Geometry

Objectives : 1. Students will be able to differentiate between 2-D and 3-D shapes.

2. Will develop the understanding of the concept of angles in daily life.

4. Will be able to understand Right angle, Acute angle and Obtuse angle.

5. Will be able to understand symmetry of 2-D and 3-D shapes.

We have studied about straight and curve lines, sides and edges. In this chapter, we will study about point, line segment, ray, angle, right angle, 2-D and 3-D shapes.

7.1 Point, Line, Line Segment and Ray :

Point – Point is represented as (.). We can represent it with the tip of a pencil. We can name them with letters of English alphabet like A, B, C etc.
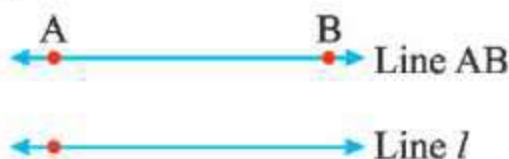
A•   B•

C•

Line – When a thread (or rope) is held between any two points A and B and is stretched endlessly in both directions then it forms a line.

A straight line neither has breadth nor has thickness. It goes endlessly in two opposite directions. We cannot show a line as a whole but we can represent it as a figure.

A   B   Line AB

Line l

Double arrows in the line AB shows that it can be extended infinitely in both directions. It has no end points.

Line Segment — If we take a part of the line then arrows are not marked, this finite part of line is called line segment. It has two end points.

A •————————————• B   Line Segment AB

Ray — In our daily life, we use word 'sun's rays. These rays comes from sun directly to the earth. Here a ray is a fixed track/path which has one end fixed and another end goes infinitely as shown in the figure :

Ray AB
A   B

A ray has no fixed length. Its name is written by taking two alphabets together. To represent a ray, starting point is named first and second point can be taken anywhere on ray.

> **Note :** ◆ Ray AB is different from BA.
> ◆ It has only one end point.

Activity

Manjeet and Ranjit are two friends. They enjoy playing together. One day they were making shapes with match sticks. They made different shapes with 6 match sticks without looking at one another's pictures.

(a)   (b)   (c)   (d)
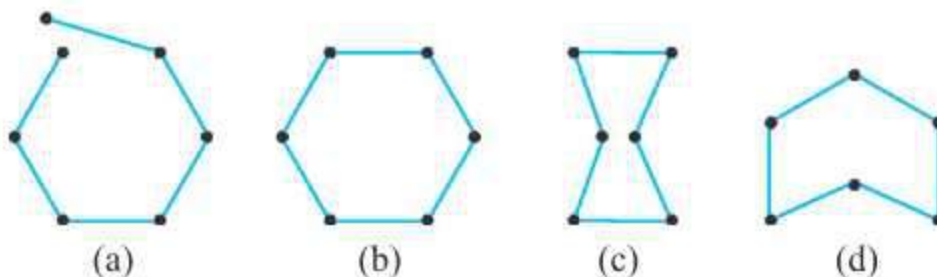
After looking at their shapes, Manjeet's elder sister Daljeet asks her "Which shapes are open or closed ?" "Can you also tell that how these closed figures are different from each other ?" [All are closed except fig (a)]

After getting no reply, Daljeet asks them to make any figure with two match sticks. They make the following figures.


Now Daljeet tells that the figures which you have made, have different angles. Manjeet and Ranjit ask her "Sister, what is an angle?" Daljeet explains that the point where both match sticks join together, an angle is formed.

Manjeet, "Ok Sister, that is why our closed figures were different because their angles were different."

- When two rays or line segments meet at a common point, it forms an angle. Common point is the vertex and both rays or line segments are called arms.

1. In the figure, angle of which colour is the smallest ?
2. Angles of which colours are equal ?
3. Make the closed figure with 4 match sticks by changing their angles.
4. With the help of 6 match sticks a figure of 6 is made. Now make this number as 9 by changing the position of 1 matchstick.
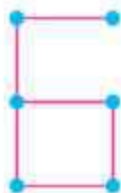
7.2 Naming of Angles

An angle can also be named by letters of English alphabet like other shapes. For example : The angle can be read as ABC and written as ∠ABC or ∠CBA (common vertex B is written in middle). So it can also be written as ∠B. Now take two match sticks and put in such a way that their edges meet at

one end. Now take one more pair of sticks and join the open ends of first pair. In this way, a closed figure is formed. Can you write the name of its different angles ?
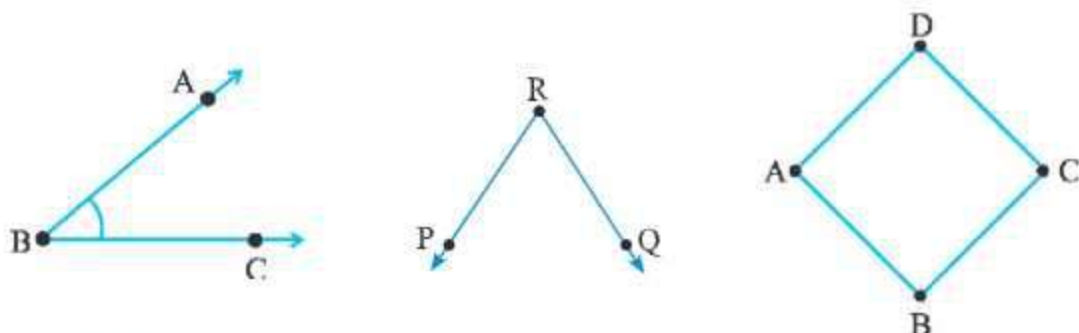

7.3 (Divider)

Activity

Teacher will ask the students to bring two sticks of ice cream. Fix their ends with the help of drawing pin in such way that they can revolve very easily. Now students will measure the different angles of different objects around them with the help of this instrument ?
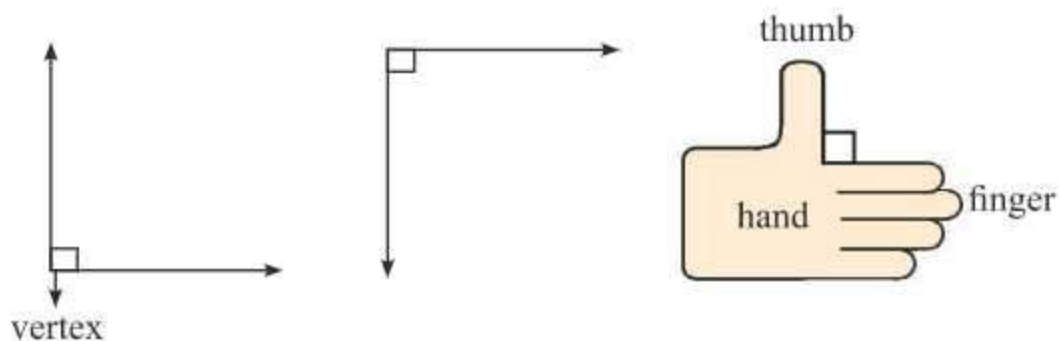
Do you have such instrument in your geometry box ? Measure the angle of edge of table and Math book and observe the divider. It opens like English alphabet 'L'.

Book

Table

This is a right angle, we write L for this.

That angle which looks like corners of book, rectangular door is called Right Angle. Its measure is always 90°.

vertex

thumb

hand

finger
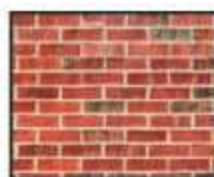
Activity

Take a square piece of paper and fold according to the given pictures.
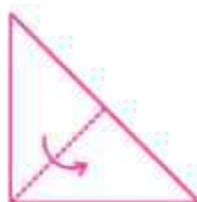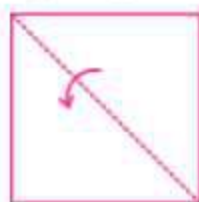
We can measure/identify any right angle with the help of a protractor given in geometry box.

7.4 Angle and its types

Rotation of a ray along a point is calld an angle. In easy words, common vertex between two rays forms an angle. Standard measurement of an angle is degree.

ray

angle

ray
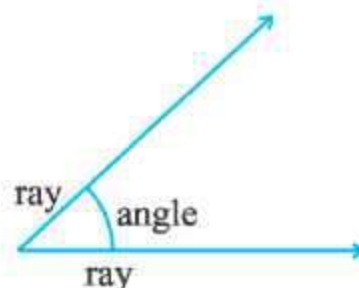
There are 7 types of angles : Zero angle, Acute angle, Right angle, Obtuse angle, Straight angle, Reflex angle, Complete angle. In this chapter, we will study only Acute angle, Right angle and Obtuse angle.

Teacher will write some English alphabets on the board and will ask students to identify them.

(a)   (b)   (c)
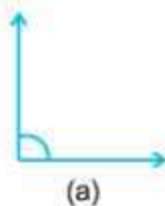
Which angle is of 90°, which angle is smaller than 90° and which angle is more than 90°.

Right Angle — An angle which has measurement of 90° is called Right Angle. Its symbol is ⌐ , as shown in figure (a) English alphabet L.

Acute Angle — An angle in figure (b) which is greater than 0° and smaller than 90° is called Acute Angle.

Obtuse Angle — An angle in figure (c) which is greater than 90° but smaller than 180° is called Obtuse Angle.

Activity

(A) Keep 10 books of Maths in a pile and one book in a slanting position as shown in the fig.

(B) Now do this by using 6 books. Take one ball and roll it from top to bottom.

 • On which slide, ball will roll fast ?

 • Which slide has smaller angle ?

Activity

Angle in a Playground.

Students, identify the different angles in the playground.
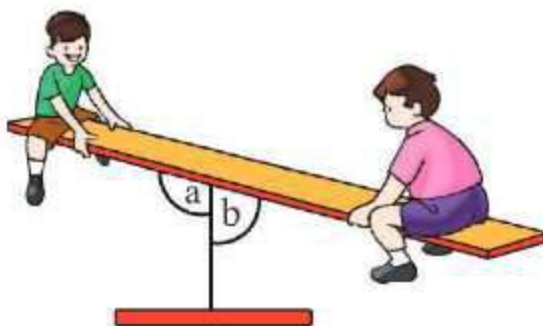
Identify ∠a and ∠b
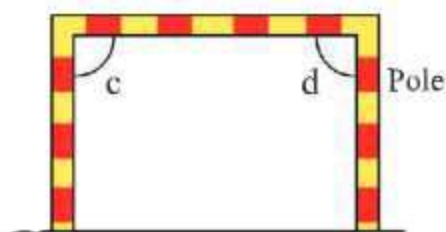
Identify ∠c and ∠d

Activity

Changing shapes

- Students, collect some match sticks and rubber of the valves of cycle tube.
- Remove the black part of the match sticks
- Make triangle with the help of three match sticks and values of the cycle tube
- With these sticks and pieces, make figure of 4, 5 and 6 sides.

Find, How many angles are there in each figure and mark them.

Now push each figure downwards with your finger. Is there any change in figure's angle ? Find out and write your answers in the following table.

Figure	Change in Angle (Yes/No)

- You can conclude from the changing figures that why triangles are used in towers/bridges ?
- Look out in your surrounding and find some places where triangles are used.

Example 1 : Out of following, which angles are acute angle, right angle or obtuse angle ?

(a)   (b)   (c)

(d)   (e)   (f)
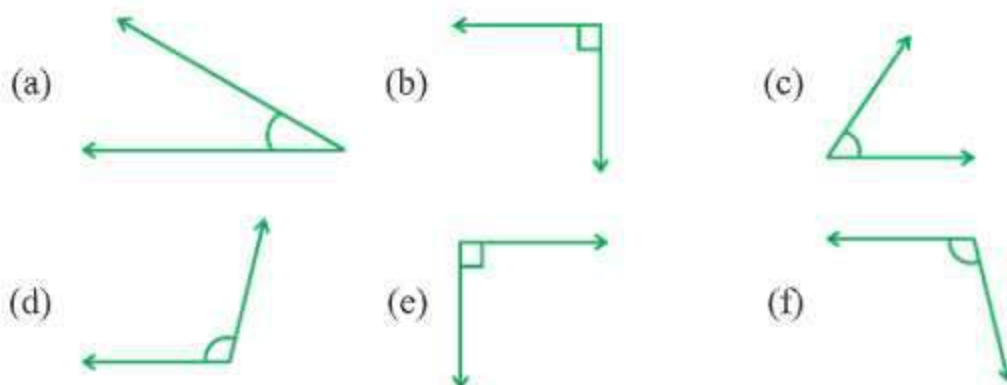
Solution : (a)
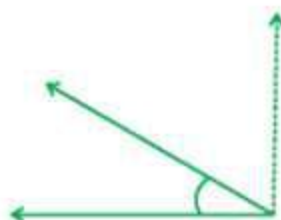
First of all, draw estimated straight dotted line for right angle. This angle is interior to right angle so it is an acute angle.
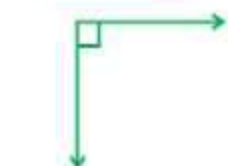
(b)

This is a right angle.

(c)
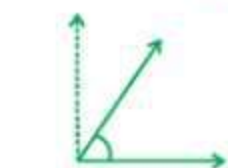
This angle is interior to right angle, so it is an acute angle.

(d)
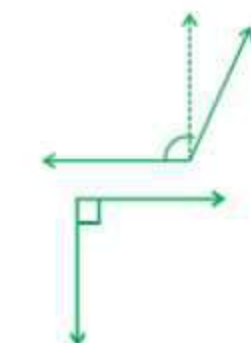
This angle is an exterior to right angle, so it is an obtuse angle.
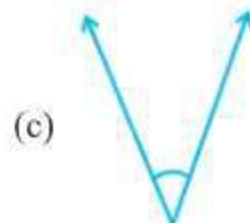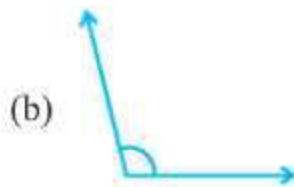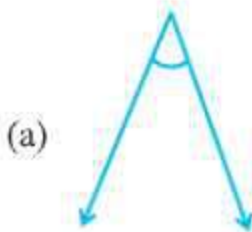
(e)

This is a right angle.
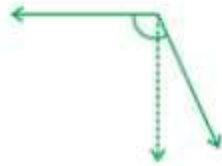
(f) This angle is exterior to right angle, so it is an obtuse angle.
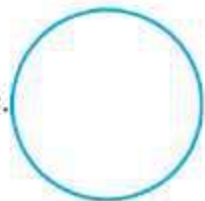
Exercise 7.1

1. **Identify the acute angle, right angle and obtuse angle in the following :**

(a)

(b)

(c)

(d)

(e)

(f)
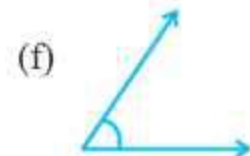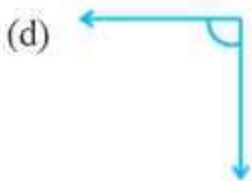
Activity

Let us make a Degree Clock.

1. Take a piece of paper and cut it in the shape of a circle.

2. Fold it into half.

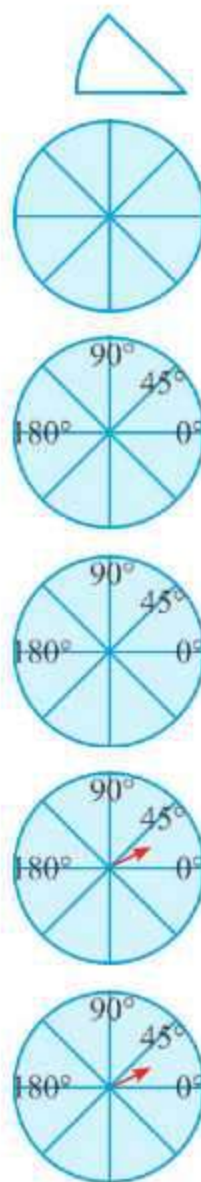3. Then fold it into one-fourth.

4. Again fold it one more time.

5. Open the page. You will see lines like this.

6. Write 0°, 45°, 90° and 180° as shown in picture.

7. Paste it on a cardboard.

8. Draw a mark from centre.

9. Draw a red mark with thick paper and fix it
   in this way so that it can be rotated.
   Your degree clock is ready.

♦ **Measure the right angle with your degree clock. Measurement of right angle is ....**

♦ Can you tell the degree of the following angles ?

   ♦ Half of right angle ....

   ♦ One-third of right angle ....
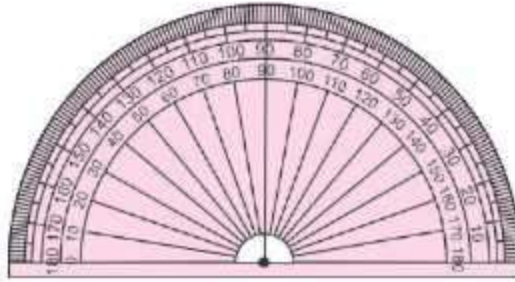
   ♦ Double of right angle ....

The angle of 90° is called a right angle.

PROTRACTOR

Teacher will show protractor (D) to the students and ask about it. Some students will reply that it is 'D'. It might be possible that some students can name it as protractor. Now the teacher will start his discussion.

Students, this is the instrument which is used in Maths. We call it Protractor.

We have discussed about acute and obtuse angles by estimation but now we will measure the angles in degree then tell surely whether it is acute or obtuse.

Features of Protractor :

♦ A Protractor looks like English alphabet 'D'. So it is also called 'D'.

♦ It has two scales. 1. Internal Scale 2. External Scale

♦ In internal scale 0, 10, 20 ...., 180 is written from left to right (clockwise)

♦ In External scale 180, 170, ... 10, 0 is written from left to right. (clock wise)

♦ Line which joins 0° to 180° is called Base line.

♦ Centre point is called centre of protractor.

7.5 Measurement of angles.

Students, now we will learn how to measure ∠XYZ

1. Place the centre point of the protractor on the vertex Y of the angle.
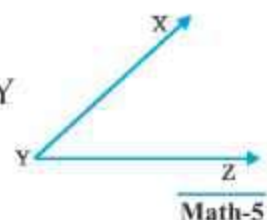
Adjust the protractor in such a way that the base line coincides with arm YZ of the angle.

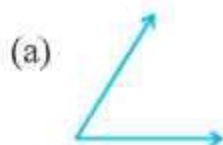2. Check the scale where the baseline lies on the points on $0°$.

3. Read the measure of the angle where the other arm YX crosses the external scale.
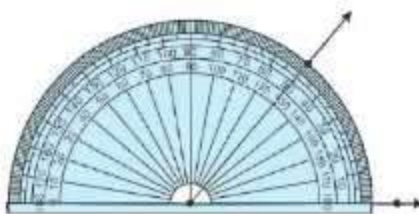
Here XY crosses at $50°$. So $\angle XYZ = 50°$.

Note Always see that scale, whose arm coincides with baseline at $0°$

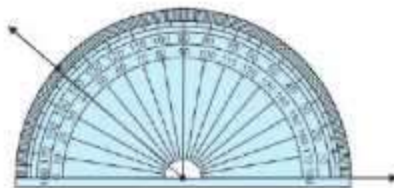**Example 1 :** Measure the following angle with the protractor.

(a)

(b)

Solution : (a)

This is $50°$. Check carefully it is not $130°$ because it is interior to right angle.

(b)

This is $140°$ not of $40°$. As it is exterior to right angle.

Example 2 : Find the acute and obtuse angles from the following :

(a) $48°$　　(b) $118°$　　(c) $125°$　　(d) $65°$

(e) $79°$

Solution : (a) $48°$　　This angle is lying in between $0°$ and $90°$. So it is an acute angle.

(b) $118°$　　This angle is lying in between $90°$ and $180°$. So this is an obtuse angle.

Geometry

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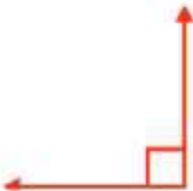
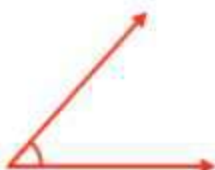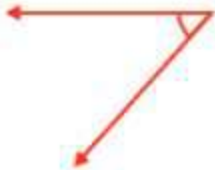(c) 125°   This angle is lying in between 90° and 180°.
             So this is an obtuse angle.

(d) 65°   This angle is lying in between 0° and 90°. So
             this is an acute angle.

(e) 79°   This angle is lying in between 0° and 90°. So
             this is an acute angle.

Exercise 7.2

1. **Measure the following angles using protractor :**

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)

(j)

2. **Draw the following angles by using protractor.**

(a) 15°   (b) 40°   (c) 42°   (d) 53°

(e) 65°   (f) 75°   (g) 90°   (h) 110°

(i) 117°   (j) 135°   (k) 157°   (l) 180°

3. **Pick out the acute angle, obtuse angle and right angle from the following :**

(a) 35°   (b) 89°   (c) 120°   (d) 100°

(e) 96°   (f) 74°   (g) 62°   (h) 166°

4. **Fill in the blanks :**

(i) An angle between 0° and 90° is called ....

(ii) 175° angle is .... angle.

(iii) The hands of a clock make an angle of .... at 3 a.m.

(iv) Measurements of an angle between North and South direction is ....

(v) An actue angle is .... than right angle.

5. **Tick the True and False.**

(i) Measurement of right angle is 90°.

(ii) Right angle is greater than acute angle but smaller than obtuse angle.

(iii) On the Internal and External scale of protractor, measurements are written up to 90°.

(iv) 85° is a right angle.

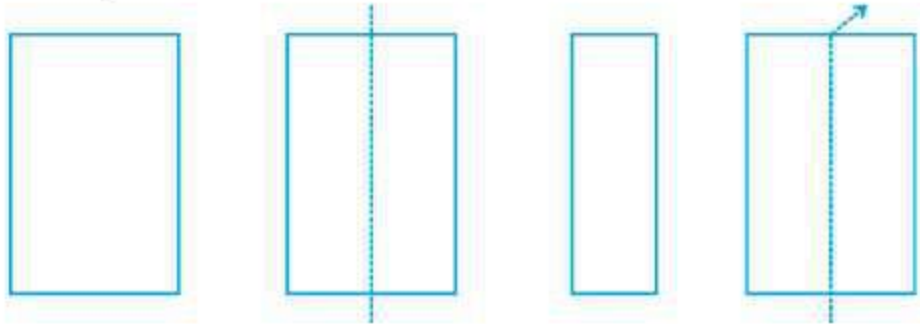(v) 115° is an obtuse angle.

(vi) 90° is an acute angle.

7.5 Symmetry

When a shape or a figure is divided into two parts of equal shape and size with a line then that line is called **symmetrical line**.
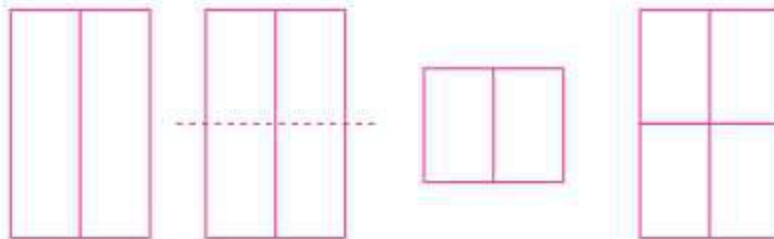
Teacher will take one paper and fold it along its length. After opening this paper, we shall see that the paper is divided into two equal parts. This is called symmetrical shape.
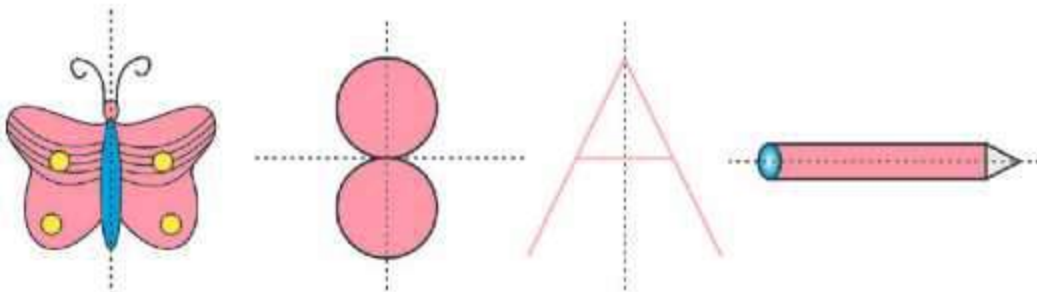
On paper, there will be crease that crease is called **line of symmetry**.

Similarly, teacher shall perform this activity by folding the paper along breadth.

So students, A shape has one or more than one Lines of symmetry also.

Here are some symmetrical pictures are as follows :

7.5.1 Symmetrical Shapes

When any shape is divided into two equal parts then this type of shape is called symmetrical shape. Both parts are like reflection of each other. Line of equal division is called Line of symmetry.

7.5.2 More than one lines of symmetry :

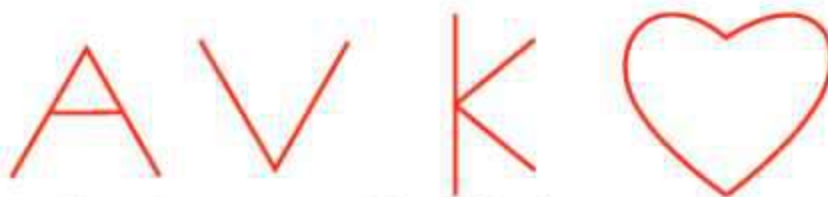There are many shapes having more than one symmetrical lines.
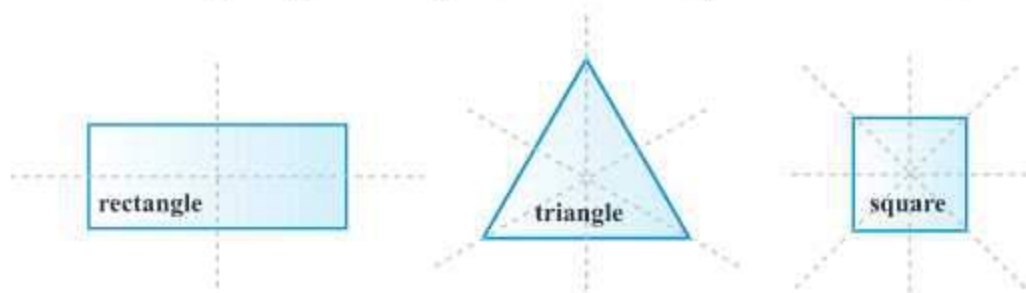
- ◆ A rectangle has 2 symmetrical lines.
- ◆ A triangle of 3 equal sides has 3 symmetrical lines.
- ◆ A square has 4 symmetrical lines.

Exercise 7.3

1. **Circle the symmetrical figures of the following :**

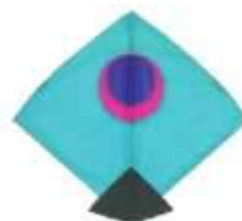2. **Draw symmetry line in the following :**

3. **Draw line of symmetry of the following :**

1.   2.   3.

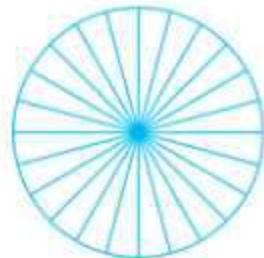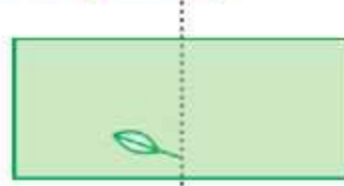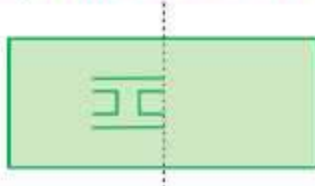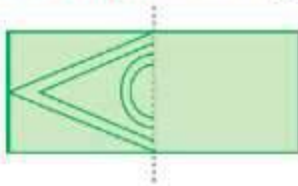4.   5.   6.

4. Complete the figure, if dotted line is a line of symmetry.

7.6 2-D and 3-D shapes

Teacher will show some shapes to the students.

Teacher will explain that dice and cone are 3-D shapes and board's surface is 2-D so we can not draw them on the board. We can only estimate them.

♦ 3-D shapes can not be drawn on board, we can take only their estimates.

♦ 2-D shapes have only two dimensions (length and breadth) and 3-D shapes have 3 dimensions (length, breadth and height)

Math-5

1. **Pick out 2-D and 3-D shapes from the following : Encircle 2-D shapes ◯ and draw △ on 3-D shapes.**


7.6 Making 3-D shapes from 2-D shapes

As we have studied in the last section that 3-D shapes are different from 2-D shapes. We can make 3-D shapes from the notes of 2-D shapes. Cube is the simplest shape as all its faces are squares.

♦ How many faces does a cube have ? six
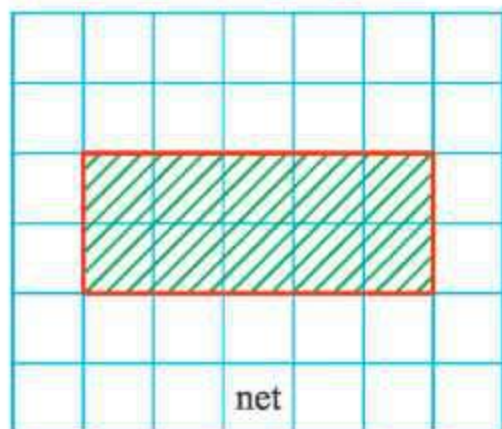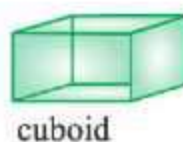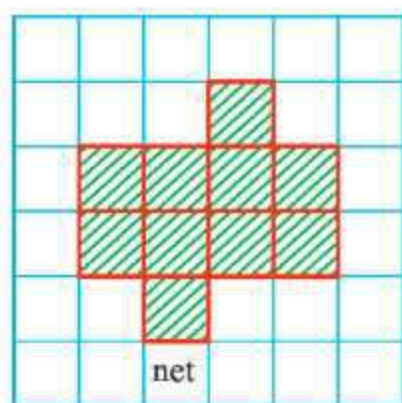
♦ What is the shape of these faces ? square
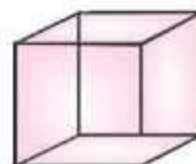
We have given some examples as under of the nets with which we can form 3-D shapes.

net   cube
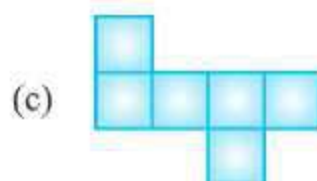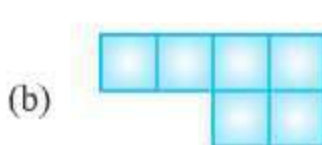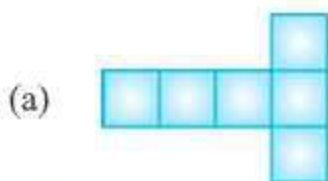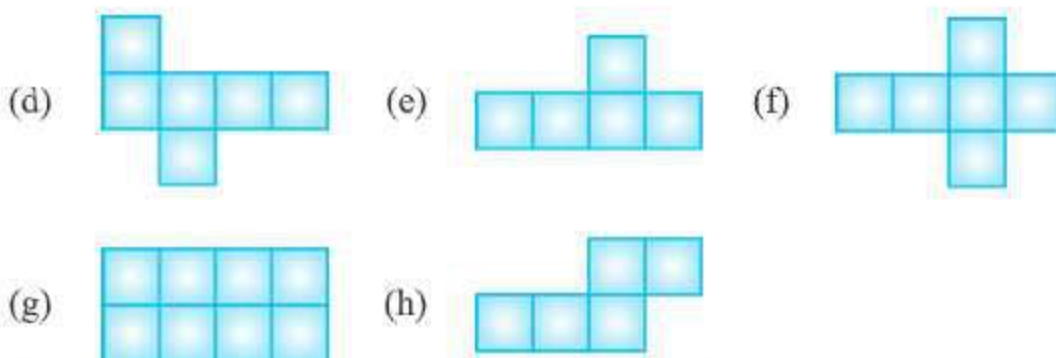
net

cuboid

net
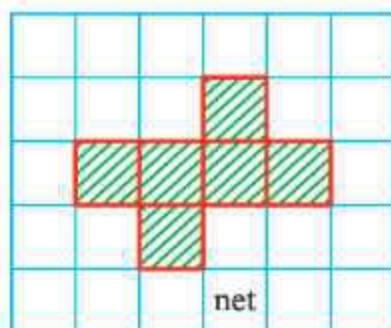
cylinder

Exercise 7.5

1. Give an examples of the following from the surroundings :

Figure	Example
Cuboid	
Cube	
Cone	
Cylinder	

2. Which of the following can form cubes ? Draw them on paper and find answers :

(a)

(b)

(c)

(d) 　(e) 　(f)

(g) 　(h)

3. **Name the figures made from the following nets :**
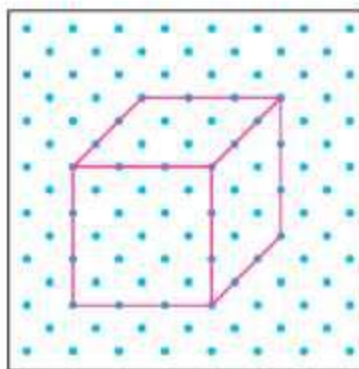

(a)　　　　　(b)　　　　　(c)　　　　　(d)
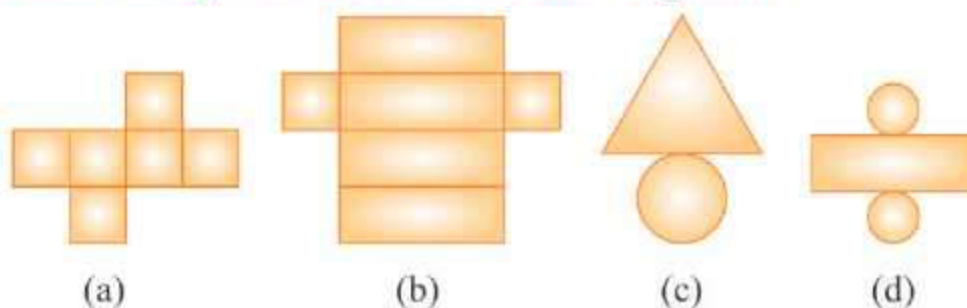
4. **Match the following figures with their nets :**

(a)

(b)

(c)

(d)
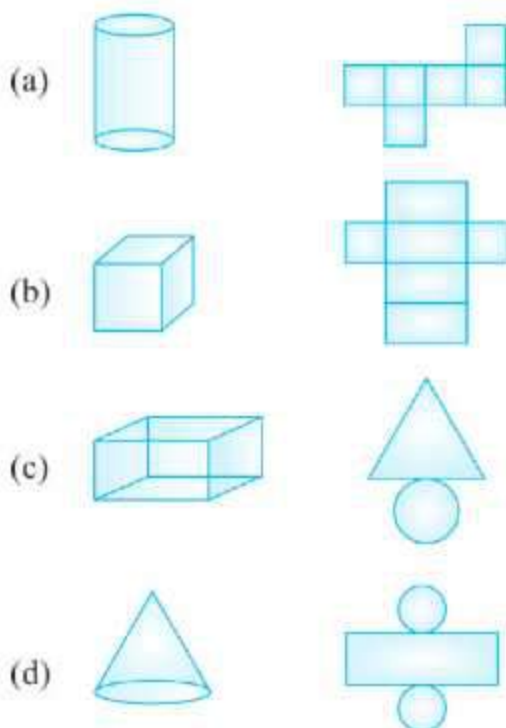
Do it yourself

We can draw cube and cuboids on isometric sheet. We are drawing cube as an example.

Teacher shall motivate students to draw cuboid on this sheet.

Important Words

2-D Shapes	-	These shapes have two sides (length and breadth)
3-D Shapes	-	These shapes have 3 sides (length, breadth and height)
Protractor	-	An instrument, to measure angles.
Degree	-	Unit of angle measurement.

Things to Remember

1. The angles are made on the point where lines bisect.
2. While naming the angle vertex is written in the middle.
3. The unit for measuring an angle is degree.
4. The angles between 0° to 90° are called acute angles, 90° angle is called right angle, angles between 90° to 180° are called obtuse angles.
5. The angles are measured with the help of protractor.
6. If any shape can be divided into two equal parts, this is called a symmetrical shape.

Learning Outcomes

1. Difference between 2-D and 3-D shapes.
2. Basic concept of angles
3. About right angle
4. Types of angles
5. Symmetrical Shapes

Answers

Exercise 7.1

1. (a) acute angle   (b) obtuse angle   (c) acute angle

   (d) right angle   (e) obtuse angle   (f) acute angle

Exercise 7.2

3. (a) acute angle   (b) acute angle   (c) obtuse angle

   (d) obtuse angle   (e) obtuse angle   (f) acute angle

   (g) acute angle   (h) obtuse angle

4. (i) acute angle   (ii) obtuse angle   (iii) right

   (iv) $180°$ (v) smaller

5. (i) True   (ii) True   (iii) False

   (iv) False   (v) True   (vi) False