CHAPTER: Understanding Quadrilaterals

Grade: **8**
Board: **CBSE**
Book: **NCERT**

1.

Chapter Summary and Placement

<Read through the following to understand how this chapter is connected with the previous and next grades and also the important concepts covered in it.>

1. The chapter is based on Understanding elementary shapes chapter of grade-6
2. Present chapter deals with types of quadrilaterals, their properties, angle sum property in quadrilaterals
3. It connects directly with Quadrilateral chapter of grade 9

2.

LEARNING OUTCOMES

<On completion of the chapter, students will be able to:>

1. Recollect definitions of closed curve, open curve, polygons.
2. Identifies different types of polygons[regular, irregular, convex, concave]
3. Calculates Interior and exterior angles of polygon
4. Identifies types of quadrilaterals
5. List properties of quadrilaterals with proofs
6. Apply the concepts to solve problems of higher order[Worksheet 5]

4. TEACHING PLAN

Follow this section for getting ideas on teaching the content covered in the chapter. The subtopic given in the first column with the matching learning outcome can be explained using instructions and resources listed subsequently

Subtopic and Learning Objective #1

Subtopic:Definitions: Closed curve, Open curve, Polygons
LO: Recollect definitions of closed curve, open curve, polygons.
1.To make the student recollect the definitions

Teacher Activity

Recap the definitions with enough examples

Check for understanding:

a) Define a polygon?
b) If the starting and end points of a curve are same then it is called _____
c) An open curve has different _____ points
d) A closed curve made up of line segments is called as_____
e) Identify closed and open curves among the given figures[figures can be of teachers choice]

Resources Suggested

Blackboard, pen and paper
Resource 1 for reference

Resource 1

Simple closed figure: A figure which start and end at the same point without crossing itself is called simple closed figure



Open figure: A figure with different starting and end points is called open figure



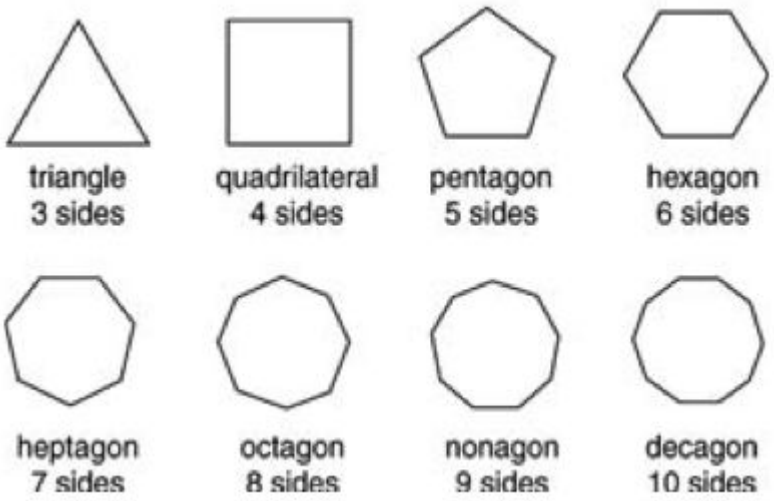
Polygons: A simple closed curve made up of only straight line segments is called a polygon.





Resource 1

Polygons are named after number of sides they have

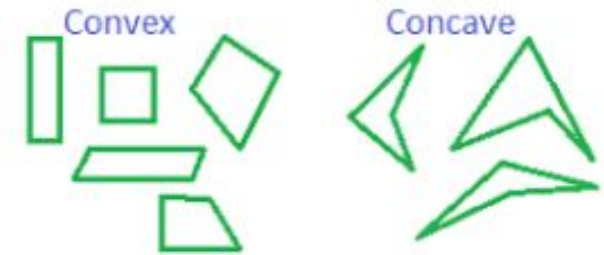


Name	Regular	Irregular
Triangle		
Quadrilateral		
Pentagon		
Hexagon		
Octagon		

Regular polygons: Equiangular and equi sided polygons are called as regular polygons. If the sides are not equal/ angles are not equal then they are called as irregular polygons

Resource 1

Convex and concave polygons: A convex polygon is defined as a polygon with all its interior angles less than 180°. If any one angle of a polygon is $>180^0$ then it is called concave polygon.



Subtopic and Learning Objective #2

Sub topic:Types of polygons[Regular and irregular polygons, Convex and concave polygons]
LO:
Identifies different types of polygons[regular, irregular, convex, concave]
1. To make student understand the definitions

Teacher Activity

Introduce definitions with good number of examples for understanding

Check for understanding:

a) Classify convex and concave polygons among the following figures[figures can be of teachers choice]
b) If an angle of a polygon is > 180^0 then it is called as_____
c) Equiangular and equi sided polygons are called as_____
d) What are irregular polygons?
e) In a convex polygon all angles are less than _____ degrees
b) Classify regular and irregular polygons among the following:
[figures can be teachers choice]

Resources Suggested

Blackboard, pen and paper **Resource 1 can be used for explanation**

Subtopic and Learning Objective #3

Sub topic:Interior and exterior angles of polygon
LO:
Calculates Interior and exterior angles of polygon
1. To make student understand the method of calculating interior and exterior angles of polygon

Teacher Activity

Introduce the method of calculating sum of interior angles by dividing each polygon into triangle[as given in NCERT text book]
As we say regular polygon is equiangular, each angle of regular polygon can be obtained by dividing its sum of interior angles by number of sides/ number of angles
Introduce that sum of exterior angle of any polygon is 360^0 and also each exterior angle is 360/n

Check for understanding:

a) Interior angle of a regular polygon with 6 sides is_____
b) Sum of exterior angles of a septagon is _____
c) Sum of interior angles of any polygon is _____
d) Interior angle of a polygon is 108^0 then name of the polygon is _____

Resources Suggested

Blackboard, pen and paper
Resource 2 can be used for formulae

Resource 2

$$\text{Sum of exterior angles of any polygon} = 360^0$$

$$\text{Each exterior angle of a regular polygon} = \frac{360^0}{n}$$

$$\text{Sum of interior angles of a regular polygon} = (n-2)\times 180^0$$

Subtopic and Learning Objective #4

Sub topic:Types of quadrilaterals
LO:
Identifies types of quadrilaterals
1. To make student understand the classification of quadrilaterals

Teacher Activity

Introduce types of quadrilaterals by classifying them

Check for understanding:

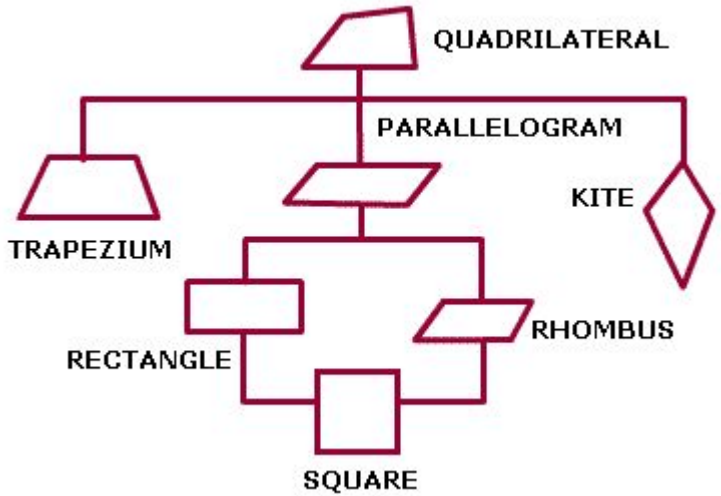
a) Name the quadrilaterals given below.

[Draw quadrilaterals on the board]

Resources Suggested

Blackboard, pen and paper
Resource 3 can be used for explanation

Resource 3


QUADRILATERAL
PARALLELOGRAM
KITE
TRAPEZIUM
RHOMBUS
RECTANGLE
SQUARE

Subtopic and Learning Objective #5

Sub topic:Properties of quadrilaterals
LO:
List out properties of quadrilaterals with proofs
1. To make student understand properties and can they be proved

Teacher Activity

Introduce and explain properties of various types of quadrilaterals using Resource 4.
Carry out **Activity 1**

Check for understanding:

a) Write the properties of Trapezium
b) Define parallelogram and write its properties
c) How can you prove that diagonals of a parallelogram bisect each other
d) Prove that Opposite angles of a rhombus are equal

Resources Suggested

Blackboard, pen and paper
Resource 4 for properties

Subtopic and Learning Objective #6

Sub topic:Properties of quadrilaterals
LO:
List out properties of quadrilaterals with proofs
1. To make student understand properties and can they be proved

Teacher Activity

Introduce and explain properties of various types of quadrilaterals using Resource 4.
Carry out **Activity 1**

Check for understanding:

a) Write the properties of Trapezium
b) Define parallelogram and write its properties
c) How can you prove that diagonals of a parallelogram bisect each other
d) Prove that Opposite angles of a rhombus are equal

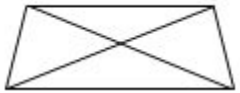
Resources Suggested

Blackboard, pen and paper
Resource 4 for properties

Resource 4

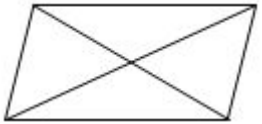
Trapezium/ Trapezoid: A quadrilateral with one pair of sides are parallel is called trapezium. In a trapezium

1. One pair of opposite sides is parallel
2. Diagonals are not equal



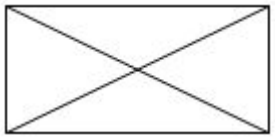
Parallelogram: A quadrilateral with two pairs of sides parallel is called a parallelogram. In a parallelogram

1. Opposite sides are parallel and equal.
2. Opposite angles are equal.
3. Adjacent angles are supplementary
4. . Diagonals are not equal
5. Diagonals bisect each other



Rectangle: A parallelogram in which each angle is a right angle is called a Rectangle. In a rectangle

1. Opposite sides parallel and equal
2. Each angle is 90^0
3. Diagonals are equal
4. Diagonals bisect each other



Resource 4

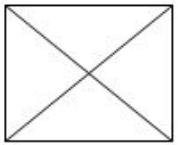
Rhombus: A parallelogram with all sides equal is called a rhombus. In a rhombus

1. All sides are equal
2. Opposite angles are equal
3. Adjacent angles are supplementary
4. Diagonals are not equal
5. Diagonals bisect each other at right angles



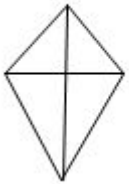
Square: A rhombus whose all angles are equal is called a square. In a square

1. All sides are equal
2. All angles are equal and 90^0
3. Diagonals are equal
4. Diagonals bisect each other at right angles



Kite: A rhombus whose set of adjacent pairs of sides are equal. In a kite

1. Each pair of adjacent sides are equal
2. One pair of opposite angles are equal
3. Diagonals are not equal
4. Diagonals bisect each other at right angles



Activity

Name of the activity- Classification of quadrilaterals
Type of activity – individual
Use it for – Learning /practice
Materials –a sheet printed with Always true, sometimes true, Never true as columns
Procedure:

1. Ask the students to think about the statements[write on the board / get them xeroxed] of quadrilaterals with respect to properties
2. Classify the statements as always true, sometimes true and never true
3. Make them write them under the respective columns
4. Statements:

1. A square is a rectangle a
2. A parallelogram is a rectangle n
3. A rhombus is a square s
4. The diagonals of a parallelogram are perpendicular s
5. The diagonals of a kite are not congruent a
6. A parallelogram has three diagonals n
7. A kite is a quadrilateral a
8. A trapezium has equal angles n
9. The diagonals of a rhombus are congruent s
10. A rectangle has perpendicular diagonals n

Activity

9. The diagonals of a rhombus are congruent s

10 A rectangle has perpendicular diagonals n

11. A parallelogram has diagonals that bisect each other a

12. A rectangle is a rhombus n

13. A trapezium has one pair of equal sides s

14. A rectangle is a square a

15. A rectangle has four equal sides s

Solutions [only for teachers reference not to circulate among students]

Always true: 1, 5, 7, 11, 14

Sometimes true:3, 4, 9, 13, 15

Never true:2, 6, 8, 10, 12

5. WORKSHEETS

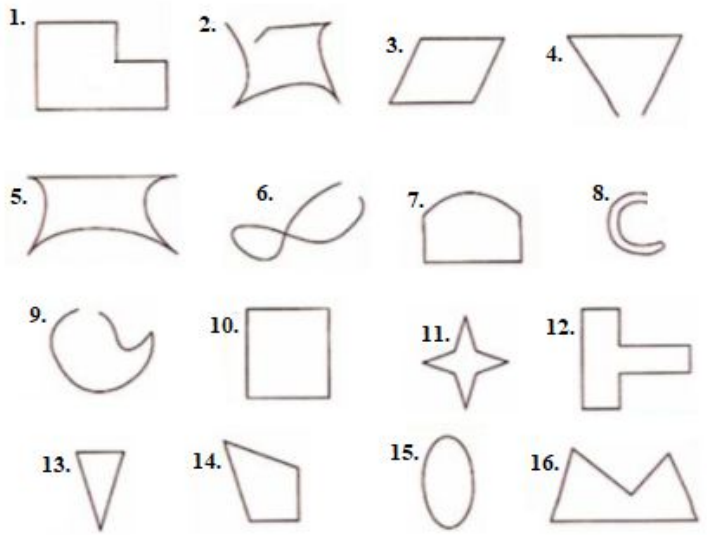
Print or copy the worksheet questions on the blackboard and ask the students to attempt them. They can be given as homework or a class test as well.

Worksheet 1

Use it like: test after the chapter is complete, homework

Answer the following:

a) Classify the following figures into Open curve, closed curve



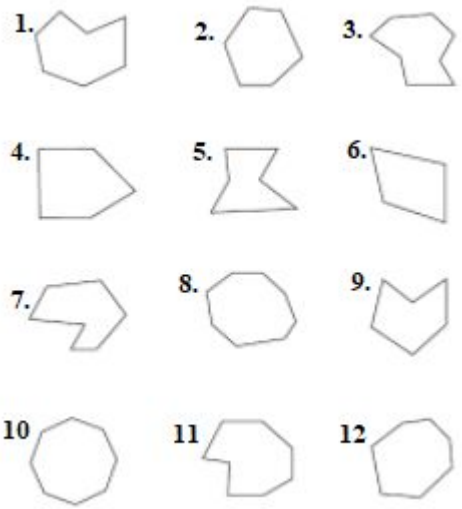
Worksheet 2

Use it like: test after the chapter is complete, homework

Answer the following:

a) Classify convex and concave among the following

b) Classify regular and irregular

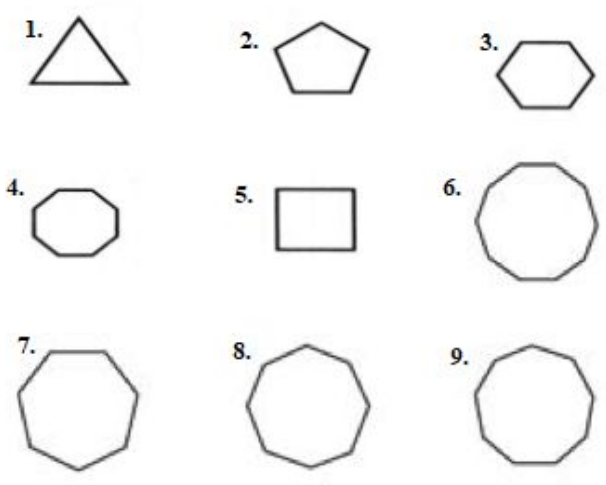


Worksheet 3

Use it like: test after the chapter is complete, homework

Answer the following

a) Name the following regular polygon and also find interior and exterior angles of each



Worksheet 4

Use it like: test after the chapter is complete, homework

Answer the following:

1. Write the properties of

a) Rhombus

b) Kite

c) Trapezium

d) Square

e) Rectangle

Worksheet 5

1) ABCD is a parallelogram with $\angle A=80^0$. The internal bisectors of $\angle B$ and $\angle$ meet at O. Find the measure of the three angles of ΔBCO.
2) A diagonal and a side of rhombus are of equal length then find the angles of the quadrilateral
3) Adjacent sides of a rectangle are in the ratio 5: 12 if the perimeter of the rectangle is 34 cm find the length of diagonal
4) The angles of a quadrilateral are in the ratio 1:2:3:4 find the angles?

6. SOLUTIONS

This section gives you sample answers for activities and questions listed above.

Worksheet 1

a)

1. Closed
2. Open
3. Closed
4. Open
5. Closed
6. Open
7. Closed
8. Open
9. Open
10. Closed
11. Closed
12. Closed
13. Closed
14. Closed
15. Closed
16. Closed

b) Polygons: 1, 3, 10, 11, 12, 13, 14, 16

Worksheet 2

a)

1. Concave
2. Convex
3. Concave
4. Convex
5. Concave
6. Convex
7. Concave
8. Convex
9. Concave
10. Convex
11. Concave
12. Convex

b)

1. Regular
2. Irregular
3. Irregular
4. Regular
5. Regular
6. Irregular
7. Regular
8. Irregular
9. Regular
10. Irregular
11. Irregular
12. Irregular

Worksheet 3

1. Triangle:- Interior angle:60^0 , Exterior angle: 120^0
2. Pentagon:- Interior angle:108^0 , Exterior angle: 72^0
3. Hexagon:- Interior angle:120^0 , Exterior angle: 60^0
4. Octagon :- Interior angle:135^0 , Exterior angle: 45^0
5. Square:- Interior angle: 90^0, Exterior angle: $9o^0$
6. Decagon:- Interior angle:144^0 , Exterior angle: 36^0
7. Septagon/ heptagon:- Interior angle: 128 4/7 ^{o} , Exterior angle: 51 $3/7^0$
8. Octagon:- Interior angle: 135^0 , Exterior angle: 45^0
9. Nonagon:- Interior angle: 140^0 , Exterior angle: 40^0

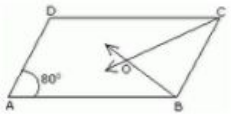
Worksheet 4

Check the answers as per resource sheet 4

Worksheet 5

ABCD is a ||gm with $\angle A = 80^0$. The internal bisectors of $\angle B$ and $\angle C$ meet at O. Find the measure of the three angles of Δ BCO.

Solution:



$\angle C = \angle A$ (Opposite angles of a ||gm are equal)

$\angle C = 800$ (Given $\angle C = 80^{0)}$

$\angle OCB = \frac{1}{2}\angle C = \frac{1}{2} \times 80 = 40^0$

$\angle B = 180^0 - \angle A$ (Sum of interior angles on the same side of the transversal is 180^0)

$= 180^0 - 80^0$

$= 100^0$

$\angle CBO = \frac{1}{2}\angle B = \frac{1}{2} \times 100^{\circ} = 50^0$ $\angle BOC = 180^0 - (\angle OBC + \angle CBO)$ (Angle sum of a Δ)

$= 180^0 - (40^0 + 50^0)$

$= 180^0 - 90^0$

$= 90^0$

∴ The Three angles of the triangle BCO namely $\angle OCB$, $\angle CBO$, $\angle BOC$ are 40^0, 50^0 and 900 respectively.

Worksheet 5

2

A diagonal and a side of a rhombus are of equal length. Find the measure of the angles of the rhombus.

Solution:

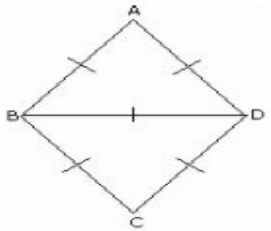
Let ABCD be the rhombus.

AB = BC = DC = DA (sides of a rhombus are equal)

But AB = BD (Given)

$\therefore$ AB = BC = CD = DA = BD

Since in Δ ABD all the sides are equal. Δ ABD is an equilateral Δ .



Similarly Δ BCD is also an equilateral.

$\therefore \angle A = \angle ABD = \angle ADB = \angle DBC = \angle C = \angle CDB = 60^0$

$\therefore \angle B = \angle ABD + \angle DDC = 60^0 + 60^0 = 120^0$

and $\angle D = \angle ADB + \angle CDB = 60^0 + 60^0 = 120^0$

$\therefore$ The angles of the rhombus are 60^0, 120^0, 60^0 and 120^0.

Worksheet 5

3

Adjacent sides of a rectangle are in the ratio 5: 12, if the perimeter of the rectangle is 34cm, find the length of the diagonal.

Solution:

Given the adjacent sides of a rectangle are in the ratio 5:12.

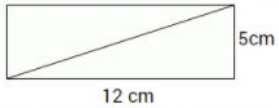
Therefore let the sides be 5x and 12x.

Then $5x + 12x + 5x + 12x = 34$

$$34x = 34$$

$$x = 1\text{cm}$$

Hence the sides are 12cm and 5cm.



The length of the diagonal = $\sqrt{(5^2 + 12^2)}$) (In a right angled triangle applying Pythagoras theorem)

$= \sqrt{(25 + 144)}$

$= \sqrt{169} = 13\text{cm}.$

Therefore the length of the diagonal is 13cm.

7. EXTRA RESOURCES

Carry out the following suggested activities/ tasks if you have the time and resources to do them

Teacher can use these videos if time and facilities permit:

1. https://www.youtube.com/watch?v=S68e7t1BEO0 - Proving properties of quadrilaterals