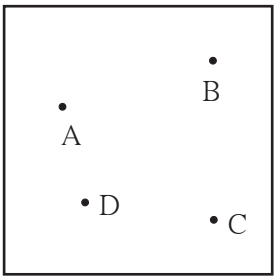
16 Quadrilaterals

Let's learn.

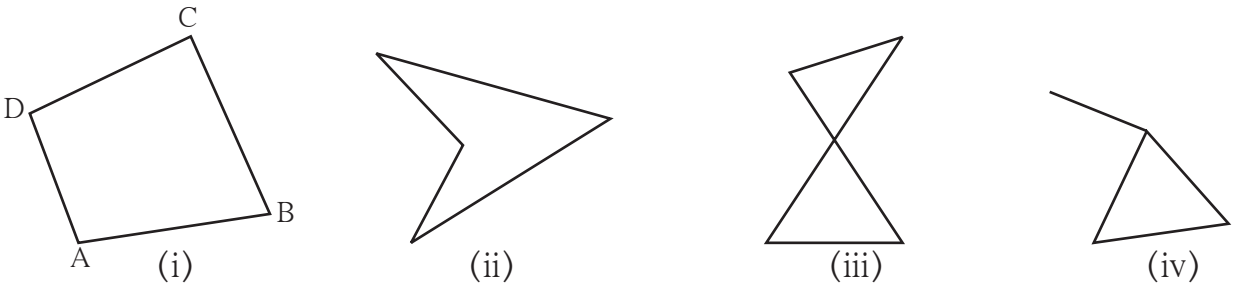
Quadrilaterals

Take four points A, B, C, D, on a paper, such that any three of them will be non-collinear. These points are to be joined to make a closed figure, but in such a way that when any two points are joined the other two must lie on the same side of that line.



The figure obtained by following the given rule is called a **quadrilateral**.

Observe the figures below and say which of them are quadrilaterals.



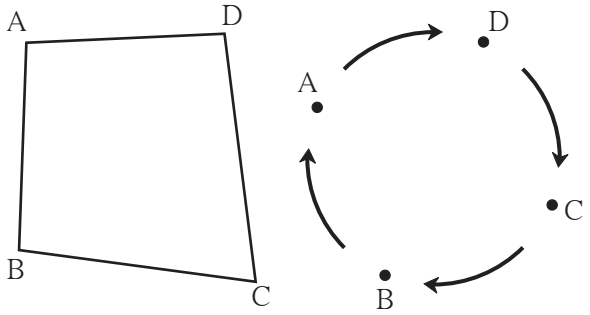
Here, figure (i) is that of a quadrilateral.

Like a triangle, quadrilateral ABCD is a closed figure. The four line segments that form a quadrilateral are called its **sides**. Seg AB, seg BC, seg CD and seg AD are the four sides of this quadrilateral. Points A, B, C and D are the **vertices** of the quadrilateral.

Reading and Writing of a Quadrilateral

- **A quadrilateral can be named by starting at any vertex and going serially either clockwise or anti-clockwise around the figure.**

When writing the name of a quadrilateral a sign like this '□' is put in place of the word 'quadrilateral'.

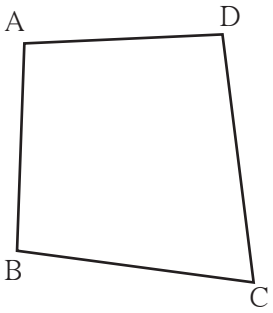


Reading	Writing
Quadrilateral ADCB	□ ADCB
Quadrilateral DCBA	□ DCBA
Quadrilateral CBAD	□ CBAD
Quadrilateral BADC	□ BADC

Write the names of this quadrilateral starting at any vertex and going anti-clockwise around the figure.

Let's learn.

Adjacent Sides of a Quadrilateral



The sides AB and AD of □ABCD have a common vertex A. Sides AB and AD are **adjacent** sides.

Name the pairs of adjacent sides in the figure alongside.

(1) ..... and ..... (2) ..... and .....

(3) ..... and ..... (4) ..... and .....

Every quadrilateral has four pairs of adjacent sides.

Adjacent sides of the quadrilateral have a common vertex.

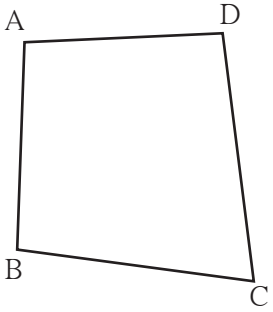
Opposite Sides of a Quadrilateral

In □ABCD the sides AB and DC have no **common vertex**. Side AB and side DC are **opposite sides** of the quadrilateral.

Name the pairs of opposite sides of this quadrilateral.

Pairs of opposite sides :

(1) ..... and ..... (2) ..... and .....

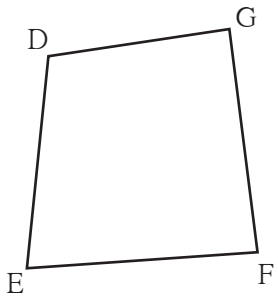


Opposite sides of the quadrilateral do not have a common vertex.

Adjacent Angles of a Quadrilateral

Take four straws/ sticks/ strips all of different lengths. Join them to each other to make a quadrilateral.

Draw its figure. We get the quadrilateral □DEFG. The two angles ∠DEF and ∠GFE have a common arm EF. These angles are neighbouring or adjacent angles.



Name the adjacent angles of the quadrilateral DEFG.

(1) ..... and ..... (2) ..... and .....

(3) ..... and ..... (4) ..... and .....

The angles of a quadrilateral which have one common arm are called adjacent angles of the quadrilateral.

Opposite Angles of a Quadrilateral

In □DEFG, the angles ∠DEF and ∠DGF do not have any common arm. ∠DEF and ∠DGF lie **opposite** to each other. Hence they are the **opposite angles** of a quadrilateral.

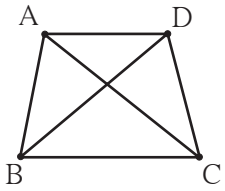
Name the other opposite angles in the figure.

1. Angle opposite to ∠EFG is ..... 2. Angle opposite to ∠FGD is .....

The angles of a quadrilateral which do not have a common arm are called opposite angles of a quadrilateral.

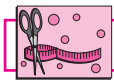
Diagonals of a Quadrilateral

In □ABCD, the line segments that join the vertices of the opposite angles ∠A and ∠C, as also of ∠B and ∠D, have been drawn. The segments AC and BD are the diagonals of the quadrilateral ABCD. The diagonal AC joins the vertices of the opposite angles ∠A and ∠C.



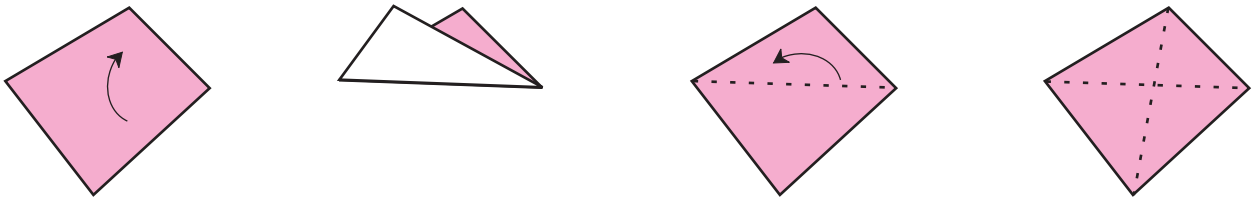
The line segments which join the vertices of the opposite angles of a quadrilateral are the diagonals of the quadrilateral.

In the figure above, name the angles whose vertices are joined by the diagonal BD.

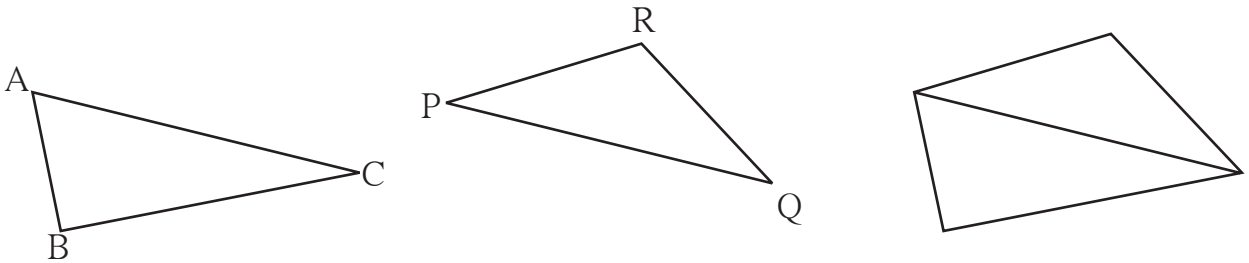


Try this.

- Cut out a paper in the shape of a quadrilateral. Make folds in it that join the vertices of opposite angles. What can these folds be called?



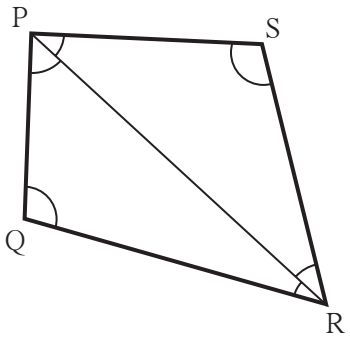
- Take two triangular pieces of paper such that one side of one triangle is equal to one side of the other. Let us suppose that in ΔABC and ΔPQR, sides AC and PQ are the equal sides.



- Join the triangles so that their equal sides lie side by side.
  What figure do we get?
  We used two triangles to obtain a quadrilateral. The sum of the three angles of a triangle is 180°. Hence, what will the sum of the angles of a quadrilateral be?

Try this.

Draw a quadrilateral. Draw one diagonal of this quadrilateral and divide it into two triangles. Measure all the angles in the figure.



Is the sum of the measures of the four angles of the quadrilateral equal to the sum of the measures of the six angles of the two triangles?

Verify that this is so with other quadrilaterals.

∴ The sum of the measures of the four angles of a quadrilateral

= 180° + 180° = 360°

Now I know –

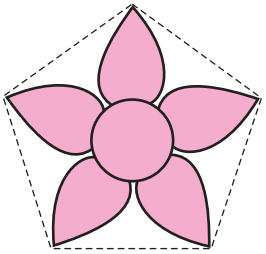
The sum of the measures of the four angles of a quadrilateral is 360°.

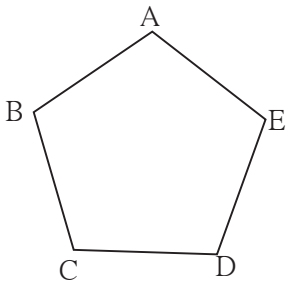
Let's learn.

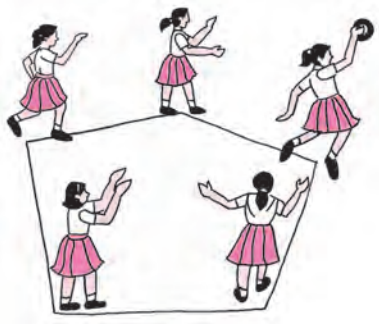
Polygons

- You must have seen the five-petal flowers of *tagar*, *kunda* or *sadaphuli*.

Draw a picture of one of those flowers. Join the tips of the petals one by one. What is the figure you get? The closed figure obtained in this way by joining five points by five line segments is called a **pentagon**.







(1) Write the names of the vertices of the pentagon.

(2) Name the sides of the pentagon. (3) Name the angles of the pentagon.

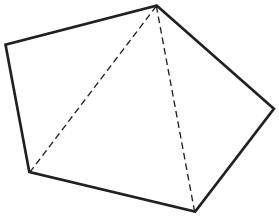
(4) See if you can sometimes find players on a field forming a pentagon.

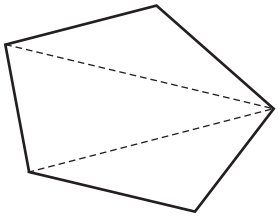
Triangles, quadrilaterals, pentagons and other closed figures with more than five sides are all called **polygons.**

Try this.

Cut out a pentagonal piece of paper. How many triangles do we get if we fold or cut along the dotted lines shown in the figure? Now can you find the sum of the angles of a pentagon?

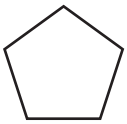
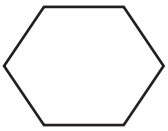
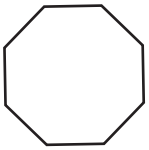
- Make other triangles by folding in different ways. Note your observations.





Practice Set 37

✸ Observe the figures below and find out their names.

Figure	Name	Figure	Name
(1) 		(3) 	
(2) 		(4) 	

Try this.

Do this activity in groups of four. From your compass boxes, collect set squares of the same shapes and place them side by side in all possible different ways. What figures do you get? Write their names.

(a) Two set squares (b) Three set squares (c) Four set squares

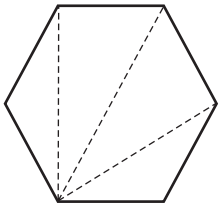
Practice Set 38

1. Draw □XYZW and name the following.
   (1) The pairs of opposite angles. (2) The pairs of opposite sides.
   (3) The pairs of adjacent sides. (4) The pairs of adjacent angles.
   (5) The diagonals of the quadrilateral.
   (6) The name of the quadrilateral in different ways.

2. In the table below, write the number of sides the polygon has.

Names	Quadrilateral	Octagon	Pentagon	Heptagon	Hexagon
Number of sides					

3. Look for examples of polygons in your surroundings. Draw them.
4. We see polygons when we join the tips of the petals of various flowers. Draw these polygons and write down the number of sides of each polygon.
5. Draw any polygon and divide it into triangular parts as shown here. Thus work out the sum of the measures of the angles of the polygon.



ΔΔΔ

ICT Tools or Links

With the help of the Paint program on a computer, draw various polygons and colour them. Make figures of regular polygons with the help of the Geogebra software.

Kaprekar Number

Take any 4-digit number in which all the digits are not the same.

Obtain a new 4-digit number by arranging the digits in descending order.

Obtain another 4-digit number by arranging the digits of the new number in ascending order.

Subtract the smaller of these two new numbers from the bigger number. The difference obtained will be a 4-digit number. If it is a 3-digit number, put a 0 in the thousands place. Repeat the above steps with the difference obtained as a result of the subtraction.

After some repetitions, you will get the number 6174. If you continue to repeat the same steps you will get the number 6174 every time. Let us begin with the number 8531.

8531 $\longrightarrow$ 7173 $\longrightarrow$ 6354 $\longrightarrow$ 3087 $\longrightarrow$ 8352 $\longrightarrow$ 6174 $\longrightarrow$ 6174

This discovery was made by the mathematician, Dattatreya Ramchandra Kaprekar. That is why the number 6174 was named the **Kaprekar number**.