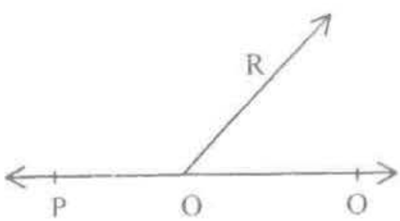
3. An envelope is given in the figure. Write obtuse angles in it.



4. Differentiate whether the following statements are true or false.

(a) x is greater than 0° and less than 90° . x is an acute angle.
(b) y is greater than 0° and less than 90° . y has one value.
(c) z lies between 90°. p represents a right angle.
(d) p is equal to 90°. p represents a right angle.
(e) l is equal to 180°. This an obtuse angle.

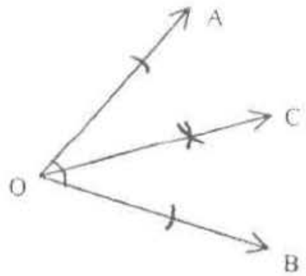
5. Write the name of acute, obtuse and straight angle of the following figure.



14.3 Construction of angles.

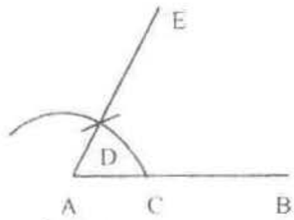
1. Construction of bisector of angles.

In the figure, measure the $\angle AOB$. Similarly measure $\angle AOC$ and $\angle BOC$ also. Lines OC divides the angle $\angle AOB$ in two equal parts. Hence a line which divides an angle into two equal parts is called bisector of the angle. In the figure, OC is the bisector of $\angle AOB$. With the help of compass bisector of any angle is drawn, which is given in the figure. Look this and understand.



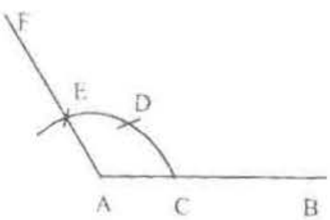
2. To construct an angle of 60°

Draw a line segment AB. Draw an arc with a pair of compasses at A. This arc cuts the line AB at C. From C, taking the previous arc cut at D. Join A and D and produced to E. The $\angle EAB = 60°$.



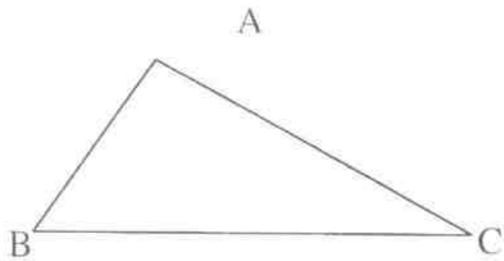
3. To construct an angle of 120°

Draw a line segment AB. Draw an arc with a pair of compasses at A. This arc cuts the line at C. From C, cut a D with an arc of 60°. From D, cut at E, taking the same arc. Join A and E and produced to F. The $\angle FAB = 120°$



(c) Scalene triangle

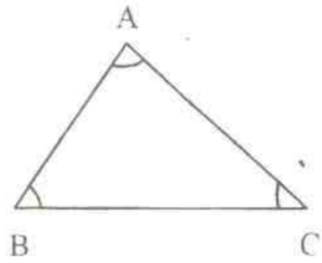
If no sides of a triangle are equal, it is called a scalene triangle. In Δ ABC none of the sides are equal. Hence Δ ABC is a scalene triangle. Measure all three angles of Δ ABC and write the relation you see between the greatest angle, the smallest angle and the sides.



Classification of Triangle according to Angles.

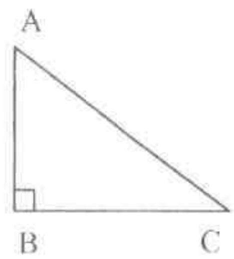
a. Acute angled triangle

If all the three angles of a triangle are less than 90° or acute angles, it is called an acute angled triangle. In ΔABC, $\angle A$, $\angle B$ and $\angle C$ all are less than 90°. Hence ΔABC is an acute angled triangle.



b. Right angled triangle

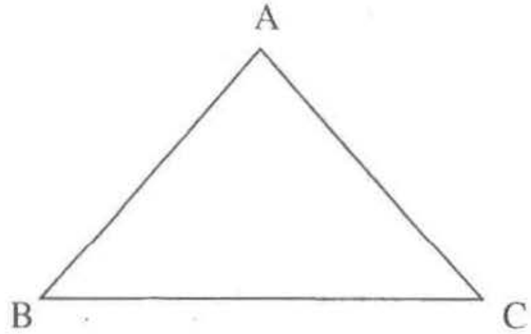
If one angle of a triangle is a right angle, it is called a right angled triangle. In ΔABC, $\angle B = 90^\circ$, so ΔABC is a right angled triangle.



15 Triangles and Polygons

15.1 Triangle

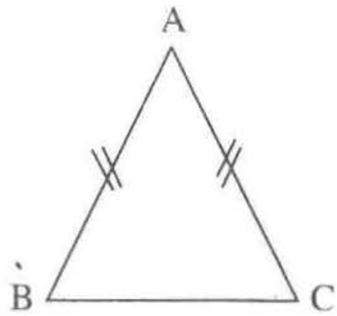
The plane figure bounded by three line segments is called a triangle. A triangle has three sides and three angles, like wise, a triangle has three vertices also.



Classification of triangles according to sides

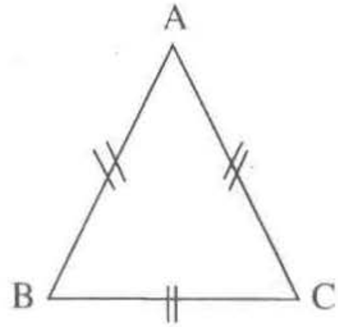
(a) Equilateral triangle

If all the three sides of a triangle are equal, it is called an equilateral triangle. In ΔABC, $AB = BC = CA$, so ΔABC is an equilateral triangle. Measure $\angle A$, $\angle B$ and $\angle C$ of the ΔABC with a protractor. Are all the angles equal?



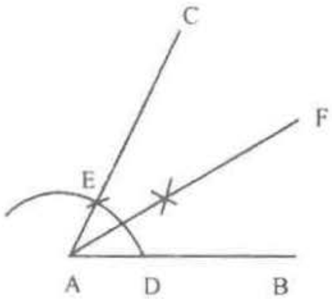
(b) Isosceles Triangle

If two sides of a triangle are equal, it is called an isosceles triangle. In Δ ABC, AB = AC so Δ ABC is an isosceles triangle.



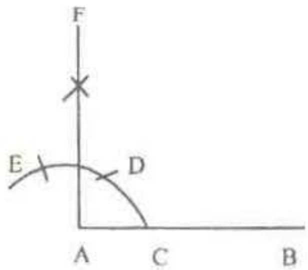
4. To construct an angle of 30°

Construct an angle of 60°. Equal arc drawn through D and E intersect at a point and join it to A. Here, $\angle FAB = \angle CAF = 30^\circ$



5. To construct an angle of 90°

Construct an angle of 120°. Equal arc drawn through D and E intersect at a point and join it to A. Here, $\angle FAB = 90^\circ$



Exercise 14.3

1. Construct the following angles with protractor and also draw the bisectors of each by using compass.

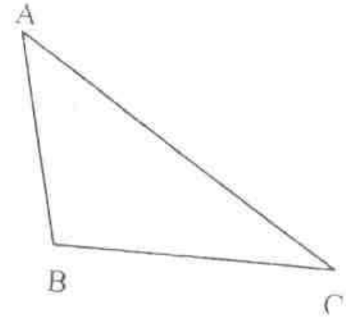
   a) 60° b) 40° c) 80° d) 75°

2. Construct the following angles with a pair of compasses.

   a) 60° b) 120° c) 30° d) 90°

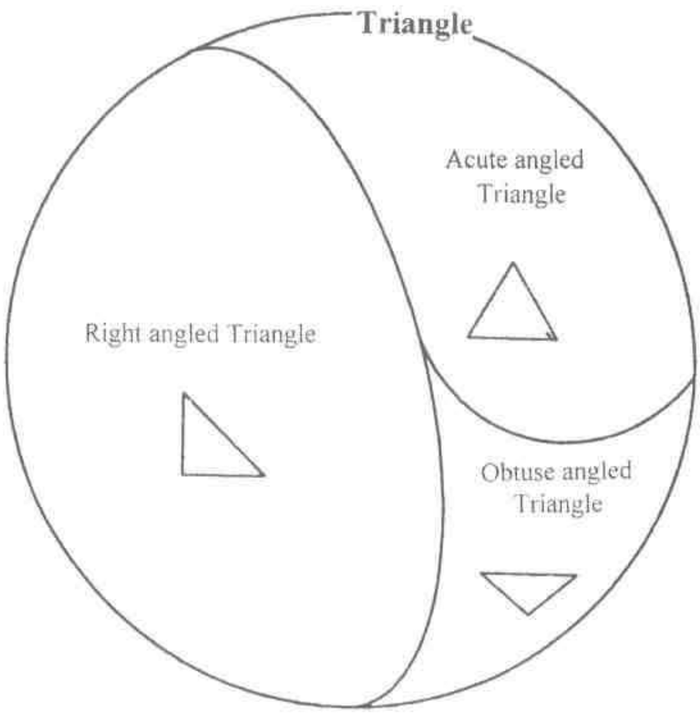
c. Obtuse angled triangle

Out of three angles of a triangle, if one angle is greater than 90°, it is called an obtuse angled triangle. In ΔABC, $\angle B > 90°$, so Δ ABC is an obtuse angled triangle.



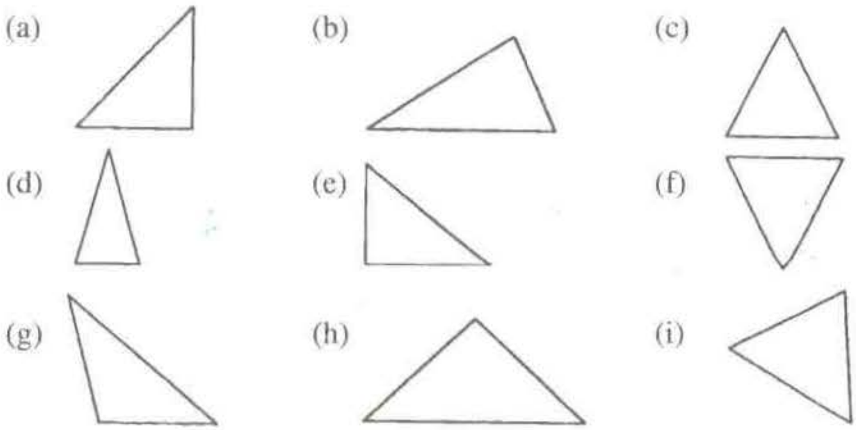
The above classification of triangles can be expressed in the form of figure as shown below.

Classification according to angles.



Exercise 15.1

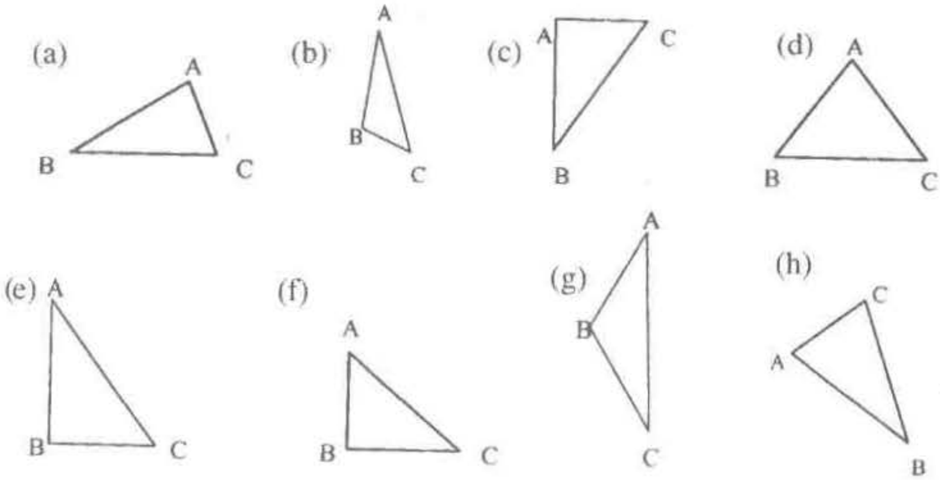
1. Measure each sides of the following triangles and classify the triangle according to side.



2. Find the sum of any two sides of each triangle of question number 1 and compare with it the third side. What is the conclusion? Is this conclusion valid for all triangles ? Discuss.

3. Is it possible to draw a triangle whose sides are
   a) 4 cm, 3 cm and 9 cm b) 4 cm, 5 cm and 9 cm
   c) 3 cm, 4 cm and 5 cm

4. Measure each angle of the following triangles and classify the triangles according to angle



5. Measure all the angles and the side of each of the angles of question number 4 and complete the following table.

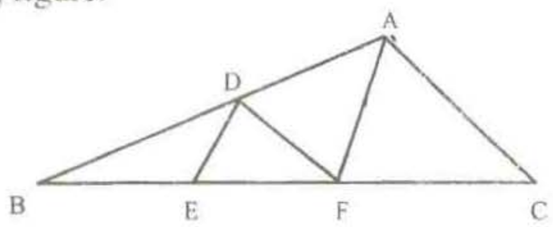
Triangle	The greatest Angle	The greatest Side
(a)	$\angle C$	AB
(b)		
(c)		
(d)		
(e)		
(f)		
(g)		
(h)		

In the above table, what is the relation between the greatest angle and the greatest side in each triangle.

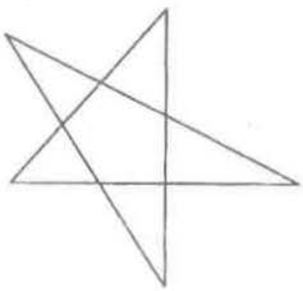
6. By making the table as above, can you find some relation between the smallest angle and the smallest side in the triangle of question number 4.

7. Find the sum of all the interior angles of each triangle of question number 4. Say, what is the conclusion?

8. Separate the right angled, acute angled or obtuse angled triangles from the following figure.



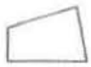
9. Can you do this also?



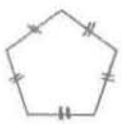
How many triangles are formed in the adjoining figure?

15.2 Polygons

A plane figure bounded by three or more than three lines is called a polygon. In the following table some polygons, their number of sides and names are given.

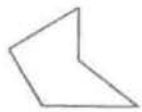
Polygon	No. of sides	Name of the plygon
	3	Triangle
	4	Quadrilateral
	5	Pentagon
	6	Hexagon
	7	Heptagon
	8	Octagon

If all the sides of a polygon are equal and their interior angle are so equal. See the figure of the regular and irregular polygon formed by 5 sides.



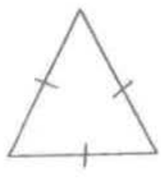
Regular

Irregular

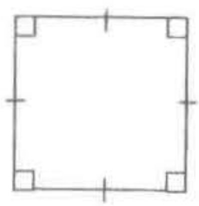


Irregular

Saying a regular triangle is an equilateral triangle.



Similarly, saying a regular quadrilateral is a square



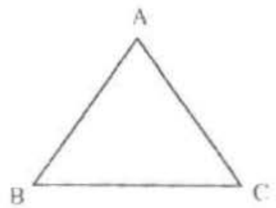
Construction of regular polygon using a ruler and a protractor

(a) Construction of an equilateral triangle.

ABC is an equilateral triangle. Measure each of its angle in degree. How much is the measure of each angle in degree ?

Example: 1

To construct an equilateral triangle in which each side is 4 cm.

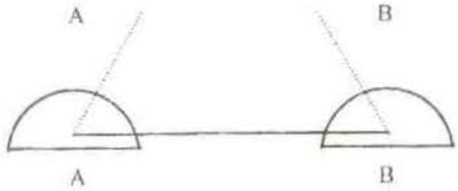


(i) Draw a line segment AB 4 cm long.

(ii) At each point A and B, draw an angle of 60° with the help of protractor.

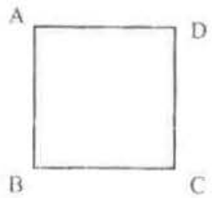
(iii) Name the point as C where the line segments making angles of 60° at the point A and B meet together.

(iv) Measure AC and BC. Hence ΔABC is the required equilateral triangle.



(b) Construction of a square.

What is the measure of each angle of a square ABCD in degree?



Example: 2

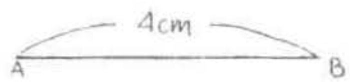
To construct a square in which each side is 4 cm

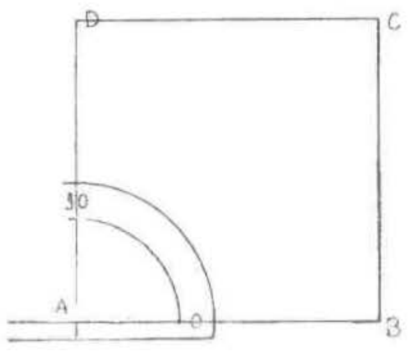
(i) Draw a line segment AB, 4 cm long.

(ii) Construct an angle of 90° at point A and B with a protractor.

(iii) Mark the point D and C on the perpendiculars AD = 4 cm at A and BC = 4 cm at B.

(iv) Join D and C with ruler. ABCD is the required square.

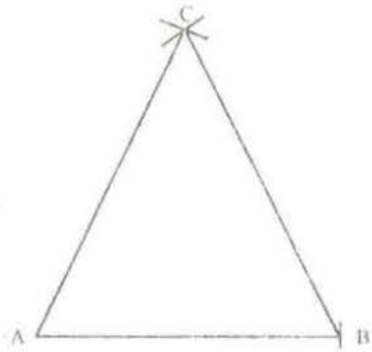




Example: 3

Construction of an equilateral triangle by using a pair of compasses as and a ruler:

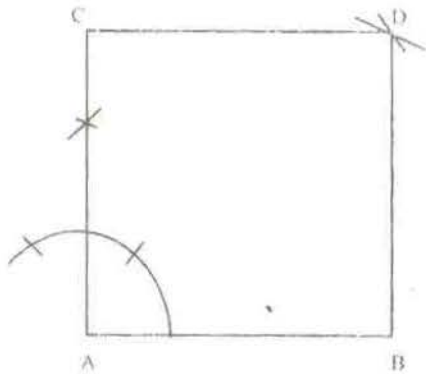
Draw a line segment AB, 4 cm long. Adjusting a compass on that line segment draw an arc from A in the line upward direction. Similarly, form B cut an equal arc and name the point as C. Join A and C and B and C.



Example: 4

Construction of a squire by using a pair of compasses and a ruler:

Draw a line segment AB, 4 cm long. Construct an angle 90° at A. Mark AC = 4 cm. From C, draw an arc of 4 cm likewise from B, cut an arc of 4 cm to interest the arc cut from C and join C and D and B and D. ABCD is the required square.



Exercise 15.2

1. Construct an equilateral triangle with the sides given below.

(a) side = 3 cm	(b) side = 4.5 cm
(c) side = 5 cm	(d) side = 3 cm.

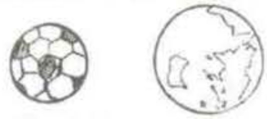
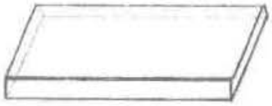
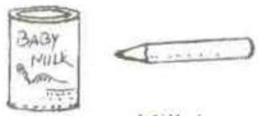
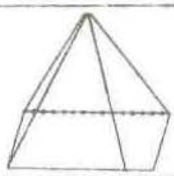
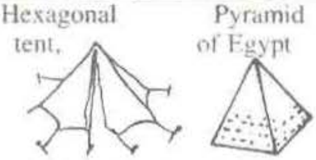
2. Construct a square with the sides given below.

(a) side = 3 cm	(b) side = 4 cm
(c) side = 4.5 cm	(d) side = 6 cm

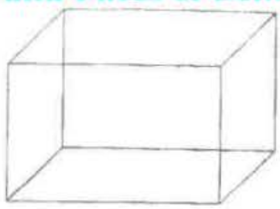
16. Solid figures

16.1 Introduction of solid figures.

Some geometrical solid figures and their samples are given below.
Make a list of samples three each, similarly to the given geometrical figures.

Geometrical solid figure	Name	Physical Sample
	Sphere	 Football, globe
	Cuboid or rectangular prism	Match box 
	Cylinder	 Milk box, pencil
	Cone	Ice-cream keep of Rice 
	Rectangular Pyramid	Hexagonal tent, Pyramid of Egypt 

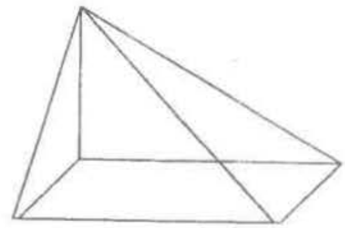
(b) Vertices, Edges and Faces of Solid Figures



How many rectangular faces are there in the given figure?

The meeting point of two rectangular planes is called an edge. How many edges are there in a cuboid? The meeting point of three edges is called a vertex. How many vertices are there in a rectangular object? To make vertices, should only three edges meet or there can also be more than that?

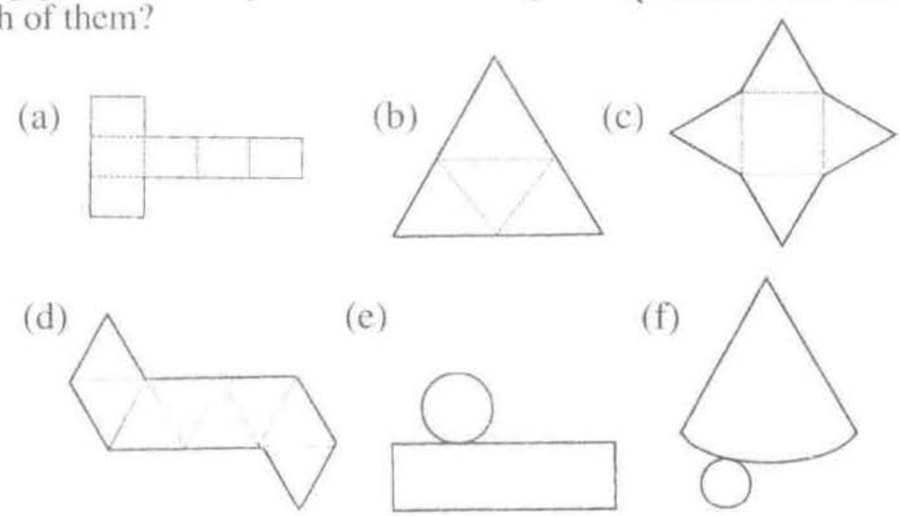
Look at the pyramid. How many vertices are there in a pyramid? How many edges are joined at the top of the pyramid? Therefore to be a vertex, more than two edges should be joined.



Count the edges (E), Faces (F) and Vertices (V) of a cuboid & cube and find the value of E+F-2. What is the value of E+F-2 ? Is E+F-2 = V ? Will it be possible in all the solids? Try with some of other solids.

(c) Construction of Some Models of Solids.

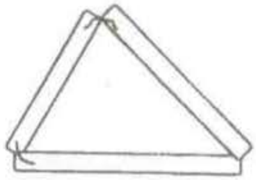
1. By folding paper, models of solid figure can be constructed. As shown in the figure, draw the figures in a thick paper and cut the boundary line. After folding the dotted line, join the edges by using gum or selo tape. What kind of figures are formed and name each of them?



As above, after constructing and colouring different figures of solid objects your class room can be decorated. Such type of objects can also be constructed by using loose soil. Construct solid objects by using soil and show them to your teacher.

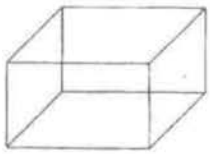
2. Skeletal models of solid objects can be constructed by using the pipe for having juice or Nigalo or Chhwali. For example, let's observe how to construct a triangle.

Insert thread through three pipes.

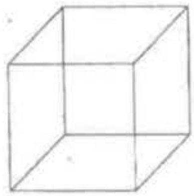


A triangle is formed after folding and tying.

Now, look at the objects constructed by the pipes for having juice (straw) and decorate your classroom by constructing such objects.

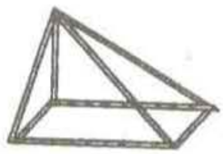


Cuboid

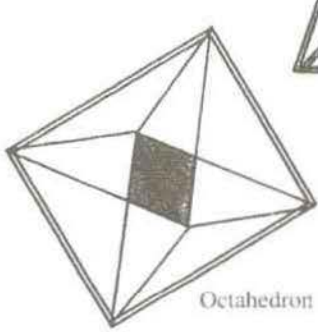


Cube

Tetrahedron



Pyramid

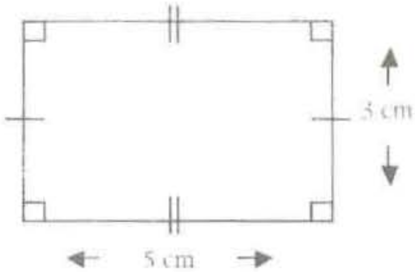


Octahedron

17. Perimeter, Area and Volume.

17.1 Perimeter

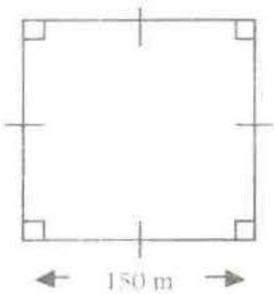
Find out by drawing the figure.
An ant completes one round of a rectangle having length 5 cm and breadth 3 cm. How much distance did it cover?



Here, the distance covered by an ant
$= 5\text{ cm} + 3\text{cm} + 5\text{ cm} + 3\text{ cm} = 16\text{ cm}$

The distance covered by an ant is called perimeter.

Look at the another example.
Hari has a squared field of length 150m. How much length of wire is needed if it has to be fenced by?



Here, the length of the wire = The perimeter of a square

$= 150\text{ m} + 150\text{ m} + 150\text{ m} + 150\text{ m} = 600\text{ m}$

The perimeter of a plane figure is the sum of the length of its sides.
In the above examples, consider length as l and breadth b of the rectangle. Perimeter (P) $= l + b + l + b = 2l + 2b = 2(l + b)$.
Similarly, consider length of square as l Perimeter (P) $= 4l$

Example: 1

How long is the side of a square whose perimeter is 16 cm?

Answer:

Perimeter of a square P= 16 cm

But $4l=16$ $\qquad \therefore l = \frac{16}{4} = 4$ cm

Thus, the length of the square = 4cm

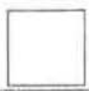
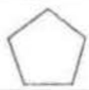
Example: 2

The length and breadth of a rectangular field is 4 m and 3 m respectively. Find the length of the wire required to fence it five times.

Answer:

Length (l) = 4m
Breadth (b) = 3m
Perimeter (P) = 2 (4+3) m = 14 m
Thus the required length of the wire to fence it five times =5×14=70 m

Look at the following table

Regular polygon	No. of sides	Length of one side	perimeter
	3	a	a + a+ a= 3a
	4	a	a+a+a+a=4a
	5	a	a+a+a+a+a+=5a
	6	a	a+a+a+a+a+a=6a
	n	a	a+a+a......n times =na.

From the above table

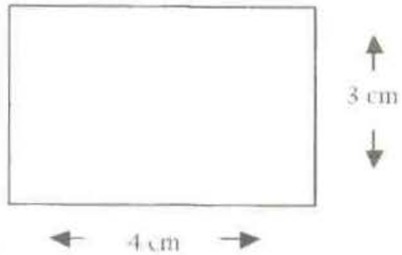
Perimeter of a regular polygon = Number of sides × length.

Exercise 17.1

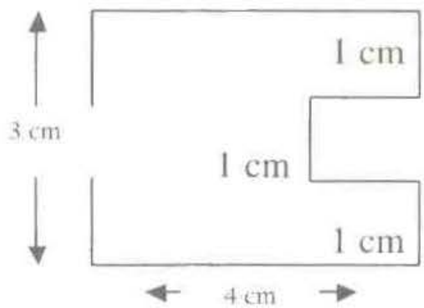
1. Find the perimeter of each of the following figures.

(a)

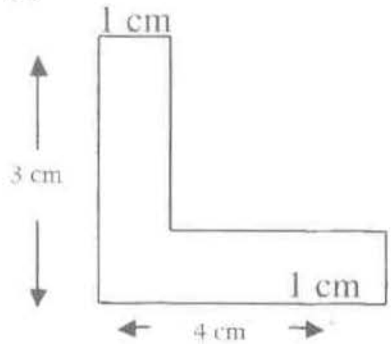
(b)



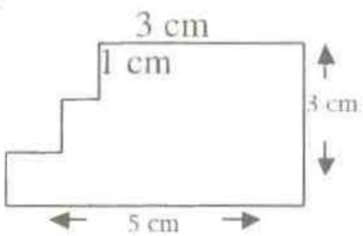
(c)



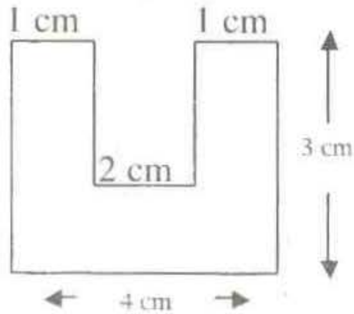
(d)



(e)



(f)

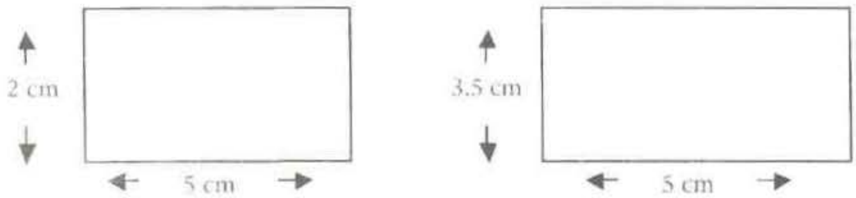


2. Find the perimeter of each of the following regular polygons.

a) Triangle, length of the side = 3 cm.
b) Triangle, length of the side = 4.2 cm.
c) Square, length of the side = 5 cm.

d) Square, length of the side = 3.5 cm.
e) Pentagon, length of the side = 4.9 cm.
f) Pentagon, length of the side = 5 cm.
g) Hexagon, length of the side = 3.2 cm.
h) Hexagon, length of the side = 5.3 cm.

3. Find the perimeter of each of the following rectangles ?



4. How much is the perimeter of a rectangle whose length is 4 cm and breadth is half of the length ?

5. The perimeter of a rectangle is 16 cm. How much is the breadth if the length is 6 cm.

6. The perimeter of a square is 32 cm. How much is the length of its side ?

7. A square field has its side 6 cm

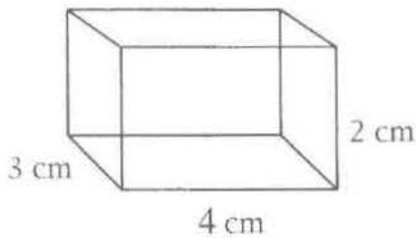
a. Find the perimeter of the square.
b. How long wire will be required to fence it 4 times ?

8. A wire 36 cm long is bent to form a square. What will be the length of the square ?

9. A wire 18 cm long is bent to form a rectangle in which the length is twice of its breadth. What are its length and breadth in cm ?

10. Can you do this, too ?

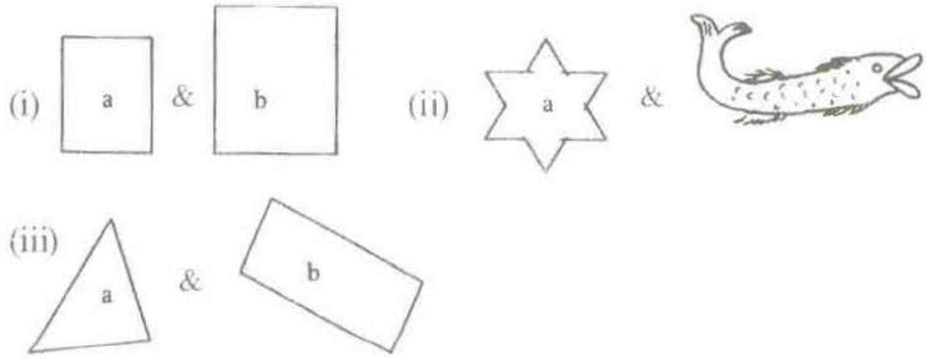
How long wire is required to make the given hollow figure ?



17.2 Area

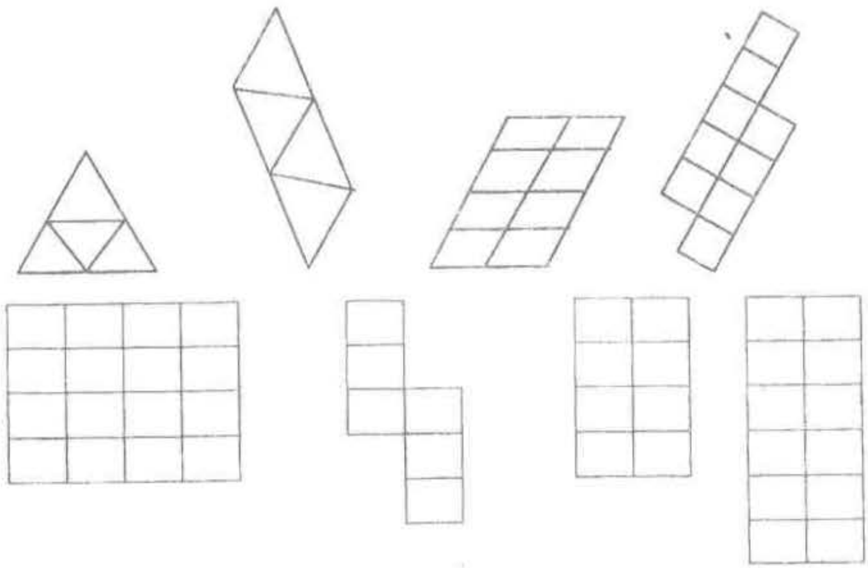
(a) Area and Unit of Area.

Which of the figure of the following occupies more place in the plane?

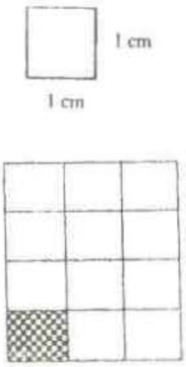


Which one of the following figures occupies more place in the plane? Here in (i), two figures are similar so it can be clearly seen that figure (b) occupies, more place than that of (a) in the plane. But in (b) and (c) figures being different in shape, so it is difficult to say by observation that which has occupied more place. How can it be found that which has occupied more place, let's discuss. Look at the following figures and guess which of the figures has occupied more place in the plane?

Here in each case, same unit it used for the objects to be compared, so it can be easily said which figure is bigger in each pair. How?



The figure on the right is a square of 1 cm × 1 cm. It can be used to compare or to know that how much place is occupied by an object in a plane. This is called the square unit and is written as 1 cm^2. (1 squared centimeter or 1sq.cm) the place occupied by an object. Area is measured in square units. The number of unit squares having 1 cm^2 each is 12 in the given figure of rectangle.

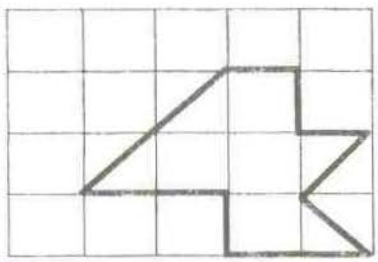


Therefore the area of rectangle is 12 sq. cm (12cm^2).

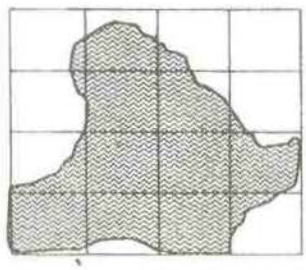
Example: 1

Find the are of the following figures by counting the unit of area.

a)



b)



Answer:

a) Number of complete square = 4
Number of half square = 4 = 2 complete square
Thus area = 4+2 = 6
Therefore, area = 6sq.cm

b) Number of complete squares = 4
Number of squares more than half = 5
Counting 1 for more than half and omitting less than half,
Approximate area = 4+5 = 9 squared units
Therefor, area = 9 squared cm. Answer

Hence, the method to know how many square units are there inside any figure. Is called the method finding out the area by counting the box.

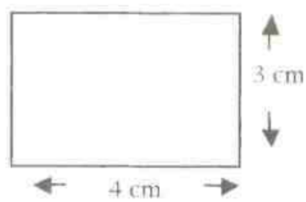
Exercise 17.2(a)

1. Find the area of each of the following by counting the squares.

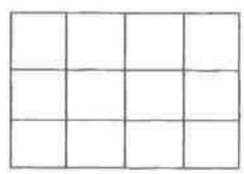
2. Find the approximate area of each of the following figures. (count 1 for more than half. Leave for less than half)

(b) Area of Rectangle.

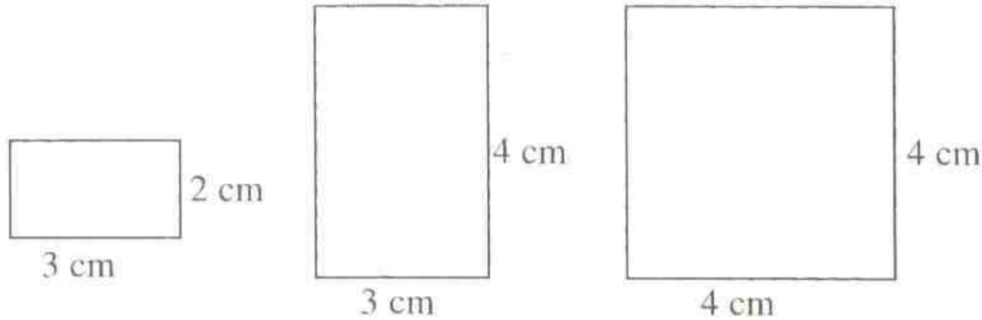
In the figure a rectangle is given whose length is 4cm and breadth is 3cm. How many squares of 1 squared cm are there in the figure? In this problem, by considering by the method of counting squares,



Area of the rectangle = 12sq. cm.
Again, if length is multiplied by breadth
Length X breadth = 4cm ? 3cm
= 12sq.cm



Find the area of such three rectangles having different length and breadth by the method of counting the box and multiplying length and breadth.



Is the same area found doing by both the method?

Thus, area of a rectangle $A = l \times b$
In any square, length and breadth are equal

Thus, length = breadth. Then,
Area (A) $= l \times l = l^2$

Example: 1

Find the area of a rectangle whose length is 5 cm and breadth is 4cm.

Answer:
Length (l) = 5cm
Breadth (b) = 4cm
Area (a) = ?

Now,

$$A = l \times b$$
$$= 5 \text{ cm} \times 4 \text{ cm}$$
$$\therefore \text{Area} = 20 \text{ cm}^2$$

Example: 2

If the area of a rectangle whose length is double of its breadth is 18cm^2,
(a) How long are the length and the breadth?
(b) How long is its perimeter?

Answer:

(a) Here, breadth = b cm and length = 2b cm and Area (A) = $18cm^2$

Now, A $= l \times b$
Or 18 $= 2b \times b$
Or $b^2 = \frac{18}{2}$
Or $b^2 = 9$
$\therefore$ b $= 3 (\text{as } b^2 = 9)$

Thus, length $l = 2b = 2 \times 3 = 6$ cm

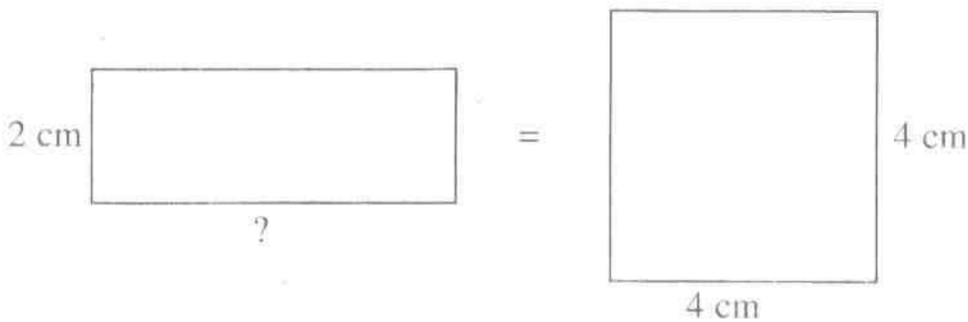
Therefore, length = 6 cm, breadth = 3 cm

(b) perimeter $= 2(l+b)$
$= 2(6+3)$
$= 18$ cm.

Therefore, Perimeter = 18 cm.

Example: 3

The side of a square is 4 cm. Find the length of a rectangle whose breath is 2 cm, and the area is equal to that of the square.

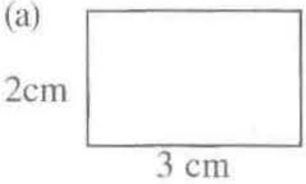


Here, length of a square $(l) = 4$ cm
Area (A) $= l^2 = (4)^2$ 16 cm^2.
Breadth of the rectangle (b) = 2 cm
Length of the rectangle (l) =?
Now, $A = l \times b$ Or, $16 = l \times 2$
Thus, length of the rectangle $(l) = 8$ cm. Answer

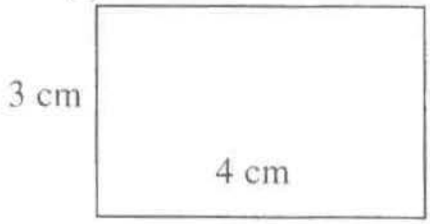
Exercise 17.2 (b)

1. Find the area of each of the following figures.

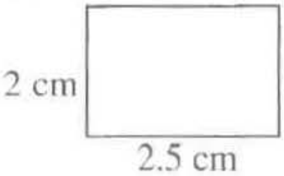
(a)



(b)



(c)



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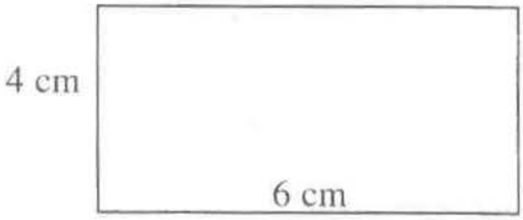
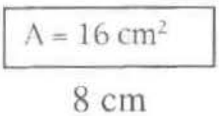
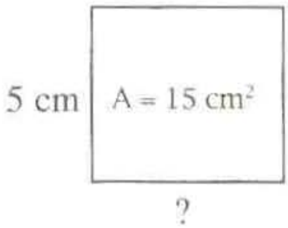


2. Find the unknown side of each of the following figures.

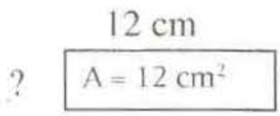
(a)



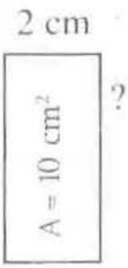
(b)



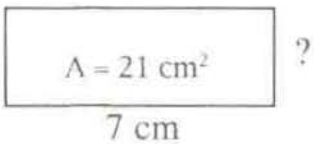
(c)



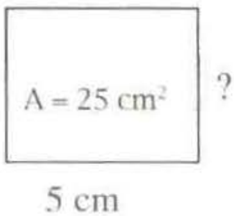
(d)



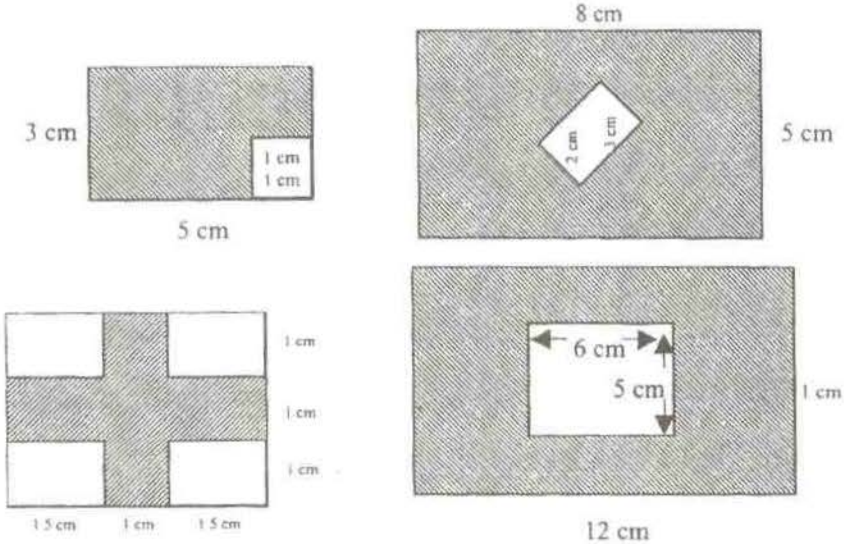
(e)



(f)



3. How much is the area of the shaded portion in the following figures.



4. Find the area and the perimeter of a square whose side is 6 cm.

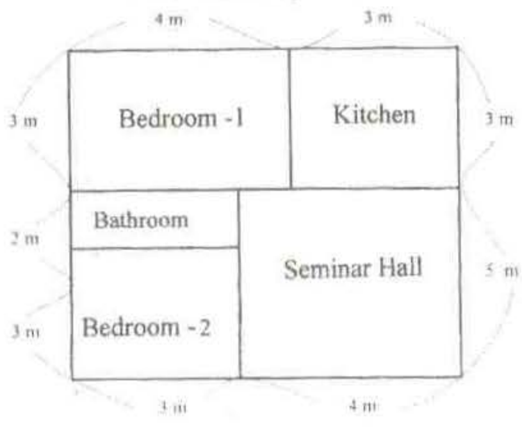
5. The length of a rectangle is three times of its breadth. If the area is 12 cm^2, how much is its perimeter?

6. The area of a square and a rectangle are equal. The area of a square is 16 cm^2 and the side of a square is half the length of the rectangle. How much is the breadth of the rectangle?

7. A construction planning of a house is given in the figure.

   a. Find the separate area of meeting hall, kitchèn, first bedroom, second bedroom.

   b. Find the total area covered by the house.



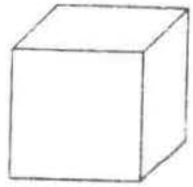
17.3 Volume of Cuboid and Cube

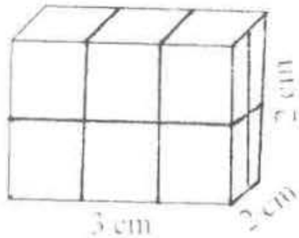
Look at the figure and discuss.

How much rice is there in the pot?
How much space is occupied by a chalk box?

The space occupied by any object is called the volume of the object.

As shown in the figure, count the number of smaller blocks given in the big block.





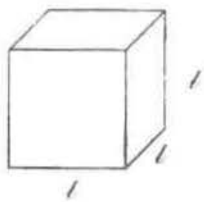
Big block = 12 small blocks
Measure the length, breadth and height of the small blocks

Here, length = 1 cm,
breadth = 1 cm,
height = 1 cm.

$\therefore$ Volume of a small block = 1 cubic cm.

Thus, in a big block there are 12 small blocks.
So volume = 12 cubic cm.

Now, measure the length, breadth and height of the big block.
Length of the big block = 3 cm, breadth = 2 cm , height = 2cm
Thus, length × breadth × height of a cuboid is
= 3 cm × 2 cm × 2 cm
= 12 cubic cm



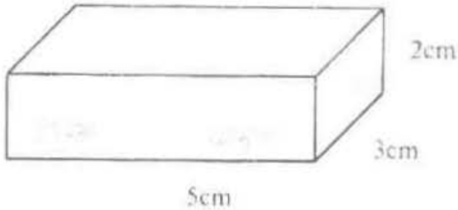
Thus, volume of the cuboid = length × breadth × height.
How can the volume of the cube be found out? Think over it

The length, breadth and height of a cube are equal
Volume = length × breadth × height
= $(\text{length})^3$

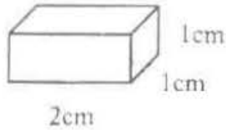
Exercise 17.3

1. How much will be the volume?

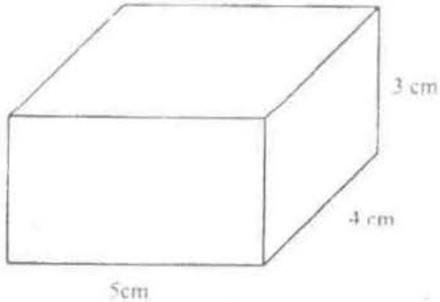
(a)



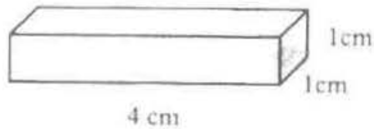
(b)



(c)



(d)



2. Find the volume of:

   a) A cuboid of length = 3 cm
   breadth = 2 cm
   height = 5 cm

   b) A cube of side 4 cm

3. Find the volume of a cuboid whose length is 4 cm, breadth is 3 cm and height is 2cm.

4. Find the volume of cube whose side is 5cm.

5. Find the length of a cubical box whose volume is 512 cubic cm.

6. The volume of a cuboid is 250 cubic its length is twice of the breadth and the height is 5 cm, find the length and the breadth of the cubiod.

18. Symmetry figures and design of polygons.

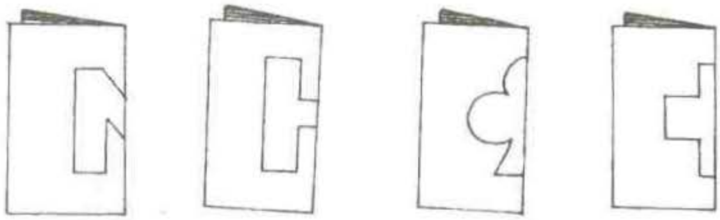
18.1 Symmetry figures

Fold a sheet of paper in two equal parts and sketch as shown in the figure.

Separate the sketch part by cutting the boundary line of the sketch by a pair of scissors. Now open and see the cut part,

What type of figure is formed ?
Isn't it like a leaf ?

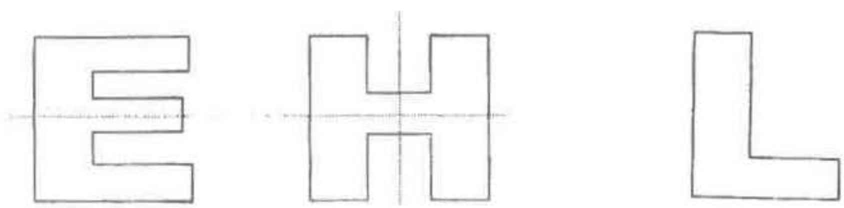
Fold the paper and sketch each of the following. Look at the figures and see what kind of figures are formed when they are cut as above.



(a) (b) (c) (d)

Each of these figures can be fold in equal parts. The figures which can be folded in two equal parts are called figures having line of symmetry. The line about which the figures are folded is called axis of symmetry. Geometrical figures have one or more than one axis of symmetries.

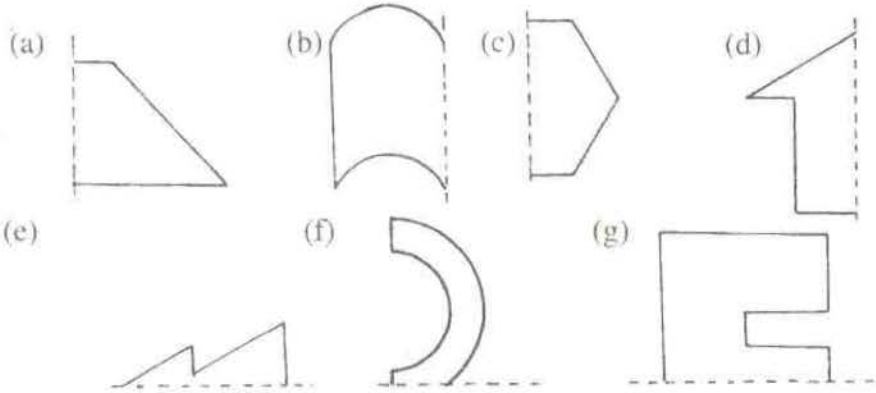
Can you give the examples of the figures which don't have axis of symmetries.



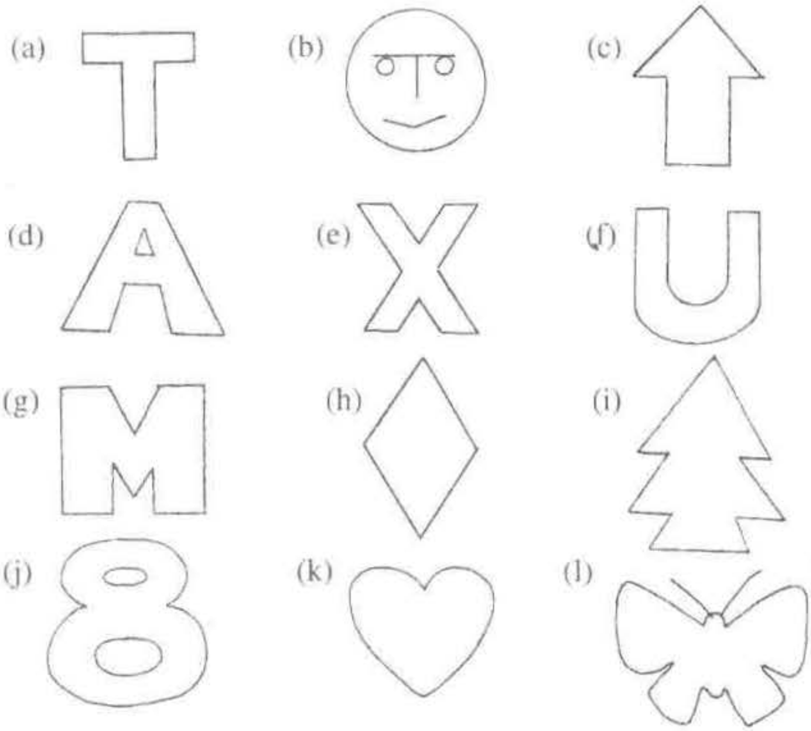
One axis of symmetry Two axis of symmetry Three axis of symmetry

Exercise 18.1

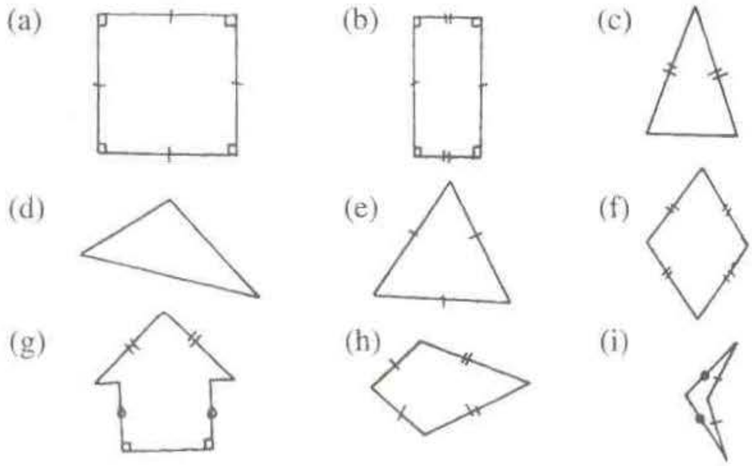
1. Axis of symmetry (Dot line) of each of the following figures is given below. Complete each of the figures.



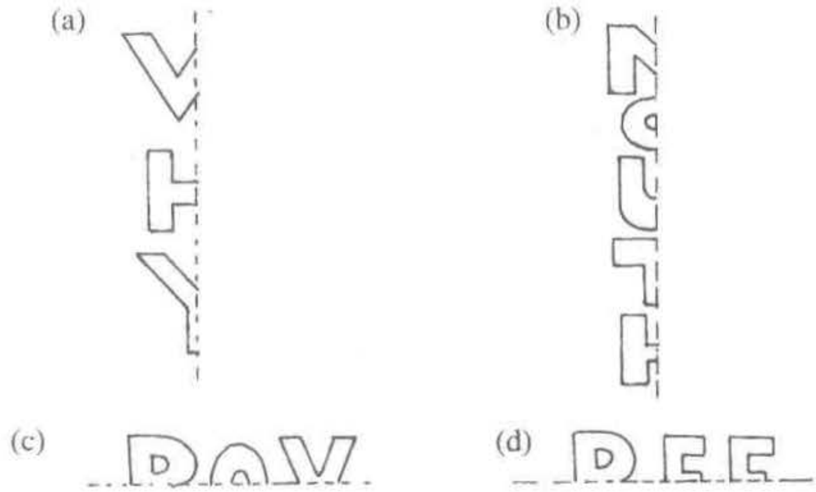
2. Draw the axis of symmetry in each of the following figures with dot line. Can there be more than one axis of symmetry in any figure?



3. Draw the axis of symmetry in each of the following geometrical figures.



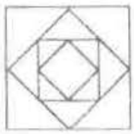
4. Complete the following English alphabets.



18.2 Design of Polygon

By drawing the polygons inside the polygons or by dividing a polygons into several polygons and by using different colours, attractive shapes and designs can be prepared. Few similar designs are given below. Try do decorate your classroom or house by using similar types of design.

1. Design of a Square.

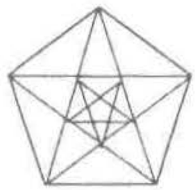


By using colour

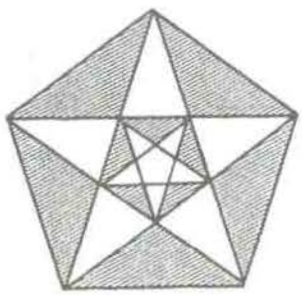
A large number of squares keep forming after joining the midpoints of the sides of every new square. Designs by same process can be applied in equilateral triangle and other polygons as well.

2. Design of a Pentagon

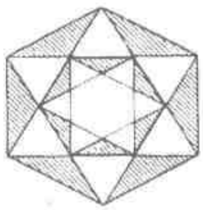
On extending the sides of a pentagon externally a star can be formed. Other stars can also be constructed along the sides of this star and using different colours an attractive design can be prepared.



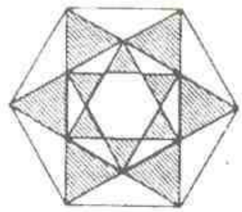
One is shown by colouring. Prepare different designs similarly and see.



3. Design of a hexagon.



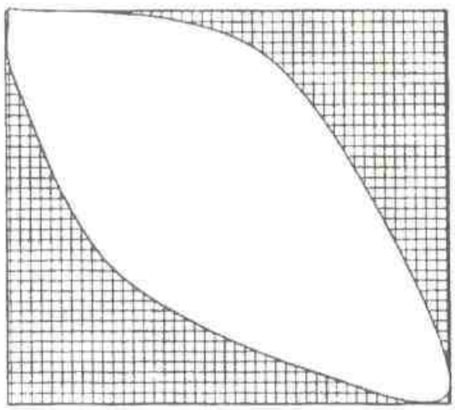
Hexagons inside a hexagon



Triangles inside a hexagon

How many trangles are there ? Count them.

4. Try to draw the same figure given below by joining the lines inside the square



Draw and see such type of linear samples or designs inside the triangle, quadrilateral and polygon. What type of designs are formed?

Answer

Exercise 1.1

1. Shrawan; the set of days.
2. Rs. 5; the set of coins.
3. China; the set of SAARC countries.
4. 17; the set of counting numbers upto 10.
5. Cube; the set of plane geometrical figures.
6. Match box; the set of circular objects.
7. Ball; the set of hexagon (Solid object having 6 faces)
8. Broom; the set of objects
9. 10; the set of prime numbers.
10. 32; the set of numbers exactly divisible by 5.
11. $\frac{3}{3}=1$; the set of fractions whose denominator is 3.
12. Equilateral triangle; the set of triangles whose only two sides are equal.
13. Round clock, the set of rectangular clock.
14. x^2+2x; the set of expression whose index is 1.
15. P; set of vowels.
16. a (×) b. (√) c. (×) d. (√)

Exercise 1.2

1. {Mechi, Koshi, Sagarmatha, Janakpur, Narayan, Bagmati, Gandaki, Lumbani, Dhaulaghari, Rapti, Karnali, Bheri, Sheti, Mahakali}
2. {1,2,3,4,5,6.7.8.9.10} or {I, II,III,IV,V,VI,VII,VII,IX,X,XII}.
3. {Baishak, Jestha, Asad, Shrawan, Bhadra, Ashwin, Kartik, Mangshir, Poush, Marg, Falgun, Chaitra}
4. {Red, Blue, White}
5. {Nepali, English, Mathematic, Social Studies, Science}
6. {Eastern region, Middle region, Western region, Mid western region, Far eastern region}
7. {1, 3, 5, 7, 9}
8. {0,5,10,15,20,25,30,35,40,45,50}

9. {2,3,5,7,9,11,12,17,19}

10. {4,6,8,9,10,12,14,15,16,18,20}

11. {3,6,9,12,15,18}

13. {7,12,17,22,27,32,42,47}

14. {1,2,3,4,5,6}

15. {1,5}

16. (i) B={0,1,2,3,4} (ii) C={3,6,9,12,15} (iii) D={2,4}
(iv) E={1,3,5} (v) F={1,5}

17. (i) The set of Roman numbers represent 1-10
(ii) The set of Even numbers from 10 to 20
(iii) The set of Odd numbers from 20 to 30
(iv) The set of first 5 small letter English alphabet.
(v) The set of instrument used to measure length in metric system.

18. (a) {x:x is a zone of Nepal} (b) {x:x is a dial number of a watch}

Exercise 1.3

1. (i) $\in$ (ii) $\notin$ (iii) $\in$ (iv) $\notin$ (v) $\notin$ (vi) $\in$
2. (i). $\in$ (ii) $\notin$ (iii) $\in$ (iv) $\notin$ (v) $\in$ (vi) $\notin$
3. (i) F,T,F,T,F,T (ii) T,T,F,T,T,T (iii) T,F,F.
4. (i) {e,i,h,s} (ii) {n,g,l} (iii) {m,a,t,c}

Exercise 1.4

1. (i) Finite, 4 (ii) Finite, 50 (iii) Infinite (iv) Infinite
2. (i) 0_1={1, 3, 5, 7, 9, 11, 13, 15, 17, 19} Finite, 10
   (ii) 0_2={21, 23, 25, 27, 29, 31, 33 ,35 ,37 ,39} Finite, 10
   (iii) 0_3={42, 43, 46, 48, 50 ....} Infinite
   (iv) T_1={3, 13, 23, 33, 43, 53 ....} Infinite
   (v) T_2={3, 13, 23} Finite, 3
   (vi) T_3={3, 13, 23, 33, 43} Finite,5

(vii) T_4={53, 63, 73, 83 ....} Infinite

(viii) {1, 6, 11, 16, 21, 26 ....} Infinite

(ix) {1, 6, 11, 16, 21, 26, 31, 35, 41, 46} Finite, 10

(x) {40, 41, 42, 43, 44, 45, 46, 47, 48, 140, 141 ....} Infinite

Exercise 1.5

1,2,3,4 show your work to the teacher.

5. A = {1, 2, 3, 4, 5, 6, 7, 8, 9}
   B = {12, 14, 16, 18, 20, 22, 24}
   C = {7, 14, 21, 28, 35, 42, 49}
   (a) 9, 7, 7 (b) B and C

6, 7, show your work to the teacher.

8. (a) 4,3,1,0,1,3,1 (b) n(B)=n(E) and n(C) =n(F)
   (c) All except n(B) and n(e) (d) (b) and ( )

9. Show your work to the teacher.

10. a. 3, b. 4, c. 8, d. 5

Exercise 2.1

1. (i) Place value of thousand, 6000
   (ii) Place value of ten, 60
   (iii) Place value of hundred, 600
   (iv) Place value of one, 6

2. (i) 579, 597, 795, 975
   (ii) 0,1 and 2, the smallest number is 102
   (iii) 7,8 and 9 the greatest number is 987

3. The greatest number is 73210
   The smallest number is 10237
   Sum is 83447

4. (i) 10999 (ii) 8999

5. Show your work to the teacher

Exercise 2.2

1. (i) 18 (ii) 49 (iii) 99 (iv) 75 (v) 660
   (vi) 70 (vii) 264 (viii) 1400 (ix) 1900 (x) 1990
   (xi) 5009 (xii) 10004 (xiii) 1000008

2. (i) XLIV (ii) LXXXIII (iii) CXLIX
   (iv) DCC (v) CMXC (vi) MCCCLI
   (vii) MMMCXLIX (viii) MMDCCLXIV (ix) $\overline{\text{V}}$DCLXX
   (vi) $\overline{\text{V}}$VIII (xi) $\overline{\text{X}}$VIII (xii) $\overline{\text{D}}$IX
   (xiii) $\overline{\text{M}}$

Exercise 2.3

1. (i) 95,432, Ninety five thousand four hundred and thirty two
   (ii) 64,35,278, Sixty four lakh thirty five thousand two hundred and seventy eight
   (iii) 1,00,00,501 One crore five hundred and one
   (iv) 43,26,75,683 Forty three crore twenty six lakh seventy five thousand six hundred and eighty three
   (v) 3,00,52,604 Three crore fifty two lakh six hundred and four
   (vi) 9,02,60,34,60,505 Nine kharbas two arabs six crore thirty four lakh sixty thousand five hundred and five
   (vii) 10,50,22,039 Ten crore fifty lakh twenty two thousand and thirty nine

2. (i) 5,34,03.769 (ii) 25,02,18,555 (iii) 30,94,22,00,600
   (iv) 6,00,43,00,82,064 (v) 3,03,03,03,03,303

3. (i) 4,73,200 Paisa- Four lakh seventy three thousand two hundred paisa
   (ii) 2,00,000 litre- Two lakh litres of kerosene oil
   (iii) 6,95,00,000 cm - Six crore gram of rice
   (iv) 10,00,00,000gm- The crore gram of rice

(v) 3,15,36,000 second - Three crore fifteen lakh and thirty six thousand seconds

4. (i) Rs. Four lakh twenty five thousand

(ii) Three crore forty lakh litre of kerosene oil

(iii) Thirty six lakh seventy thousand kg. of fertilizer

(iv) One One arabs ninety five crore metre of cloth

(v) Sixty crore five lakh unit of electricity

5. (i) 8,99,99,999 (ii) 10,99,99,999

6. 1

7. (i) 33,33,33,333 - Thirty three crore thirty three lakh thirty three thousand three hundred and thirty three

(ii) 40,000 - Forty thousand

(iii) 98,76,54,321- Ninety eight crore seventy six lakh fifty four thousand three hundred and twenty one.

(iv) 12,34,56,789- Twelve crore thirty four lakh fifty six thousand seven hundred and eighty nine.

Exercise 2.4

(a)	(1) 6	(2) 1	(3) 5	(4) 15	(5) 15
	(6) 56	(7) 1	(8) 4	(9) 48	(10) 39
	(11) 8	(12) 6	(13) 16	(14) 2	(15) 0
	(16) 0	(17) 0	(18) 1		

(b)	(1) 0	(2) 8	(3) 1	(4) 4	(5) 27
	(6) 4	(7) 35	(8) 2	(9) 1	(10) 0

Exercise 2.5

1. (ii), (iii), (v) and (vi)
2. (iv) and (vi) are divisible by 4
3. yes
4. (i) and (v)
5. (i) and (v), yes

6. (i) and (iii)

7. (i)

Exercise 2.6

1. (a) {2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24} (b) {3, 6, 9, 12, 15,18, 21, 24, 27}
   (c) {4, 8, 12, 16, 20, 24, 28} (d) {5, 10, 15, 20, 25, 30, 35}
   (e) {21, 28, 35, 42, 49} (f) {64, 72, 80, 88, 96}
   (g) {54, 63, 72, 81, 90, 99} (h) {6, 12, 18, 24, 30}
   (i) {11, 22, 33, 44, 55, 66, 77, 88, 99, 110} (j) {60, 72, 84, 96}

2. {6, 12, 18, 24} not equal set

3. (a) {9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99} (b) yes

4. (a) A ={2, 4, 6, 8, 10, 12, 14, 16, 18} (b) B ={3, 6, 9, 12, 15, 18}
   (c) C = {6, 12, 18} (d) D = {6, 12, 18} C and D are equal set

5. (a) yes (b) no

6. (a) $F_{(10)}$ = {1, 2, 5, 10} (b) $F_{(15)}$ = {1, 3, 5, 15}
   (c) $F_{(11)}$ ={1, 11} (d) $F_{(17)}$ = {1, 17}
   (e) $F_{(25)}$ = {1, 5, 25} (f) $F_{(35)}$ = {1, 5, 7, 35}
   (g) $F_{(30)}$ = {1, 2, 3, 5, 6, 10, 15, 30}

7. (a) $F_{(20)}$ ={1,2,4,5,10,20}
   (b) $F_{(2)}$ ={2, 4, 6, 8, 10, 12, 14, 16, 18, 20}
   (c) The intersection of $F_{(20)}$ and $F_{(2)}$ = {2,4,10,20}

8. (a) Overlapping, finite (b) overlapping, infinite
   (c) overlapping, finite (d) overlapping, finite (e) disjoint

9. {45, 90} 10. {0 Feet, 6 Feet, 12 Feet}

11. {50 km, 100 km, 150 km, 200 km ....}

12. Each 12 hours or again they ring together at 12 noon only.

Exercise 2.7

1. (i) Prime numbers (ii) composite numbers
   iii) 8 (iv) 14

(v) 22

(v) Maximum 5 prime numbers between 1 to 10 and minimum 1 prime number between 90 to 100.

2. (i) T (ii) F (iii) T (iv) T (v) F (vi) F (vii) T (viii) T

3. (i) P_{20}= {2,3,5,7,11,13,17,19} (ii) C_{20} = {4,6,8,9,10,12,14,15,16,18,10}
(iii) E_{20}= {2,4,6,8,10,12,14,16,18,20} (iv) O_{20}= {1,3,5,7,9,11,13,15,17,19}
(v) F_{20}= {1,2,4,5,10,20} (vi) A= {7,14}

4. Show your work to the teacher.

Exercise 2.8

1. (a) (i) $2 \times 3 \times 3$ (ii) $2 \times 2 \times 5$ (iii) 2×23 (iv) $2 \times 2 \times 2 \times 3 \times 3$
(b) (i) 3×7 (ii) $2 \times 3 \times 5$ (iii) $2 \times 2 \times 2 \times 7$
(iv) $2 \times 2 \times 2 \times 2 \times 5$ (v) $3 \times 5 \times 7$
(vi) $2 \times 2 \times 2 \times 2 \times 3 \times 3$ (vii) $5 \times 5 \times 11$ (viii) $5 \times 5 \times 5 \times 5$

2. (a) 2 (b) 1 (c) 72 (d) 5 (e) 25

Exercise 2.9(a)

1. (a) 2 (b)3 (c) 4 (d) 9 (e) 3 (f) 8
2. (a) 3 (b) 6 (c) 8 (d) 9 (e) 9 (f) 12
3. 9
4. 3 persons, 3 oranges and 4 apples.
5. 6, 2 lemons and 3 oranges
6. 10 litres
7. 3 meters
8. 5

Exercise 2.9(b)

1. (a) 15 (b) 12 (c) 24 (d) 40 (e) 24
(f) 42 (g) 42 (h) 36 (i) 18

2. (a) 18 (b) 36 (c) 24 (d) 70 (e) 140
(f) 120 (g) 120 (h) 72

3. 11 am

4. After 2 weeks, find out by seeing Month and Date.

5. 400 km.

Exercise 2.10

1. (a) 7, 8, 9, 10 (b) 1, 3, 5, 7, 9 ......
   (c) 1, 3, 6, 10, 15 (d) 4, 9, 16, 25 ......

2 and 3 show your work to the teacher.

Exercise 2.11

1. (a) 1 (b) 0 (c) 16 (d) 49 (e) 81
   (f) 9 (g) 36 (h) 100
2. (a) 1 (b) 4 (c) 9 (d) 16 (e) 81
   (f) 100 (g) 225 (h) 625
3. (a) 5 (b) 6 (c) 8 (d) 9 (e) 11
   (f) 12 (g) 18 (h) 25
4. (a) 2 (b) 3 (c) 5 (d) 3
5. (a) 4315 (b) 41
6. 2401
7. 35
8. Show your work to the teacher.
9. (a) 4 (b) 5 (c) 10 (d) 3
10. (a) 27 (b) 64 (c) 216 (d) 343 (e) 729 (f) 1000

Exercise 3.1

1. (a) Left (b) Right (c) Left (d) Right (e) -5 big (f) -8 small (g) 7
2. (a) 8 (b) 5 (c) 3 (d) 2 (e) 0
3. (a) 7 (b) < (c) > (d) > (e) < (f) >
4. 17
5. 6 km.

Exercise 4.1

1. (a) $\frac{3}{5}$ (b) $\frac{6}{10}$ (c) $\frac{9}{15}$ (d) $\frac{12}{20}$
2. (a) $\frac{6}{10}, \frac{9}{15}, \frac{12}{20}, \frac{15}{25}$ (b) $\frac{35}{40}, \frac{49}{56}, \frac{56}{64}, \frac{42}{48}$
3. (a) 2 (b) 3 (c) 5 (d) 10 (e) 10 (f) 20
4. (a) not equal (b) not equal (c) equal fraction (d) equal fraction
5. (a) $\frac{1}{4}$ (b) $\frac{7}{8}$ (c) $\frac{7}{22}$ (d) $\frac{13}{19}$ (e) $\frac{2}{3}$ (f) $\frac{3}{5}$
6. (a) $<$ (b) $=$ (c) $>$ (d) $>$ (e) $=$ (f) $<$
7. (a) $\frac{1}{4} < \frac{1}{3} < \frac{1}{2}$ (b) $\frac{3}{4} < \frac{4}{5} < \frac{9}{10}$
   (c) $\frac{1}{6} < \frac{2}{9} < \frac{5}{12}$ (d) $\frac{3}{10} < \frac{7}{20} < \frac{11}{30}$
8. Samina eat more bread.
9. From taxi

Exercise 4.2

1. (i) $\frac{3}{5}$ (ii) $\frac{1}{2}$ (iii) $\frac{3}{4}$ (iv) 4 (v) $9\frac{1}{7}$ (vi) $11\frac{7}{15}$
2. (i) $\frac{2}{5}$ (ii) $\frac{1}{6}$ (iii) $1\frac{1}{4}$ (iv) 2 (v) $2\frac{1}{5}$ (vi) $10\frac{1}{2}$
3. (i) $1\frac{1}{6}$ (ii) $\frac{7}{8}$ (iii) $\frac{7}{18}$ (iv) $1\frac{1}{4}$
   (v) $4\frac{1}{4}$ (vi) $4\frac{3}{20}$ (vii) $6\frac{7}{12}$ (viii) $8\frac{3}{4}$
4. (i) $1\frac{1}{6}$ (ii) $\frac{7}{20}$ (iii) $\frac{5}{18}$ (iv) $1\frac{1}{4}$ (v) $2\frac{9}{16}$
   (vi) $1\frac{1}{2}$ (vii) $1\frac{7}{30}$ (viii) $7\frac{7}{30}$ (ix) $4\frac{17}{36}$
5. (i) $\frac{5}{12}$ (ii) $3\frac{1}{4}$ (iii) $1\frac{7}{12}$ (iv) $6\frac{1}{4}$
6. $\frac{1}{2}$ part

7. $\frac{1}{4}$ part

8. $\frac{1}{10}$ part

Exercise 4.3

1. (a) $\frac{1}{2}\times\frac{2}{3}$ (b) $\frac{2}{3}\times\frac{2}{6}$ (c) $\frac{3}{8}\times\frac{2}{3}$

2. (a) $\frac{1}{15}$ (b) $\frac{4}{15}$ (c) $\frac{1}{12}$ (d) $3\frac{11}{18}$ (e) $\frac{3}{4}$ (f) $9\frac{5}{8}$

3. (a) $\frac{1}{5}$ (b) $\frac{2}{7}$ (c) 25 cm (d) Rs. 1.10

4. Show your work to the teacher.

5. (a) 2 (b) 18 (c) 25 (d) 2
   (e) $1\frac{3}{5}$ (f) $1\frac{3}{13}$ (g) 2 (h) $1\frac{1}{3}$ (i) $2\frac{1}{4}$

6. Rs. 35

7. 11 km.

8. 24 times

9. 40

10. 20 times

11. 6

Exercise 4.4

1. (a) $\frac{3}{4}$ (b) $\frac{31}{50}$ (c) $1\frac{1}{20}$ (d) $2\frac{23}{40}$ (e) $\frac{11}{12}$ (f) $\frac{94}{105}$
   (g) $1\frac{1}{8}$ (h) $\frac{29}{44}$ (i) $\frac{20}{27}$ (j) $2\frac{41}{42}$ (k) $4\frac{1}{12}$

2. (a) $\frac{2}{9}$ (b) $7\frac{1}{6}$ (c) $5\frac{1}{3}$ (d) $3\frac{13}{21}$

3. (a) $\frac{2}{9}$ part (b) $1\frac{1}{4}$ (c) $\frac{3}{4}$ (d) $8\frac{11}{20}$ (e) Rs. 22.50

Exercise 4.5

1. (a) 1.375 (b) 0.271 (c) 2.444 (d) 12.916 (e) 3.312
2. (a) $\frac{1}{2}$ (b) $\frac{13}{10}$ (c) $\frac{251}{100}$ (d) $\frac{313}{20}$ (e) $\frac{7509}{1000}$ (f) $\frac{493}{40}$

Exercise 4.6

1. (a) 5.84 (b) 51.92 (c) 1.473 (d) 29.64 (e) 19.509
   (f) 54.76 (g) 27.1
2. (a) 2.58 (b) 6.85 (c) 7.012 (d) 9.056 (e) 1.164
   (f) 8.4 (g) 0.901 (h) 3.4 (i) 6.176
3. (a) 2.122 (b) 5.804
4. Rs. 2.50
5. (a) 12.8 cm (b) 54.8 cm
6. (a) Rs 7.50 (b) Rs. 2.50
7. 24.25 km
8. 0.75

Exercise 4.7

1. (a) 12, 120,1200 (b) 105, 1050, 10500 (c) 1.2, 12, 120
   (d) 0.25, 2.5, 25 (e) 3.45, 34.5, 345 (f) 1, 10, 100
2. (a) 123.4, 12.34, 1.234 (b) 36.05, 3.605, 0.3605
   (c) 5.82, 0.582, 0.0582 (d) 4.85, 0.485, 0.0485
   (e) 0.005, 0.0005, 0.00005 (f) 0.15, 0.015, 0.0015
3. Show your work to the teacher.
4. (a) 1.5 km (b) 0.15 km (c) 0.015 km
5. 0.022 km
6. 0.675 kg.

Exercise 4.8

1. (a) 13.8 b) 4.8 (c) 13.5 (d) 0.84
   (e) 9.9 (f) 9.9 (g) 8.896 (h) 5.828

2. (a) 0.8 (b) 0.11 (c) 2.4 (d) 0.39 (e) 0.81 (f) 0.309

3. (a) 0.3 (b) 0.154 (c) 2.76 (d) 4.2 (e) 1.155 (f) 5.055

4. 5.1 m

5. 2.3 m, 52.9 m^2 (Square m)

Exercise 4.9

1. (a) 2.6 m (b) 3.6 (c) 15.5 (d) 27.6
2. (a) 3.63 (b) 12.59 (c) 17.42 (d) 13.03
3. (a) 5.325 (b) 6.543 (c) 6.415 d) 17.343
4. (a) 0.333 (b) 0.667 (c) 0.167 (d) 2.522
5. (a) 6 cm (b) 13 cm (c) 17 cm (d) 56 cm
6. (a) Rs. 6 (b) Rs. 13 (c) Rs. 26 (d) Rs. 24
7. (a) 46 km (b) 148 km (c) 15 kg (d) 17 kg

Exercise 5.1

1. (a) 1000 mm (b) 1300 mm (c) 1240 mm (d) 300 cm
   (e) 3000 gm (f) 368000 mg (g) 1.35 kg (h) 0.000075 kg
   (i) 2000 *ml* (j) 3751 *ml* (k) 2.756 *l* (l) 18000 sec
   (m) 11760 sec (n) 18540 sec (o) 0.1014 sec (p) 24 month
   (q) 4 years
2. (a) 0.262 m (b) 26.2 cm
3. 70 cm 4. 0.4 cm 5. 25 kg
6. 200 g 7. 100 g 8. 180 *l*
9. 888000 mm^3 10. 6 bottles 11. 10 days
12. 240000 m 13. 1 km per min.

Exercise 5.2

1. (a) 165 Paisa (b) 306 paisa (c) 350 paisa (d) Rs. 0.80
   (e) Rs. 21.46 (f) 0.24
2. (a) Rs. 60 (b) Rs. 33 (c) Rs. 112.50 (d) Rs. 62.50
3. Rs. 11.10 4. Rs. 750 5. Rs. 304 6. Rs 276
7. Rs. 952.50 8. Rs. 24,216

Exercise 6.1

1. (a) $\frac{20}{100}$ (b) $\frac{75}{100}$ (c) $\frac{84}{100}$ (d) $\frac{68}{100}$ (e) $\frac{100}{100}$
2. (a) $\frac{3}{25}$ (b) $\frac{1}{4}$ (c) $\frac{21}{50}$ (d) $\frac{17}{20}$ (e) $\frac{4}{25}$
   (f) $\frac{9}{20}$ (g) $\frac{13}{20}$ (h) $\frac{9}{10}$ (i) $\frac{1}{5}$ (j) $\frac{7}{20}$
3. (a) 40% (b) 5% (c) 48% (d) 135% (e) 74%
   (f) 10% (g) 80% (h) 25%
4. (a) $\frac{4}{25}$ (b) 16%
5. 70%
6. (a) 70% (b) 30%
7. 60% 8. 60%
9. 68%

Exercise 6.2

1. (a) 4:7 (b) 23:12 (c) 1:3 (d) 1:5 (e) 7:8 (f) 1:2
   (g) 20:33 (h) 1:4 (i) 3:20 (j) 1:25 (k) 1:4 (l) 1:10
2. (a) 4:3 (b) 3:4
3. (a) 2:3 (b) 3:2 (c) 1:1
4. $\frac{4}{6} = \frac{8}{12} = \frac{20}{30} = \frac{24}{36} = \frac{40}{60}$
5. (a) 105:94 (b) 94:105 (c) 105:199
6. Breadth 12 m
7. (a) breadth of a room = $\frac{14}{3}$ m, (b) perimeter = $23\frac{1}{3}$ m
   (c) area = 36.667 m^3
8. 10 9. 12 10.20

Exercise 7.1

1.	(a) Rs 25	(b) Rs. 406	(c) Rs. 22	(d) Rs 127
2.	(a) loss Rs. 45	(b) profit Rs. 206	(c) loss Rs. 760	(d) profit Rs. 185
3.	Gain Rs. 5	4. Rs. 395	5. Rs. 20	6. Loss, Rs.6.50
7.	profit Rs. 1.20	8. profit Rs. 60		

Exercise 7.2

1.	(a) Rs. 40	(b) Rs. 73	(c) Rs. 750	(d) Rs. 375
2.	Rs. 280	3. Rs. 185	4. Rs. 1950	5. Rs. 50
6.	Rs. 720	7. Rs. 1405		

Exercise 8.1

1.	(a) Rs. 375	(b) Rs. 1001	(c) Rs. 22750	(d) Rs. 14278.50
2.	(a) Rs. 20	(b) Rs. 18	(c) Rs. 31	(d) Rs. 25
3.	Rs. 60	4. Rs. 144	5. Rs. 950	6. Rs. 18
7.	Rs. 5	8. Rs. 1125	9. 25 paisa	10. Rs. 8

Exercise 8.2

1. (a) (ii) Rs. 24 (iii) Rs. 40 (b) (iv) Rs. 10 (vi) Rs. 50
   (c) (vii) Rs. 20 (viii) Rs. 60

2.	Rs. 240	3. Rs. 210	4. Rs. 120	5. Rs. 270	6. Rs. 1350
7.	Rs. 1360	8. Rs. 2400	9. Rs. 5425	10 Rs. 26000	

Exercise 9

1.	Rs. 75	2. Rs. 60	3. Rs. 200	4. Rs. 450	5. Rs $3\frac{1}{3}$
6.	Rs. 73.50	7. Rs. 50	8. Rs. 72	9. Rs. $333\frac{1}{3}$	10. Rs. $\frac{PNR}{100}$

Exercise 10.1

1. Show your work to the teacher 2. Show your work to the teacher

3. (i) No (ii) 9 (iii) 14 (iv) 7 (v) No
4. (i) 13 (ii) 12 (iii) 1 iv) 500 *ml*

Exercise 10.2

1. Show your work to the teacher. 2. Show your work to the teacher.
3. Show your work to the teacher.
4. (i) Monday (ii) Saturday (iii) Equal (iv) Tuesday
   (v) 175 (vi) $22\frac{6}{7}$ (vii) 50
5. (i) maximum-house, minimum-bus
   (ii) Truck and Bicycle, Motor and Van.
   iii) 80 iv) 15 v) 6 vi) 6

Exercise 11.1

1. (i) Variable (ii) constant (iii) constant (iv) constant
   (v) variable (vi) constant.
2. (i) 5,6,7,8 (ii) 4 (iii) 22,24,26,28 (iv) 4
3. (i) variable (ii) constant (iii) variable (iv) constant
4. (i) both are constant (ii) y (iii) 1 (iv) 19
5. (i) constant (ii) constant

Exercise 11.2

1. $x+2$, $y-2$, ab, $\frac{3}{z}$
2. (i) $5-x$ (ii) $5+y$ (iii) $x-15$ (iv) $4y+5$ (v) $3z \div y$
   (vi) $2x$ vii) $x-y$ (viii) $6y+z$ (ix) $\frac{m}{n}+p$
3. (i) $\rightarrow$ f (ii) $\rightarrow$ g (iii) $\rightarrow$ e (iv) $\rightarrow$ c
   (v) $\rightarrow$ a (vi) $\rightarrow$ b
4. Rs. $(8x+12y)$ 5. Show your work to the teacher.

Exercise 11.3

1.	8	2. 11	3. 12	4. 13	5. 25.1
6.	12	7. 61	8. 12	9. 10	10. 154
11.	216				
12.	(a) 1	(b) 5	(c) 3	(d) 3	(e) 16
	(f) 3	(g) 35	(h) 48	(i) 150	(j) 4
	(k) 3	(l) 4			
13.	(a) 6 cm	(b) 16 cm	(c) 12 cm	(d) 13 cm	(e) 10 cm
	(f) 17 cm				

14. (a) (3p+q) m and 13 m b) (3p+3q) m and 21 m c) (p+2q) m and 11 m

Exercise 11.4

1.	(a) Like term	(b) like term	(c) unlike term	(d) unlike term
	(e) like term			
2.	(a) $3m+7n$	(b) $8x^2y+13xy^2$	(c) $10xy+4yz$	
	(d) $10a+10b+12c$	(e) $5ab+4bc+5ca$	(f) $10x^2+9x+9$	
3.	(a) $-2a$	(b) $6a-3b-4c$	(c) $-y^2$	
4.	(a) $2x-3y$	(b) $18a-17b$	(c) $-x-7y$	(d) $2y^2-4xy$
	(e) $3a^2-7ab+7b^2$	(f) $-6b+8c$	(g) $-4a-2b$	
5.	(a) $3x$	(b)	(c) x	(d) $6x$
6.	(a) 9m	(b) 10.5 m	(c) 3m	(d) 18m

Exercise 11.5

1.	(a) ab	(b) $2ac$	(c) $3ay$	(d) y	(e) 0
2.	(a) $6a$	(b) $12b$	(c) $35c^2$	(d) $72d$	
	(e) $5ab$	(f) $3bc$	(g) $6c$	(h) $6pq$	
	(i) $8rs$	(j) $30a^2$	(k) $3bcd$	(l) $24bcd$	
	(m) $75abc$	(n) $36ac$	(o) $3yz$	(p) $6yz$	

3. (a) ab sq.cm (b) pq.sq.cm (c) 6xy sq.cm (d) $\frac{1}{6}$ rs sq.m

4. a) xyz cubic cm b) $6ab^2$ cubic cm

Exererise 11.6

1. (a) a^2+ab (b) $2ab+b^2$ (c) $2xy+6y^2$
   (d) $12ab+21b^2$ (e) $16xy+20y^2$ (f) $80a^2+56ab$
2. (a) $ax+bx$ (b) $4ab+6b^2$ (c) $4x^2+20xy$
3. (a) $14a^2+2ab$ (b) $20a^2+30ab$ (c) $80x^2+240xy$ d) $63a^2+140a$

Exercise 12.1

1. True	2. True	3. True	4. False
5. False	6. False	7. False	8. True
9. True	10. False	11. False	12. True

Exercise 12.2

1. (a) Open (b) True (c) True (d) Open
   (e) Open (f) False (g) Open (h) False
   (i) Open (j) Open
2. (a) 4 (b) 5 (c) 8 (d) 49
   (e) 8 (f) 3 (g) 10 (h) 25
   (i) 0 (j) 15 (k) 12 ((l) 16
3. (a) 29 (b) 1,3,5,15 (c) 11,13,17,19 (d) 30 (e) 0

Exercise 12.3

1. (a) 8 (b) 7 (c) 4 (d) 3
   (e) 4 (f) 5 (g) 20 (h) 21
2. (a) 8 (b) 3 (c) 14 (d) 13 e) 9
   (f) 10 (g) 5 (h) 6 (i) 7

Exercise 12.4

1. (a) 9 (b) 5 (c) 21 (d) 5
   (e) 12 (f) 21 (g) 21 (h) 2

	(i) 3	(j) 12	(k) 1	(l) 72
	(m) 1	(n) 5	(o) 6	(p) 10
	(q) 25	(r) 1		
2.	(a) $x = 8$	(b) $y = 0$	(c) $z = 15$	(d) $x = 9$
	(e) $p = 2$	(f) $x = 24$	(g) $x = 12$	(h) $n = 3$
3.	(a) 24	(b) 50	(c) 10	(d) 125
	(e) 6 m	(f) 25	(g) 15	

Exercise 12.5

1. (a) $<$ (b) $>$ (c) $>$ (d) $=$ (e) $=$

   (f) $<$ (g) $>$ (h) $<$ (i) $<$

2. (a) T (b) F (c) F (d) T

   (e) F (f) T (g) F (h) T (i) F

3. (a) 3 is not an odd number (b) Pokhara is not the capital of Nepal

   (c) 281 is not a prime number. (d) 120 in not exactly divisible by 6

   (e) Earth is not a star (f) 16 is not square of 4

   (g) $a+b > c$

   (h) (i) $a+c > b+c$ (ii) $a-c > b-c$ (iii) $ac \not< bc$ (iv) $\frac{a}{c} \not< \frac{b}{c}$

   (i) 8 is not a factor of 123

   (j) Every even number are not divided by 2

4. 4 and 5 show your work to the teacher.

Exercise 12.6

1. $A \rightarrow (2, 1)$ $b \rightarrow (1, 2)$ $C \rightarrow (1, 4)$ $D \rightarrow (2, 5)$ $E \rightarrow (3, 6)$

   $F \rightarrow (6, 5)$ $G \rightarrow (5, 4)$ $H \rightarrow (4, 3)$ $I \rightarrow (5, 1)$

2. (a) Triangle (b) Right angled triangle (c) isosceles triangle

   (d) quadrilateral (e) square (f) quadrilateral

   (g) flag

3. Show your work to the teacher.

4. S(10, 6) 5. (5, 4)

Exercise 13.1

1 and 2. show your work to the teacher

3. a) Triangle b) Rectangle c) National flag of Nepal d) star

4, 5, 6, 7, 8 and 9 show your work to the teacher

Exercise 13.2

1 and 2 show your work to the teacher

3. AB and AC are parallel

4. AB ∥ EF

5 (a) one (b) one

Exercise 13.3

1. Show your work to the teacher 2. Rectangle
3. Show your work to the teacher 4. Parallelgram

Exercise 14.1

Show your work to the teacher.

Exercise 14.2

1. a) Acute angle b) acute angle c) Right angle
   d) Right angle e) Reflex angle f) Reflex angle
2. Right angle: ∠ AED, ∠ DEF
   Acute angle: ∠EAB, ∠ ABC, outside CDE
   Straight angle: ∠ AEF
   Reflex angle: Outside ∠ ABC, outside ∠ CDE
   Inside ∠ BCD, outside ∠ BAE
3. ∠ AFD, ∠ BEF, ∠ CGF
4. a) True b) False c) True d) True e) False
5. Obtuse angle ∠ POR, Acute angle ∠ POQ
   Straight angle ∠ POQ

Exercise 14.3

Show your work to the teacher.

Exercise 15.1

1. (a) Scalene triangle (b) Isosceles triangle
   (c) Equilateral (d) Isosceles triangle
   (e) Scalene triangle (f) Equilateral
   (g) Isosceles triangle (h) Scalene
   (i) Equilateral
2. The sum of two sides is greater than the third side.
3. (a) No (b) No (c) Yes
4. (a) Acute angled triangle (b) Obtuse angled
   c) Right angled f) Right angled
   g) Obtuse angled h) Acute angled
5. a) ∠ B, AC b) ∠ B, AC c) ∠ A, BC
   d) ∠ A, BC e) ∠ B, AC f) ∠ B, AC
   g) ∠ A, BC h) ∠ A, BC and ∠ C, AB
6. The angle opposite to greater side is greater.
   The angle opposite to smaller side is smaller.
   The sum of three interior angles of a triangle is 180 or two right angle.

8.and 9. show your work to the teacher.

Exercise 15.2

Show your work to the teacher.

Exercise 17.1

1. (a) 10 cm (b) 14 cm (c) 16 cm (d) 14 cm
   (e) 16 cm (f) 18 cm
2. (a) 9 cm (b) 12.6 cm (c) 20 cm (d) 14 cm
   (e) 24.5 cm (f) 25 cm (g) 19.2 cm (h) 31.8 cm
3. (a) 14 cm (b) 17 cm
4. 12 cm 5. 2 cm 6. 8 cm
7. (a) 24 cm (b) 96 cm

8. 9 cm 9. 6 cm and 3 cm 10 36 cm

Exercise 17.2(a)

All units are in square.

1.	(a) 8	(b) 7	(c) 5	(d) 7	
	(e) 6	(f) 4	(g) $6\frac{1}{2}$	(h) 5	
	(i) 20	(j) 8	(k) 12		
2.	(a) 10	(b) 14	(c) 14	(d) 13	e) 24

Exercise 17.2 (b)

1.	(a) 6 cm^2	(b) 12 cm^2	(c) 5 cm^2	(d) 24 cm^2
2.	(a) 2 cm	(b) 3 cm	(d) 1 cm	(d) 5 cm
	(e) 3 cm	(f) 5 cm		
3.	(a) 14 cm^2	(b) 34 cm^2	(c) 6 cm^2	(d) 90 cm^2
4.	36 cm^2, 24cm	5. 16 cm	6. 2 cm	
7.	a) 2 cm^2, 9 m^2, 12m^2, 9m^2		b) 56m^2	

Exercise 17.3

1.	a) 30 cubic cm	b) 2 cubic cm	c) 60 cubic cm	d) 4 cubic cm
2.	a) 30 cubic cm	b) 64 cubic cm		
3.	a) 24 cubic cm			
4.	125 cubic cm			
5.	8 cm			
6.	length = 10 cm, breadth = 5 cm			

Exercise 18.1

Show your work to the teacher.