Chapter 7

Shapes and Patterns

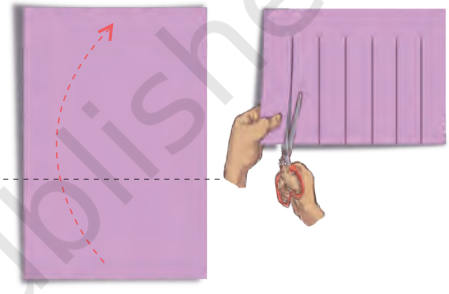
Weaving Mats

You may have seen woven baskets of different kinds. If you look closely, you will notice different weaving patterns on each basket.

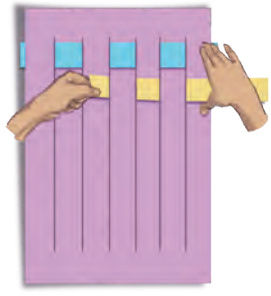
We will try weaving some mats with paper strips.

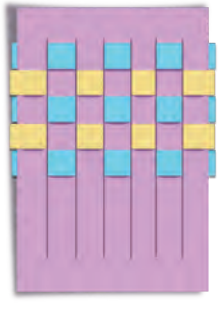
1. Let us make paper mats.

You will need—A coloured paper (30 cm long and 20 cm wide) and eight paper strips of two different colours (3 cm wide and longer than 20 cm).



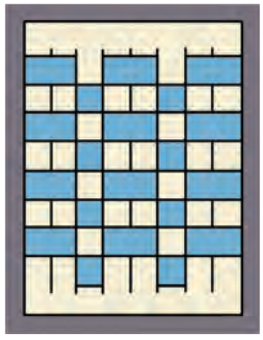
(a) Take a coloured paper 30 cm long and 20 cm wide.
(b) Fold the coloured paper in half along the longer side.
(c) Draw vertical lines at equal distances from the closed end and cut slits leaving a gap of 3 cm at the top.
(d) Carefully unfold the paper. There will be no cuts in the paper at the top and the bottom.
(e) Now cut 8 paper strips of 3 cm width in 2 colours and of length slightly longer than 20 cm.
(f) Take one colour strip and weave it across the slits going 1 under and 1 over, and again 1 under and 1 over. Repeat it for the first row.
(g) Take one more strip of another colour and weave it across the slits going 1 over and 1 under, and again 1 over and 1 under. Repeat it for the second row.
(h) Weave all the strips in the same alternating pattern. Neatly fold any extra strip ends behind the mat. Your mat is ready!





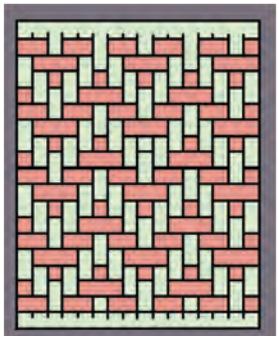
We can describe the pattern of the above weave as follows.
Row 1—1 under, 1 over, 1 under, 1 over, ... (repeat)
Row 2—1 over, 1 under, 1 over, 1 under, ... (repeat)

2. Can you figure out how to make this mat?



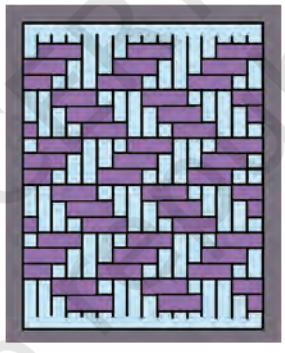
Let us try to understand how this mat is woven by looking at the pattern in the first two rows.
Row 1—2 over, 1 under, 2 over, 1 under, ...
Row 2—2 under, 1 over, 2 under, 1 over, ...
You can use strips of the same colour or 2 different colours, one for each row.

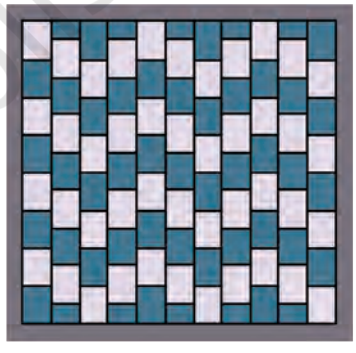
3. Try to weave a pattern, using the rules given below.



Row 1—2 over, 1 under, 2 over, 1 under, ... (repeat).
Row 2—1 under (do not repeat), 3 over, 3 under, 3 over, 3 under, ... (repeat).
Row 3—2 under, 1 over, 2 under, ... (repeat).
Row 4—1 over (do not repeat), 3 under, 3 over ... (repeat).
Continue weaving in this order.

4. Can you work out the steps for any of these designs and weave the pattern?

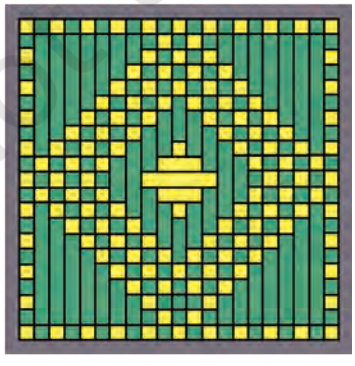


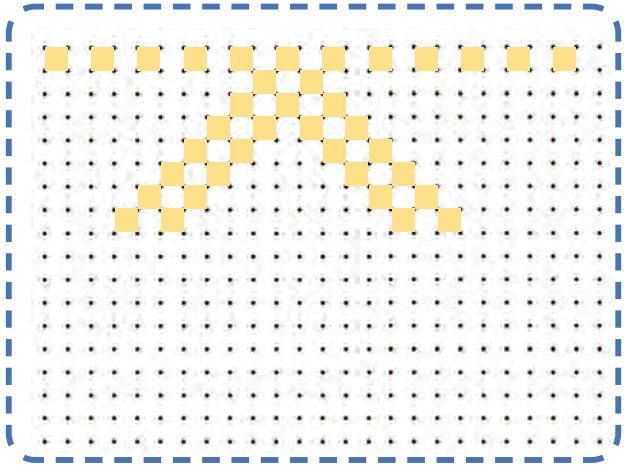


Write the steps of the pattern in your notebook for each row until it starts repeating.

Let Us Try

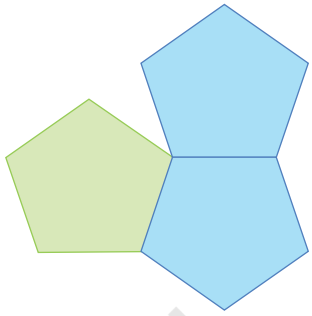
Draw the following pattern on a grid paper. Part of it is done for you. Now, complete the rest of the grid to get the full design.





Tiling and Tessellation

We often use tiles of the same shape or a combination of shapes to cover a region.



You can see pentagons (5-sided figures) in this figure.

As all its sides are equal it is a **regular pentagon.**

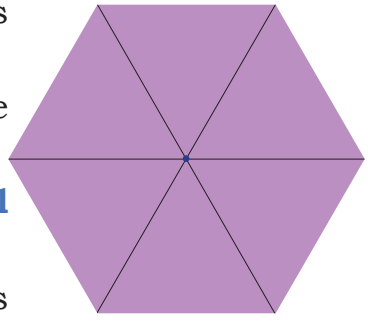
Shapes that have equal sides are called **regular shapes.**

We have placed 3 pentagons around a point. Can we fit one more into the empty space?

Pentagons cannot fill a region without leaving gaps. So, we say that regular pentagons do not tessellate.

Find Out

Can regular triangles fit together at a point without any gap? How many of them fit together? (A sample triangle is given at the end of the book). Do you see that regular triangles fit around a point as shown here?



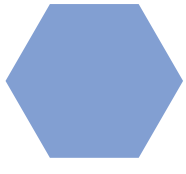
Regular triangles when fitted around a point leave no gaps and there is no overlap.

Triangles with all equal sides are also called **equilateral triangles**.

Therefore, equilateral triangles tessellate. Can squares (a regular 4-sided shape) fit together around a point without any gap or overlap? Try it out using cutouts of squares (a sample square is given at the end of the book). How many squares did you need?

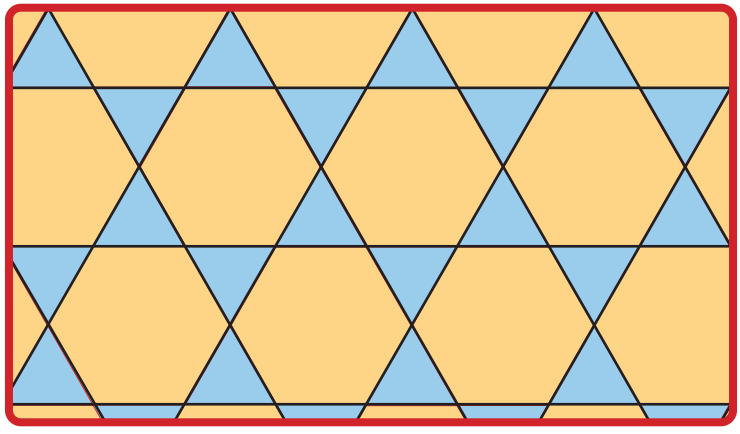
Can five squares fit together around a point without any gaps or overlaps? Why or why not?

Can **regular hexagons** (6-sided shapes with equal sides) fit together around a point without any gaps or overlaps? Try and see (a sample hexagon is given at the end of the book). How many fit together at a point?

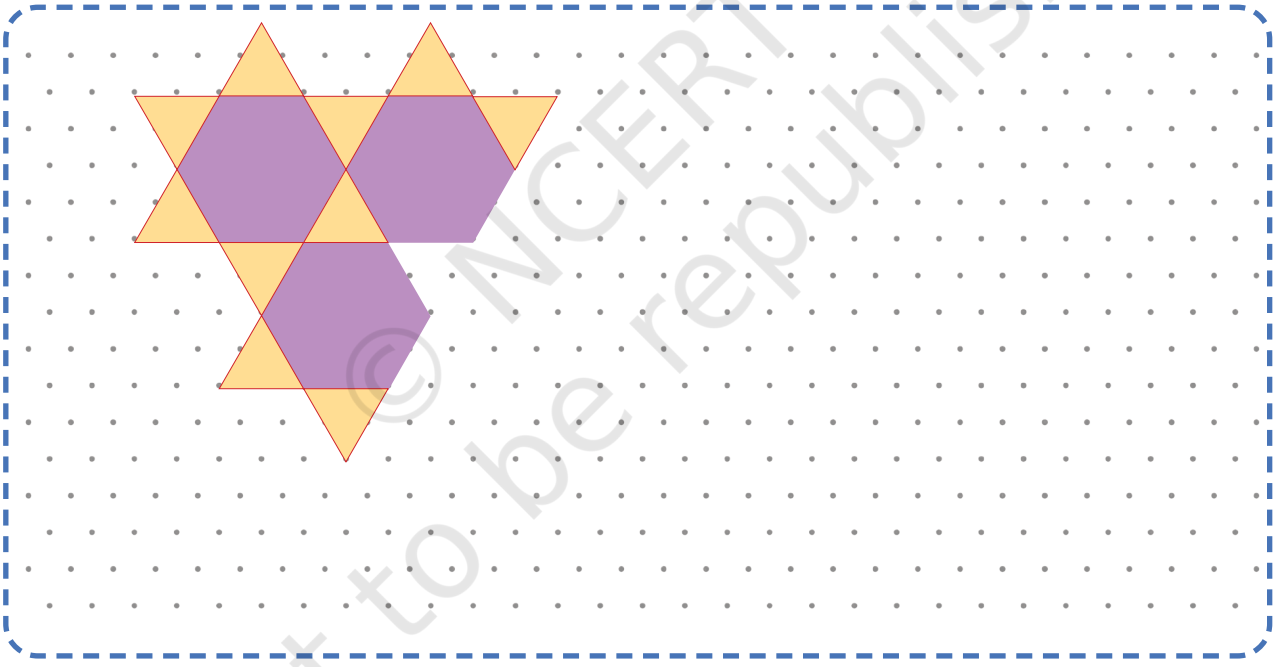


Here is a tessellating pattern with more than one shape.

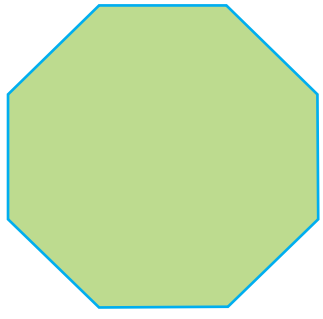
What shapes have been used in this pattern? _____, _____.



Continue the pattern given below and colour it appropriately.



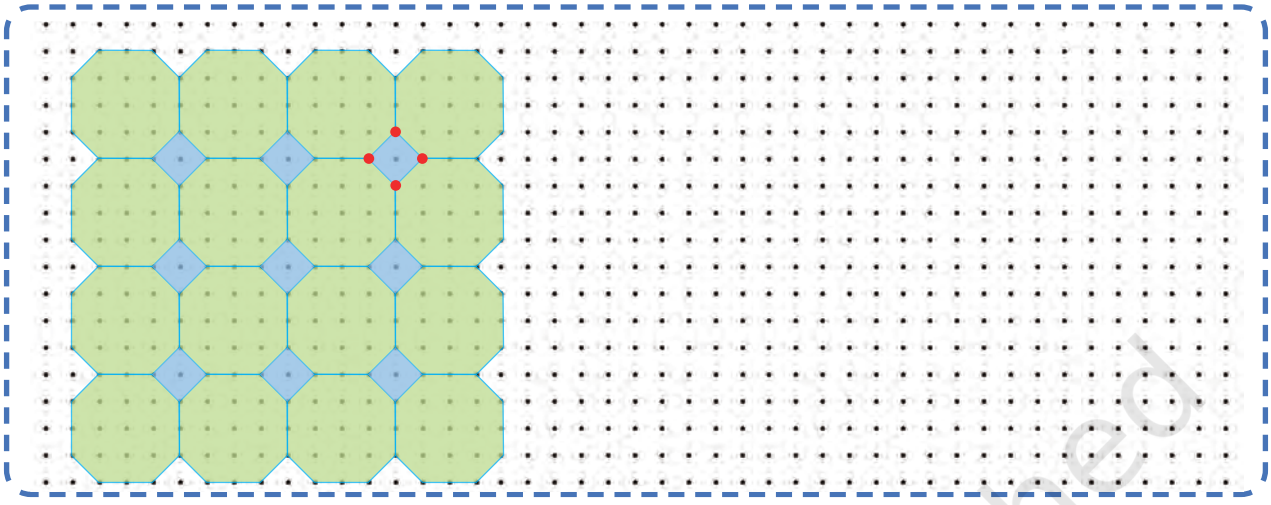
A **regular octagon** means a shape with eight equal sides.



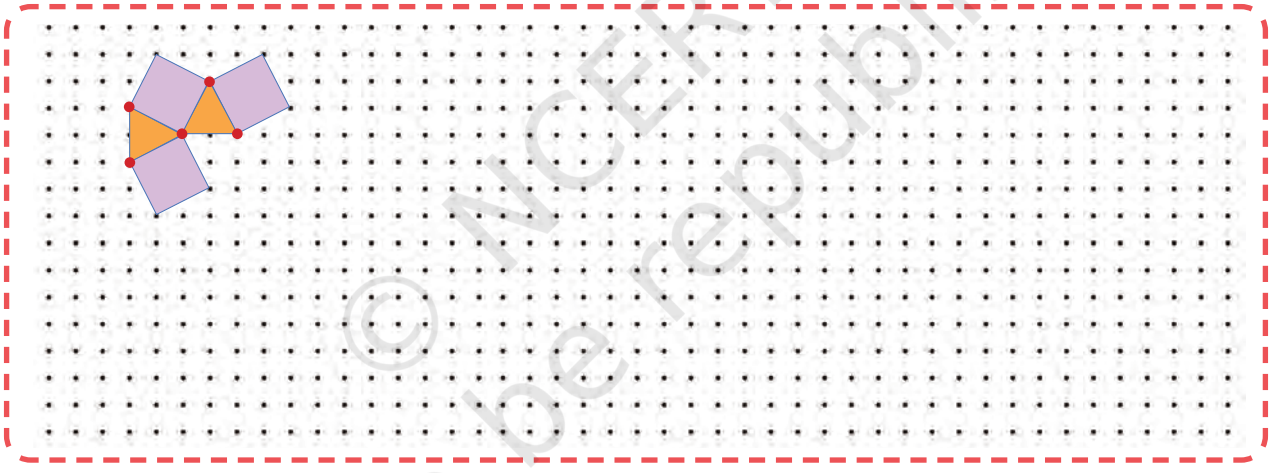
Do regular octagons fit together without any gaps or overlaps? Try drawing the same and check.

Regular octagons do not tessellate.

Look at the pattern given below. What shapes are coming together at the marked points? Are the same set of shapes coming together at these points? Continue the pattern and colour it appropriately.



Here is a tiling pattern made using two different shapes—squares and triangles. Are the triangles equilateral? Why or why not?

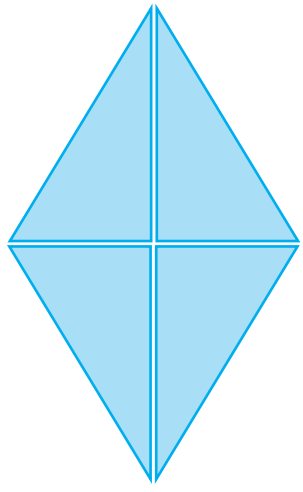


What shapes are coming together at the marked points?

Are the same set of shapes coming together at these points? Continue the pattern and colour it appropriately.

Create similar patterns using other cutouts of shapes.

A **rhombus** is a shape with all equal sides. It has been divided into four triangles.



You will find a copy of this rhombus at the end of the book. Cut out the triangular pieces for the following activities.

What geometrical shapes can you make by fitting 2 of these triangles together? Trace the shapes you created.

1. How many different types of triangles can you make?

   Now, observe and measure the sides of these triangles. What do you notice?

Each triangle has 2 equal sides. Such triangles are called **isosceles triangles**.

Trace the isosceles triangles on a paper and cut them out. Fold them in half. What do you notice about their angles?

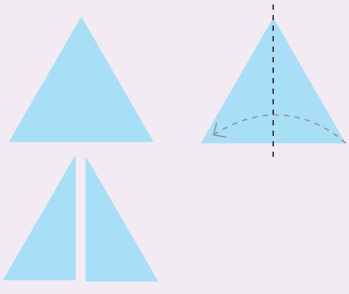
Each isosceles triangle has 2 equal angles.

2. Is it possible to make a triangle where all three sides are equal (equilateral triangle)?
3. Is it possible to make a triangle where all three sides are unequal?

Try This

Cut the equilateral triangle provided at the end of the book. Check if all the angles of an equilateral triangle are equal—just like you did with the isosceles triangle.

Equilateral triangles have equal angles.

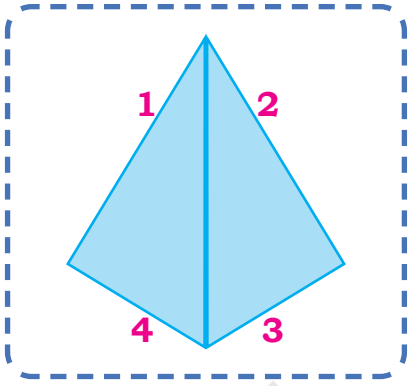


Now, cut the equilateral triangle in half. How many sides of each new triangle are equal?
Triangles that have no equal sides are called **scalene triangles**.
Check in scalene triangles whether any two or more angles are equal?

Note for Teachers: Encourage the learners to use paper folding methods to compare the angles of a shape.

4. How many different 4-sided shapes (quadrilaterals) can you make?

Here are three possible shapes.



Have you made a shape like the one shown on the right?

This shape is called a **kite**.

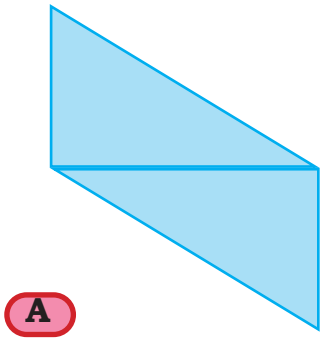
What do you notice about the sides of a kite?

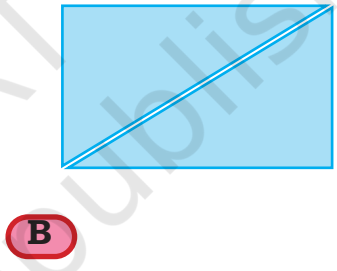
Side 1 = Side 2.

Similarly, Side 3 = Side 4.

These sides are called **adjacent sides**.

Here are two other possible quadrilaterals that are not kites.





5. Measure the sides of each of these two quadrilaterals A and B. What do you notice?

   Are there any pairs of sides that are equal? Which pairs are equal—adjacent or opposite?

Quadrilaterals whose opposite sides are equal are called **parallelograms**.

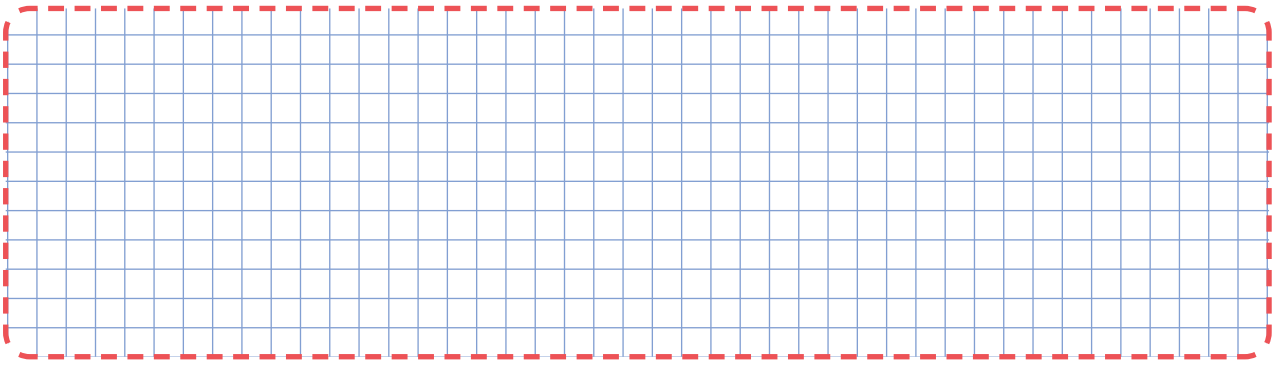
What types of angles do quadrilaterals A and B have? Which angles are equal in each of the above parallelograms?

In parallelogram A, opposite angles are equal.

In parallelogram B, all angles are equal and are right angles. Such a parallelogram is called a **rectangle**.

A rectangle is a special type of parallelogram.

6. In the grid given below, draw two different kites and parallelograms each.

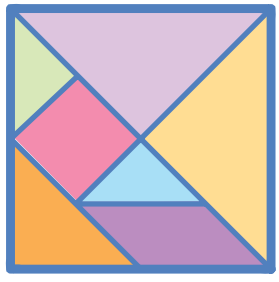


7. Now, use 3 triangles from the rhombus to form shapes. How many sides do each one of them have?

Using 3 triangular pieces of the rhombus, try creating a (a) 3-sided shape, (b) 4-sided shape, and (c) 5-sided shape.

8. Which of these shapes can be made with all 4 pieces? Try and find out.
   (a) Square
   (b) Rectangle
   (c) Triangle
   (d) Pentagon (5-sided)
   (e) Hexagon (6-sided)
   (f) Octagon (8-sided)

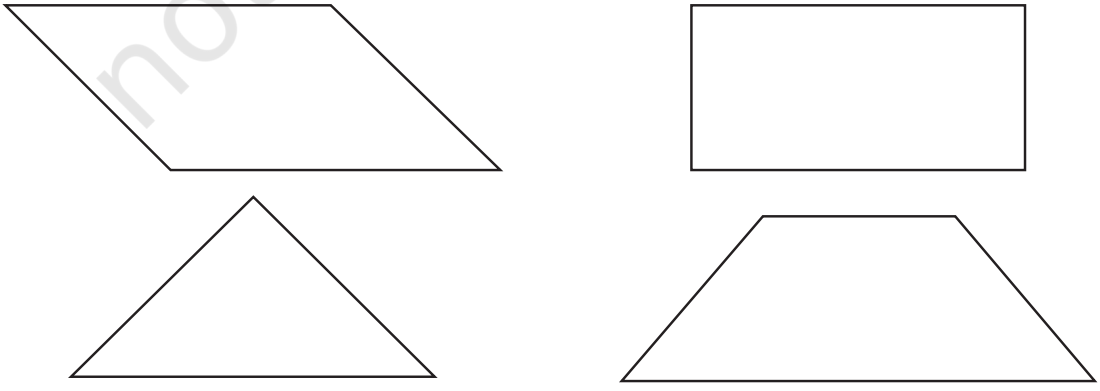
Tangram



Look at the tangram set given at the end of your textbook. Cut out all the shapes. Name them.

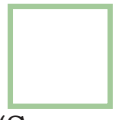
(a) How are they same or different from each other?
(b) What do you notice about the angles of each of the shapes?
(c) What do you notice about the sides of each of the shapes?

Now, use some or all of the pieces of your tangram set to make the following shapes. There may be more than one way to do it.



Which Shape Am I?

Match the statements with appropriate shapes. Do some of them describe more than one shape?

	Statement	Shape
1.	All my angles are right angles, but all my sides are not equal.	 (Square)  (Rectangle)  (Rhombus) (Parallelogram)
2.	All my sides are equal, but all my angles are not.	
3.	My opposite angles are equal, but my sides do not make a right angle.	
4.	Two pairs of sides are equal, but they do not make a right angle.	
5.	All my sides make right angles with each other and are equal.	
6.	My opposite angles are equal and so are my sides.	
7.	My opposite angles are equal and my sides make right angles.	

Kites

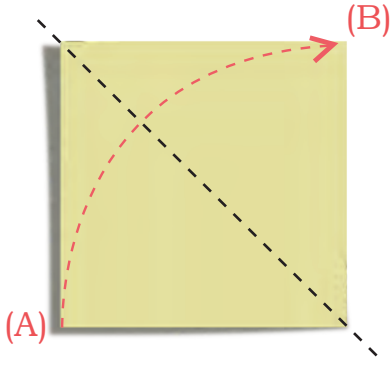
Make your own kite shape.

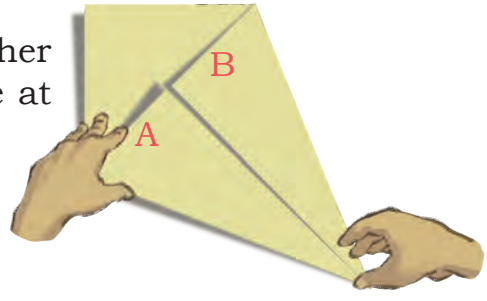
(a) Start with a square piece of paper.

(b) Take one corner of the paper and fold it towards the opposite corner, creating a sharp crease along the diagonal.

(c) Open and fold the corner A inwards, aligning the edge with the crease you just made.

(d) Repeat on the other side, folding the other corner B inwards to align with the crease at the centre.





You have a kite shape!

What shapes do you see in the kite?

Play with Circles

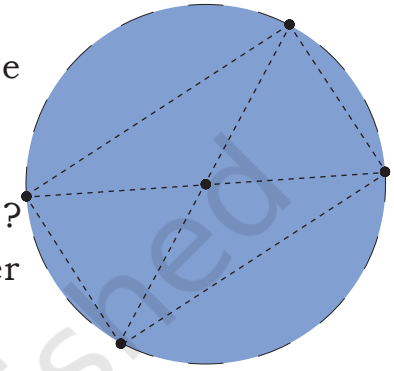
Do you remember a circle?

(a) Draw a circle with a compass and mark its centre.

(b) Draw its diameter. Mark the endpoints of the diameter.

(c) Draw another diameter of the circle and mark the endpoints.

(d) Now join the four points.



What shape is formed? Check the sides of the quadrilateral and the angles obtained.

Try with a different pair of diameters.

What do you notice about the shape that is formed?

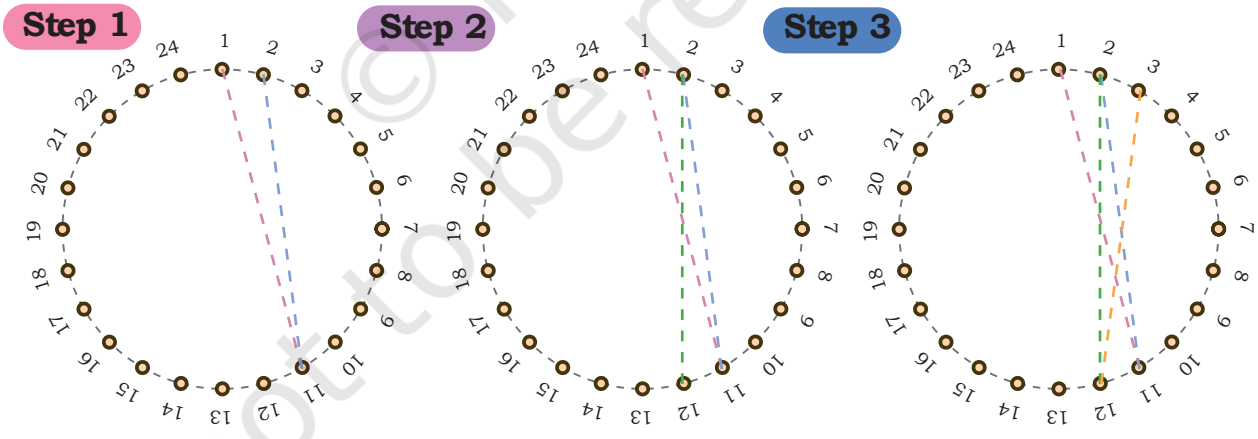
Is it possible to create a 4-sided shape other than a rectangle through this process?

Circle Designs

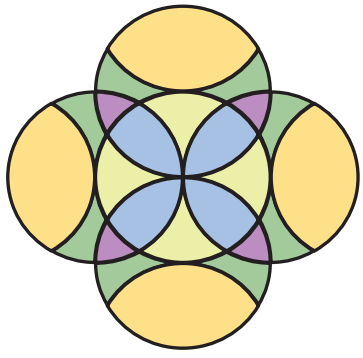
Look at the circle given below. It is marked with points 1 to 24.

Join points 1 to 11, 11 to 2, 2 to 12, and so on till you reach back at 1.

(Try it with different coloured threads on a thick paper or cloth.)

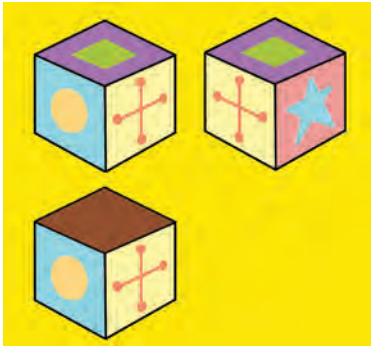


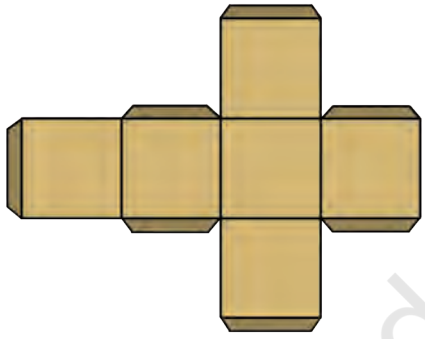
Can you think of a way to make a design exactly like the image given here? Try to make it.



Cube Connections

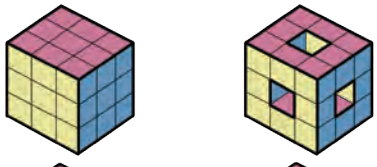
1. Here are three views of a cube. Can you draw them on the net in the correct order?



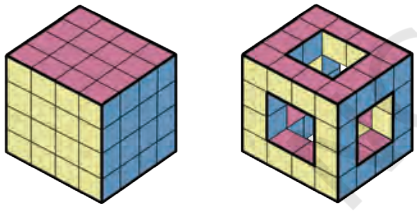


2. Here are some big solid cube frames. How many small cubes have been removed from each cube?

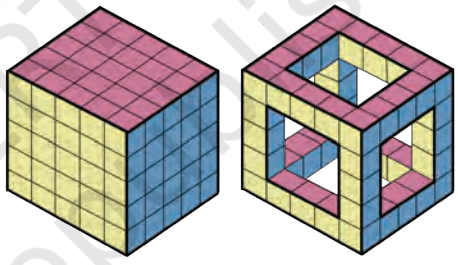
(a)



(b)



(c)



3. Nisha has glued 27 small cubes together to make a large solid cube. She paints the large cube red. How many of the original small cubes have—

(a) three faces painted red? _____ (b) two faces painted red? _____

(c) one face painted red? _____ (d) no faces painted red? _____

Puzzle

Tanu arranged 7 shapes in a line. She used 2 squares, 2 triangles, 1 circle, 1 hexagon, and 1 rectangle.

Find her arrangement using the following clues:

(a) The square is between the circle and the rectangle.
(b) The rectangle is between the square and the triangle.
(c) The two triangles are next to the square.
(d) The hexagon is to the right of the triangle.
(e) The circle is to the left of the square.

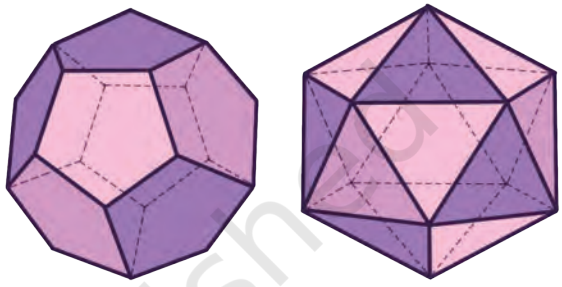
Icosahedron and Dodecahedron

What do these names mean? Once you count their faces, you will know.

Use the nets provided at the end of the book to make icosahedron and dodecahedron models.

What shapes do you see in an icosahedron and a dodecahedron?

Icosahedron: ..... Dodecahedron: .....



Do all the faces look the same?

Icosahedron: ..... Dodecahedron: .....

How many faces meet at a vertex (point)?

Icosahedron: ..... Dodecahedron: .....

Do the same number of faces meet at each vertex?

Icosahedron: ..... Dodecahedron: .....

How many edges do you see?

Icosahedron: ..... Dodecahedron: .....

How did you count them such that you do not miss out any edge or count an edge twice?

Can you think of any other solid shapes that have faces that look the same?

Do the same number of faces meet at each common vertex? .....

You can also build some 3-D shapes using straws or ice-cream sticks and clay or play dough.

Which shapes did you make ?