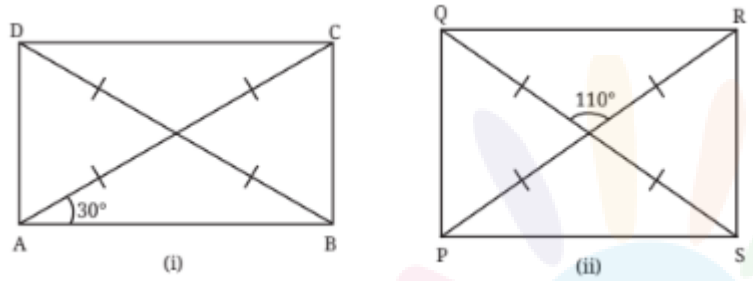
NCERT Solutions For Class 8 Maths

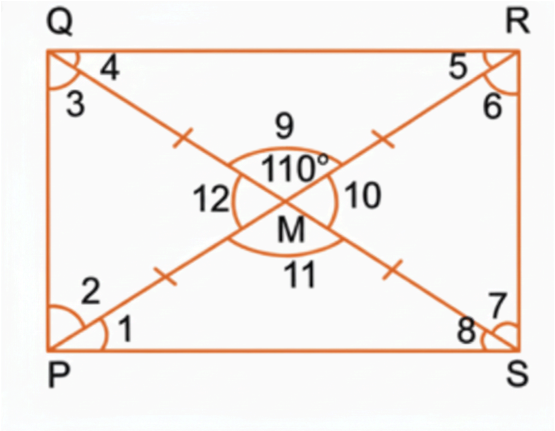
Chapter 4 - Quadrilaterals

Question 1.

Find all the other angles inside the following rectangles.



Solution:



(i) The given rectangle is ABCD.

We have $\angle 1 = 30^\circ$

$\angle 1 + \angle 2 = 90^\circ$

$\therefore \angle 2 = 90^\circ - \angle 1 = 90^\circ - 30^\circ = 60^\circ$.

MD = MA

⇒ ∠3 = ∠2 = 60°

∠3 + ∠Z4 = 90°

∴ ∠4 = 90° – ∠3 = 90°- 60° = 30°

MC = MD

⇒ ∠5 = ∠4 = 30°

∠5 + ∠6 = 90°

∴ ∠6 = 90° – ∠5 = 90° – 30° = 60°

MB = MC

⇒ ∠7 = ∠6 = 60°

MB = MA

⇒ ∠8 = ∠1 = 30°

In ΔAMB, we have

∠1 + ∠9 + ∠8 = 180°.

∴ 30° + ∠9 + 30° = 180°

∴ ∠9 = 180° – 60° = 120°

∠11 = ∠9 = 120° (Vertically opposite angles)

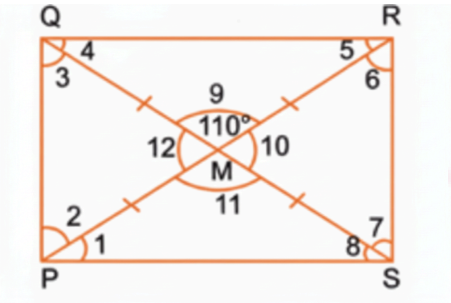
∠9 + ∠10 = 180° (Linear angles)

$\therefore \angle 10 = 180^\circ - 120^\circ = 60^\circ$

$\angle 12 = \angle 10 = 60^\circ$ (Vertically opposite angles)

$\therefore \angle 2 = 60^\circ, \angle 3 = 60^\circ, \angle 4 = 30^\circ, \angle 5 = 30^\circ, \angle 6 = 60^\circ, \angle 7 = 60^\circ, \angle 8 = 30^\circ, \angle 9 = 120^\circ, \angle 10 = 60^\circ, \angle 11 = 120^\circ$ and $\angle 12 = 60^\circ$.

(ii) The given rectangle is PSRQ.



We have $\angle 9 = 110^\circ$.

$\angle 11 = \angle 9 = 110^\circ$ (Vertically opposite angles)

$\angle 9 + \angle 10 = 180^\circ$ (Linear angles)

$\therefore \angle 10 = 180^\circ - 110^\circ = 70^\circ$

$\angle 12 = \angle 10 = 70^\circ$ (Vertically opposite angles)

MP = MS

$\Rightarrow \angle 1 = \angle 8$

In ΔPMS, we have

$\angle 1 + \angle 11 + \angle 8 = 180^\circ$.

$\Rightarrow \angle 1 + 110 + \angle 1 = 180^\circ$

$\Rightarrow 2\angle 1 = 180^\circ - 110$

$\Rightarrow 2\angle 1 = 70^\circ$

$\Rightarrow \angle 1 = 35^\circ$

$\therefore \angle 8$ is also 35°.

$\therefore \angle 1 + \angle 2 = 90^\circ$

$\Rightarrow \angle 2 = 90^\circ - \angle 1$

$\Rightarrow \angle 2 = 90^\circ - 35^\circ$

$\Rightarrow \angle 2 = 55^\circ$

MQ = MP

$\Rightarrow \angle 3 = \angle 2 = 55^\circ$

$\therefore \angle 3 + \angle 4 = 90^\circ$

$\Rightarrow \angle 4 = 90^\circ - \angle 3$

$\Rightarrow \angle 4 = 90^\circ - 55^\circ$

$\Rightarrow \angle 4 = 35^\circ$

MR = MQ

$\Rightarrow \angle 5 = \angle 4 = 35^\circ$

$\therefore \angle 5 + \angle 6 = 90^\circ$

$\Rightarrow \angle 6 = 90^\circ - \angle 5$

$\Rightarrow \angle 6 = 90^\circ - 35^\circ$

$\Rightarrow \angle 6 = 55^\circ$

MS = MR

$\Rightarrow \angle 7 = \angle 6 = 55^\circ$

∴ ∠1 = 35°, ∠2 = 55°, ∠3 = 55°, ∠4 = 35°, ∠5 = 35°, ∠6 = 55°, ∠7 = 55°, ∠8 = 35°, ∠10 = 70°, ∠11 = 110° and ∠12 = 70°.

Question 2.

Draw a quadrilateral whose diagonals have equal lengths of 8 cm that bisect each other, and intersect at an angle of:

(i) 30°

(ii) 40°

(iii) 90°

(iv) 140°

Answer:

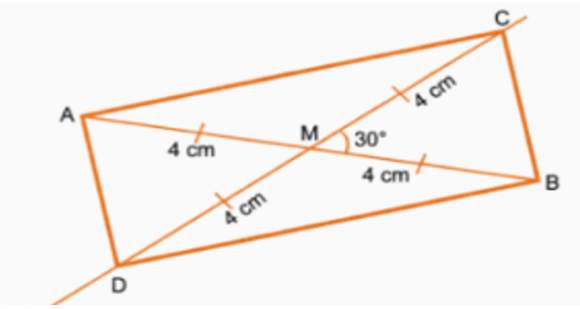
(i) Draw a line segment AB measuring 8 cm.

Mark a point M on AB such that AM = MB = 4 cm.

Using a protractor, construct a 30° angle at point M on the side MB.

On this new line, mark points C and D so that MC = MD = 4 cm.

Now, join A to D, D to B, B to C, and C to A. Thus, ABCD is the required quadrilateral.



Since the diagonals **AB** and **CD** are equal in length and bisect each other at **M**, the quadrilateral **ACBD** is a **rectangle**.

(ii) Draw a line segment **AB** of **8 cm**.

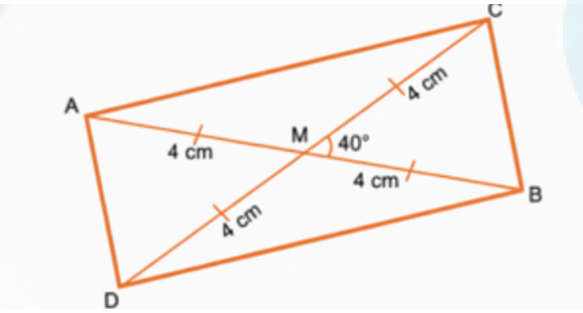
Mark a point **M** on **AB** such that **AM = MB = 4 cm**.

Using a protractor, construct a **40° angle** at point **M** on the side **MB**.

On this new line, mark points **C** and **D** so that **MC = MD = 4 cm**.

Join **A to D**, **D to B**, **B to C**, and **C to A**.

Hence, **ABCD** is the required **quadrilateral**.



Since the diagonals AB and CD are equal in length and bisect each other at M, the quadrilateral ACBD is a rectangle.

(iii) Draw a line segment **AB** measuring **8 cm**.

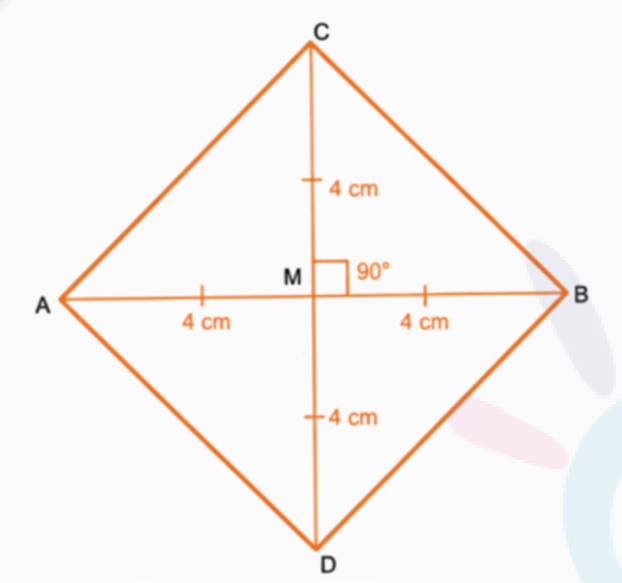
Mark a point **M** on **AB** such that **AM = MB = 4 cm**.

Using a protractor, construct a **90° angle** at point **M** on the side **MB**.

On this perpendicular line, mark points **C** and **D** so that **MC = MD = 4 cm**.

Join **A to D**, **D to B**, **B to C**, and **C to A**.

Thus, **ACBD** is the required **square**.



Since the diagonals **AB** and **CD** are equal in length, bisect each other at **M**, and are **perpendicular** to each other, the quadrilateral **ACBD** is a **square**.

(iv) Draw a line segment **AB** of length **8 cm**.

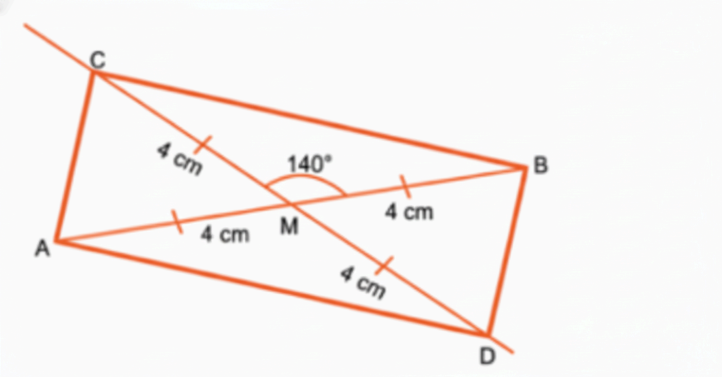
Locate point **M** on **AB** so that **AM = MB = 4 cm**.

With a protractor, construct an angle of **140°** at point **M** on the side **MB**.

Along this ray, mark points **C** and **D** such that **MC = MD = 4 cm**.

Join **A–D**, **D–B**, **B–C**, and **C–A**.

Hence, **ACBD** is the required **quadrilateral**.



Since the diagonals AB and CD are equal in length and bisect each other at M, the quadrilateral ACBD is a rectangle.

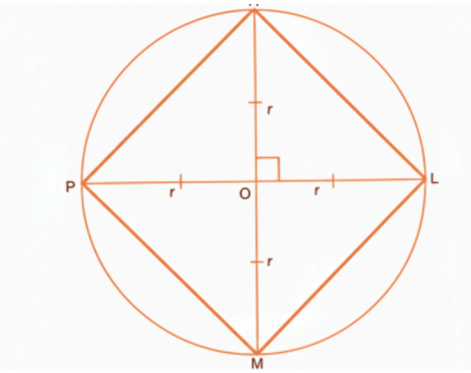
Question 3.

Consider a circle with centre O. Line segments PL and AM are two perpendicular diameters of the circle. What is the figure APML? Reason and/or experiment to figure this out.

Answer:

In the figure, PL and AM are two perpendicular diameters of the circle.

Let the radius of the circle be r.



Then,

PL = PO + OL = r + r = 2r

and

AM = AO + OM = r + r = 2r

∴ PL = AM

Hence, in the quadrilateral APML, the diagonals PL and AM are equal and perpendicular to each other.

Also, OP = OA = OL = OM = r, so the diameters PL and AM bisect each other at O.

Therefore, the quadrilateral APML is a square.

Question 4.

We have seen how to get 90° using paper folding. Now, suppose we do not have any paper but two sticks of equal length and a thread. How do we make an exact 90° angle using these?

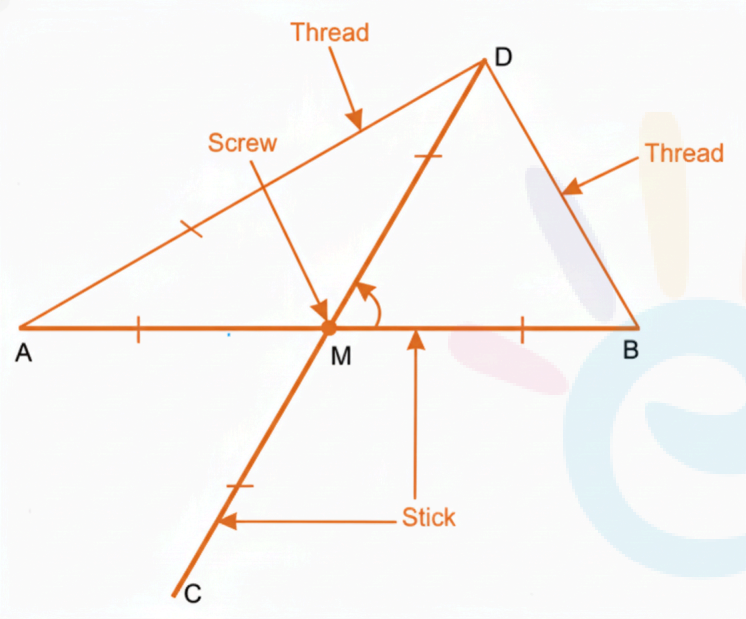
Answer:

Let AB and CD be two sticks of equal length, say 6 cm each. Using a ruler, mark the midpoints of both sticks and fix a screw through these midpoints.

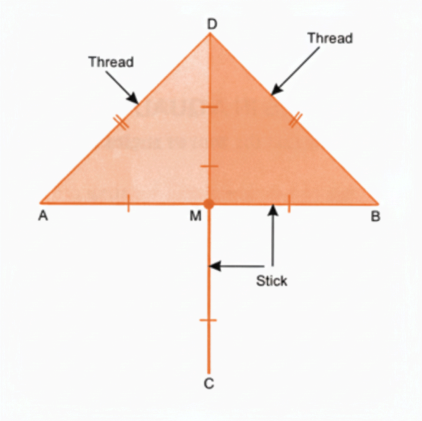
With the help of a thread, measure the distances AD and BD.

Rotate the sticks around the screw until the distances AD and BD become equal.

In this position, tighten the screw to fix the sticks.



The new positions of the sticks are shown in the (fig).



Now, tie pieces of thread along AD and BD as shown in the (image).

Consider the triangles ΔAMD and ΔBMD.
We have:

- AM = BM (since M is the midpoint),
- AD = BD, and
- MD is common.

∴ By the SSS congruence condition,
ΔAMD ≅ ΔBMD.

Hence, ∠AMD = ∠BMD.
Since ∠AMD + ∠BMD = 180° (linear pair),
we get:
2∠AMD = 180°
⇒ ∠AMD = 90°

Therefore, ∠AMD = ∠BMD = 90°,
and the angle between the sticks is 90°.

Question 5.

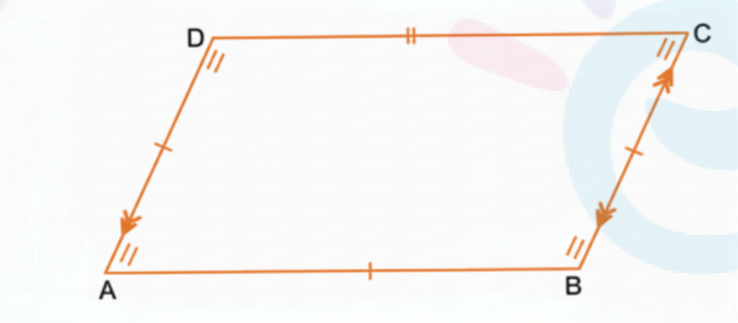
We saw that one of the properties of a rectangle is that its opposite sides are parallel. Can this be chosen as a definition of a rectangle? In other words, is every quadrilateral that has opposite sides parallel and equal a rectangle?

Answer:

Let ABCD be a quadrilateral where the opposite sides are parallel and equal.
That is, AB || DC and AD || BC, and also AB = DC and AD = BC.

Thus, in quadrilateral ABCD, the opposite sides are equal.
However, for ABCD to be a rectangle, each angle must be 90°.

The given conditions (AB || DC and AD || BC) only confirm that ABCD is a parallelogram, but they are not sufficient to prove that all angles of ABCD are right angles.

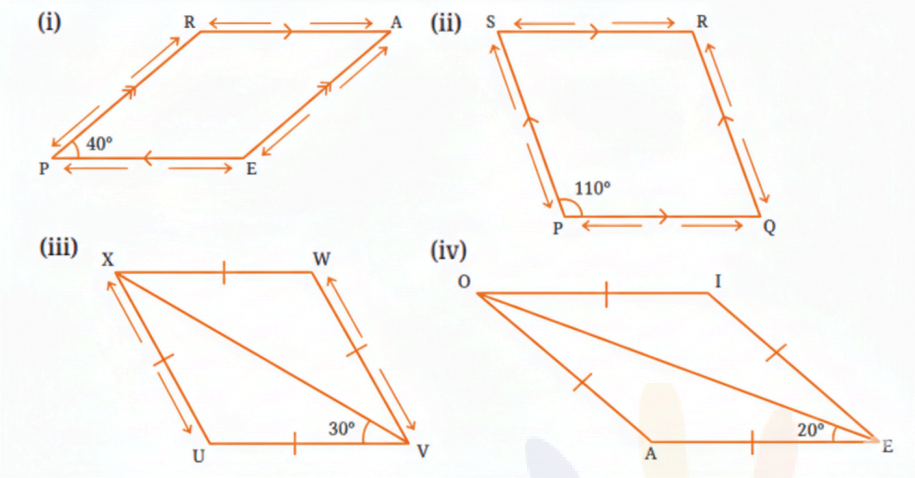


∴ ABCD may not necessarily be a rectangle.
∴ Therefore, a rectangle cannot be defined merely as a quadrilateral with equal and parallel opposite sides.

Figure It Out (Page 102)

Question 1.

Find the remaining angles in the following quadrilaterals.



Answer:

(i) Since the opposite sides of quadrilateral PEAR are parallel, it is a parallelogram.

In this parallelogram, PE acts as a transversal to the parallel sides PR and EA.

The angles ∠RPE and ∠AEP are interior angles on the same side of the transversal.

∴ ∠RPE + ∠AEP = 180°

⇒ 40° + ∠AEP = 180°

⇒ ∠AEP = 180° – 40° = 140°

Since opposite angles of a parallelogram are equal,

∴ ∠EAR = ∠EPR = 40° and ∠ARP = ∠AEP = 140°.

(ii) Since the opposite sides of quadrilateral PQRS are parallel, it is a parallelogram.

Here, PQ serves as a transversal to the parallel sides PS and QR.

The angles ∠SPQ and ∠RQP are interior angles on the same side of the transversal.

∴ ∠SPQ + ∠RQP = 180°

⇒ 110° + ∠RQP = 180°

⇒ ∠RQP = 180° – 110° = 70°

Since opposite angles of a parallelogram are equal,

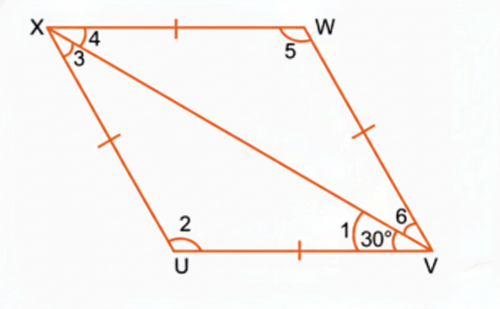
∴ ∠QRS = ∠QPS = 110° and ∠PSR = ∠RQP = 70°.

(iii) The quadrilateral UVWX is a rhombus since all its sides are equal.

Given that ∠1 = 30°.

In a rhombus, the diagonals bisect the vertex angles,

∴ ∠6 = 30°.



In ΔUVX, since UV = UX, the triangle is isosceles, and therefore

∠1 = ∠3

∴ ∠3 = 30°

Hence, ∠4 = 30° as well.

Now, in ΔUVX,

∠1 + ∠2 + ∠3 = 180°

⇒ 30° + ∠2 + 30° = 180°

⇒ ∠2 = 180° – 60° = 120°

Since opposite angles of a rhombus are equal,

∠5 = ∠2 = 120°

Therefore,

∠2 = 120°, ∠3 = 30°, ∠4 = 30°, ∠5 = 120°, and ∠6 = 30°.

(iv) Please try yourself.

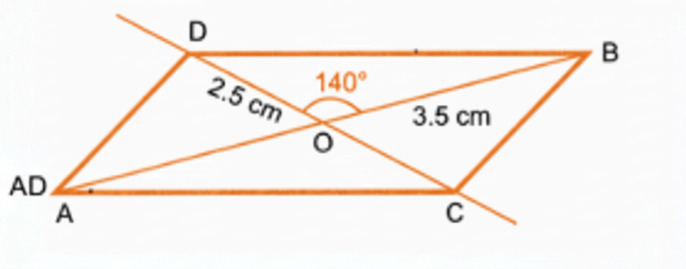
Question 2.

Using the diagonal properties, construct a parallelogram whose diagonals are of lengths 7 cm and 5 cm, and intersect at an angle of 140°.

Answer:

Draw a line segment AB measuring 7 cm.

Mark a point O on AB such that AO = OB = 3.5 cm.



At point O, construct an angle of 140° on the side OB.

On this line, mark points C and D such that OC = OD = 2.5 cm.

Thus, CD = 5 cm, and O becomes the midpoint of both AB and CD.

Now, join A–C, C–B, B–D, and D–A.
The resulting figure ACBD is a quadrilateral whose diagonals AB and CD bisect each other at O.

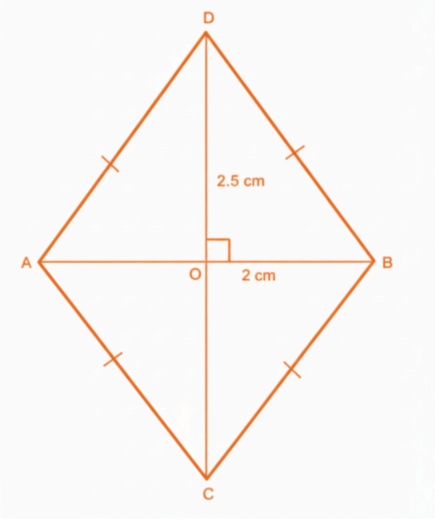
∴ ACBD is the required parallelogram.

Question 3.

Using the diagonal properties, construct a rhombus whose diagonals are of lengths 4 cm and 5 cm.

Answer:
Draw a line segment AB of 4 cm.
Mark a point O on AB such that AO = OB = 2 cm.

At point O, draw a line perpendicular to AB.
On this perpendicular line, mark points C and D such that OC = OD = 2.5 cm.
Thus, CD = 5 cm, and O is the midpoint of both AB and CD.



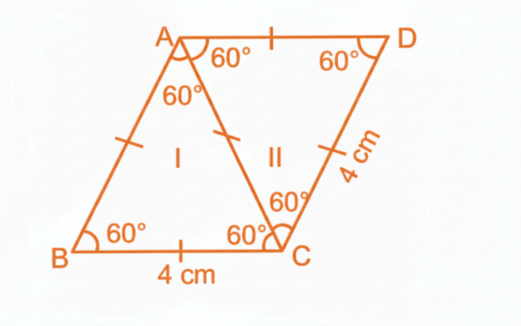
Now, join A–C, C–B, B–D, and D–A.

The quadrilateral ACBD has diagonals AB and CD that bisect each other at O and are perpendicular to each other.
∴ ACBD is the required rhombus.

Figure It Out (Pages 107-109)

1. Find all the sides and the angles of the quadrilateral obtained by joining two equilateral triangles with sides 4 cm.

Answer:
Let two equilateral triangles, each with sides measuring 4 cm, be joined as shown below.



The resulting quadrilateral ABCD has all its sides equal to 4 cm.
The interior angles of the quadrilateral are:
∠A = 60° + 60° = 120°,
∠B = 60°,
∠C = 60° + 60° = 120°, and
∠D = 60°.

2. Construct a kite whose diagonals are of lengths 6 cm and 8 cm.

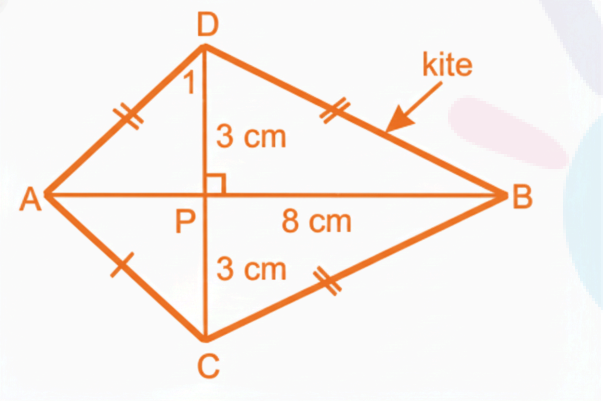
Answer:

Draw a line segment AB measuring 8 cm.

Mark a point P on AB and draw a perpendicular line to AB passing through P.

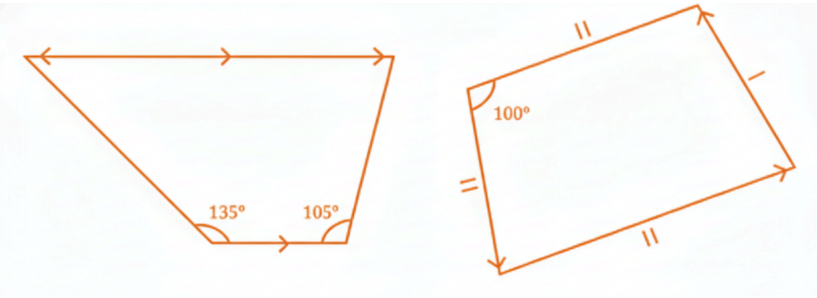
On this perpendicular, mark points C and D such that PC = PD = 3 cm.

Now, join A–C, C–B, B–D, and D–A.



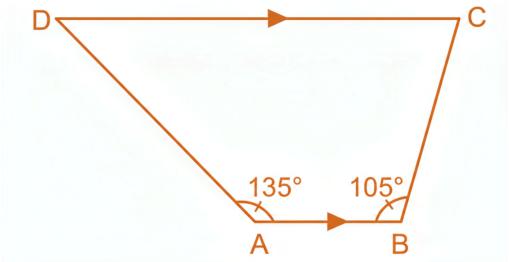
ACBD is the required kite, having diagonals of lengths 6 cm and 8 cm.

3. Find the remaining angles in the following trapeziums.



Answer:

(i) Let the given trapezium be ABCD, where AB and DC are parallel.



Since the sum of the interior angles on the same side of a transversal is 180°,

$\therefore \angle A + \angle D = 180^\circ$ and $\angle B + \angle C = 180^\circ$

Now,

$\angle A + \angle D = 180^\circ$

$\Rightarrow 135^\circ + \angle D = 180^\circ$

$\Rightarrow \angle D = 180^\circ - 135^\circ = 45^\circ$

Similarly,

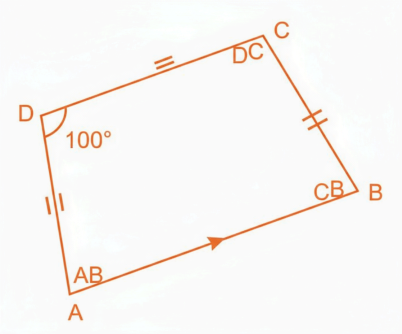
$\angle B + \angle C = 180^\circ$

$\Rightarrow 105^\circ + \angle C = 180^\circ$

$\Rightarrow \angle C = 180^\circ - 105^\circ = 75^\circ$

$\therefore$ The remaining angles are $\angle D = 45^\circ$ and $\angle C = 75^\circ$.

(ii) Let the given trapezium be ABCD.



Since AD = BC, the trapezium ABCD is isosceles.

In an isosceles trapezium, the angles opposite to equal sides are equal.

$\therefore \angle C = \angle D = 100^\circ$

Also, since AB || DC,

$\angle A + \angle D = 180^\circ$ and $\angle B + \angle C = 180^\circ$

Now,

$\angle A + \angle D = 180^\circ$

$\Rightarrow \angle A + 100^\circ = 180^\circ$

$\Rightarrow \angle A = 80^\circ$

Similarly,

$\angle B + \angle C = 180^\circ$

$\Rightarrow \angle B + 100^\circ = 180^\circ$

$\Rightarrow \angle B = 80^\circ$

$\therefore$ The remaining angles are $\angle A = 80^\circ$, $\angle B = 80^\circ$, and $\angle C = 100^\circ$.

4. Draw a Venn diagram showing the set of parallelograms, kites, rhombuses, rectangles, and squares. Then answer the following questions.

(i) What is the quadrilateral that is both a kite and a parallelogram?

(ii) Can there be a quadrilateral that is both a kite and a rectangle?

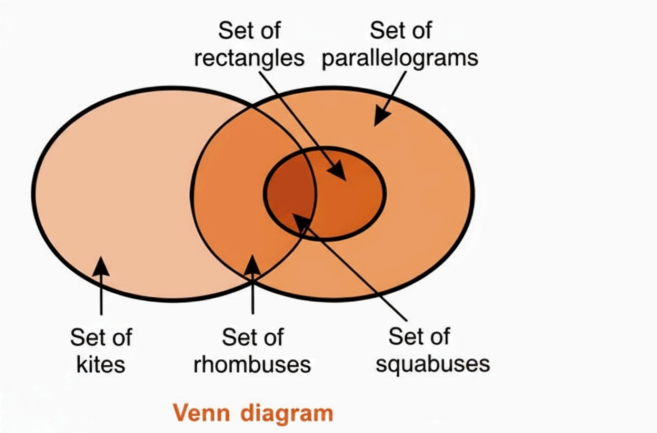
(iii) Is every kite a rhombus? If not, what is the correct relationship between these two types of quadrilaterals?

Answer:

We know the following relationships among different quadrilaterals:

- Every rectangle is a parallelogram.
- Every square is a rectangle.
- Every square is also a rhombus.
- Every rhombus is a kite.

The Venn diagram below illustrates the relationship between parallelograms, kites, rhombuses, rectangles, and squares.

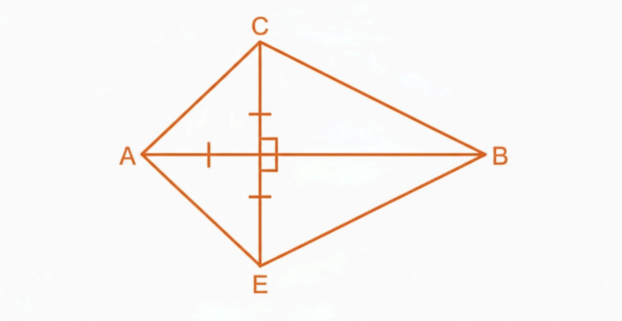


Venn diagram

(i) The set of rhombuses lies in the intersection of both the kites and parallelograms sets.
∴ A rhombus is both a kite and a parallelogram.

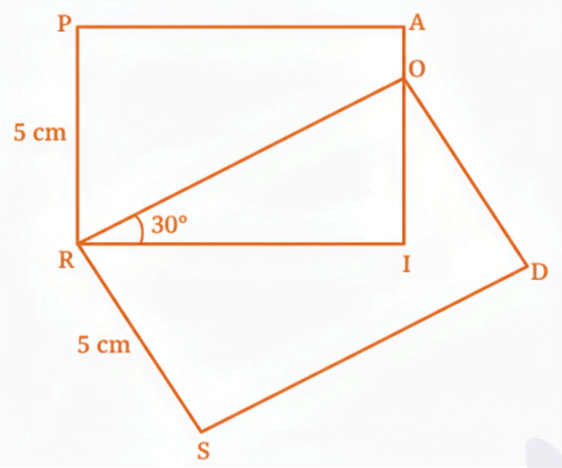
(ii) A kite is not a rectangle, and a rectangle is not a kite.
∴ No quadrilateral can be both a kite and a rectangle.
Hence, there is no overlapping region between the set of kites and the set of rectangles.

(iii) Every kite is not a rhombus.
In the given figure, the kite ABCD is not a rhombus.
The correct relationship is that every rhombus is a kite, but not every kite is a rhombus.



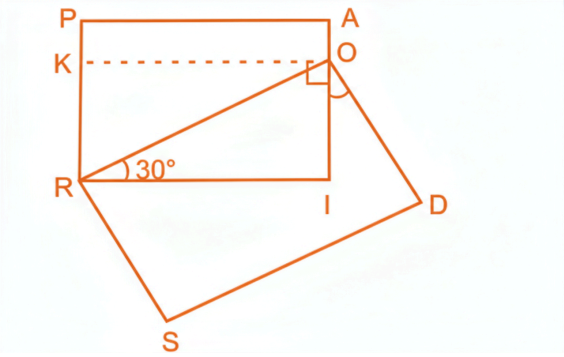
The correct relationship is that every rhombus is a kite.

Question 5.
If PAIR and RODS are two rectangles, find ∠IOD.



Answer:

From O, draw a line OK parallel to RI.



∴ ∠KOR = ∠ORI = 30° (Alternate angles)

Now, ∠KOR + ∠ROI = 90°

⇒ 30° + ∠ROI = 90°

⇒ ∠ROI = 90° – 30° = 60°

Also, ∠ROI + ∠IOD = 90°

⇒ 60° + ∠IOD = 90°

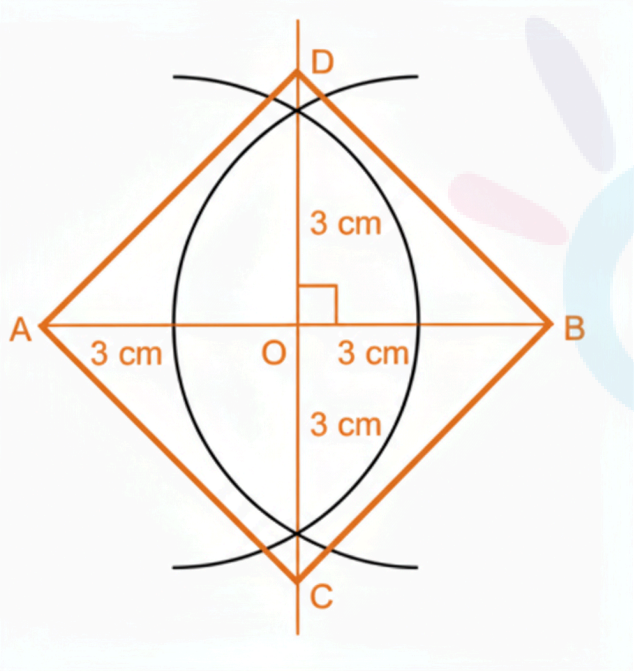
⇒ ∠IOD = 90° – 60° = 30°

Hence, ∠ROI = 60° and ∠IOD = 30°

6. Construct a square with a diagonal of 6 cm without using a protractor.

Answer:

Draw a line AB equal to 6 cm.



We have 6 ÷ 2 = 3.

With centres at A and B, draw arcs of radius slightly more than 3 cm, say 4 cm.

Join the points where these arcs intersect.

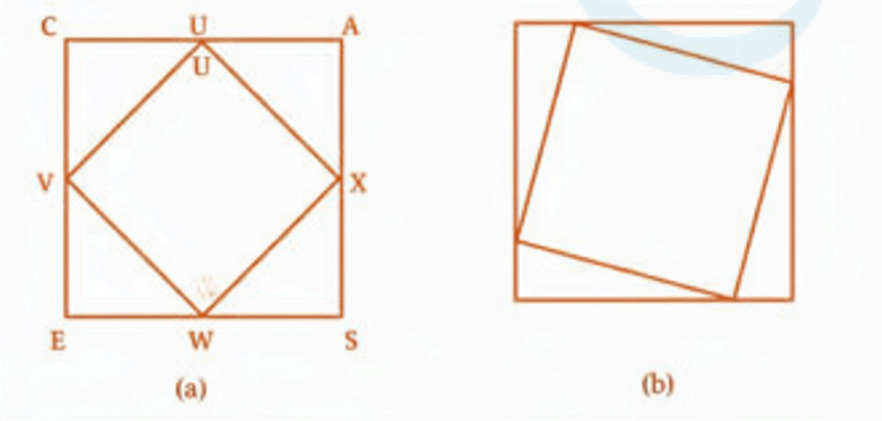
Let this line intersect AB at O.

Now, mark points C and D on this perpendicular line such that OC = OD = 3 cm.

Join AC, CB, BD, and DA.

Thus, ACBD is the required square with diagonals measuring 6 cm.

7. CASE is a square. The points U, V, W, and X are the midpoints of the sides of the square. What type of quadrilateral is UVWX? Find this by using geometric reasoning, as well as by construction and measurement. Find other ways of constructing a square within a square such that the vertices of the inner square lie on the sides of the outer square, as shown in Figure (b).



Answer:

(a) U, V, W, and X are the midpoints of the sides of the square.

In triangles ΔVCU and ΔUAX:

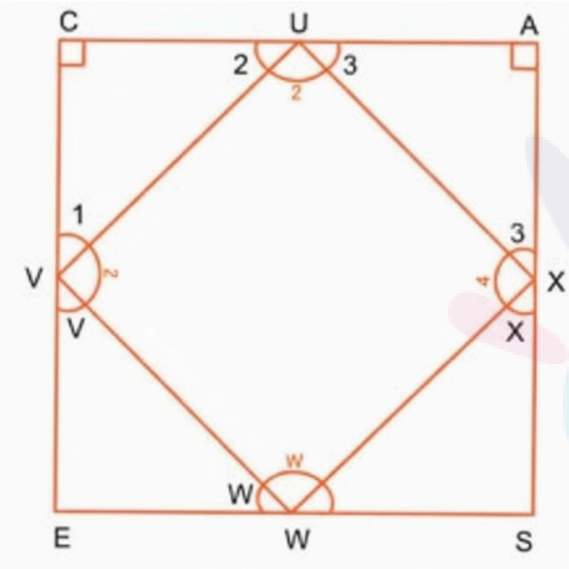
VC = UA, ∠VCU = ∠UAX = 90°, and CU = AX.

∴ By the **SAS congruence rule**, ΔVCU ≅ ΔUAX.

∴ VU = UX.

Similarly, we can show that VU = XW and VU = WV.

Hence, **all sides of quadrilateral UVWX are equal.**



In ΔVCU, VC = CU

⇒ ∠1 = ∠2

Also, ∠1 + ∠C + ∠2 = 180°

⇒ ∠1 + 90° + ∠1 = 180°

⇒ 2∠1 = 90°

⇒ ∠1 = 45°

Therefore, ∠2 is also 45°.

Similarly, ∠3 = ∠4 = 45°.

Now, ∠2 + ∠VUX + ∠3 = 180°

⇒ 45° + ∠VUX + 45° = 180°

⇒ ∠VUX = 180° – 90°

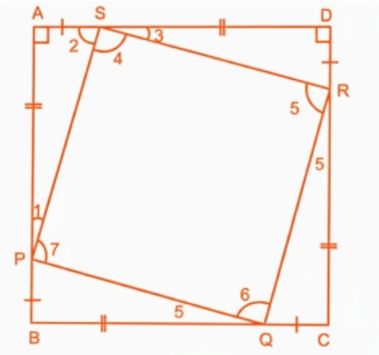
⇒ ∠VUX = 90°

In the same way, ∠VXW = 90°, ∠XWV = 90°, and ∠WVU = 90°.

Hence, by definition, quadrilateral UVWX is a square.

(b) Let ABCD be a square.

Take points P, Q, R, and S such that AS = BP = CQ = DR.



Since all the sides of the squares are equal,
we have **DS = AP = BQ = CR**.

In ΔPAS and ΔSDR,
PA = SD, ∠PAS = ∠SDR = 90°, and AS = DR.
∴ By the **SAS criterion**, ΔPAS ≅ ΔSDR.
Hence, **PS = SR**.

Similarly, **PS = RQ** and **PS = QP**,
so all sides of the quadrilateral **PQRS** are equal.

In ΔPAS,
∠1 + ∠2 + 90° = 180°
⇒ ∠1 + ∠2 = 90°
⇒ ∠3 + ∠2 = 90° (since ∠1 = ∠3).

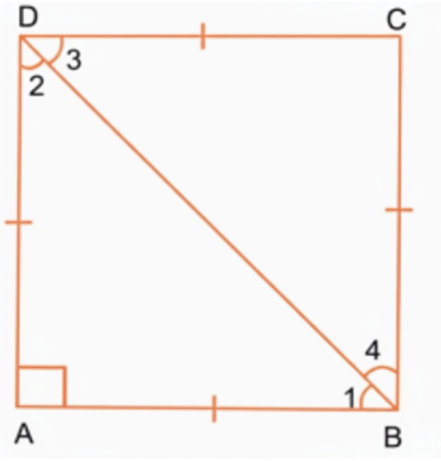
Also,
∠2 + ∠4 + ∠3 = 180°
⇒ 90° + ∠4 = 180°
⇒ ∠4 = 90°.

Similarly, **∠5 = 90°, ∠6 = 90°, and ∠7 = 90°**.
Therefore, by definition, **the quadrilateral PQRS is a square.**

8. If a quadrilateral has four equal sides and one angle of 90°, will it be a square? Find the answer using geometric reasoning as well as by construction and measurement.

Answer:

Let ABCD be a quadrilateral such that AB = BC = CD = DA and ∠DAB = 90°.
Join BD.



In ΔADB and ΔCDB,
AD = CD, AB = CB, and DB is the common side.
∴ ΔADB ≅ ΔCDB.
Hence, ∠A = ∠C = 90°.

In ΔDAB, since AB = AD, we have ∠1 = ∠2.
Also, ∠1 + 90° + ∠2 = 180°
⇒ ∠1 + ∠2 = 90°
⇒ ∠1 = ∠2 = 45°.

In ΔCDB, since CD = CB, we have ∠3 = ∠4.
Also, ∠3 + 90° + ∠4 = 180°
⇒ ∠3 + ∠4 = 90°
⇒ ∠3 = ∠4 = 45°.

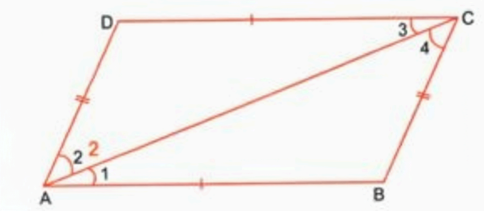
Therefore,
$\angle ABC = \angle 1 + \angle 4 = 45^\circ + 45^\circ = 90^\circ$
and
$\angle ADC = \angle 2 + \angle 3 = 45^\circ + 45^\circ = 90^\circ$.

Thus, each angle of the quadrilateral ABCD is 90°.
Hence, ABCD is a square.

By measurement, we also find that AB = BC = CD = DA and $\angle A = \angle B = \angle C = \angle D = 90^\circ$.

9. What type of quadrilateral is one in which the opposite sides are equal? Justify your answer.
Hint: Draw a diagonal and check for congruent triangles.

Answer:
Let ABCD be a quadrilateral in which opposite sides are equal.
Join AC.



In ΔADC and ΔCBA,
AD = CB, DC = BA, and AC is the common side.

∴ By the SSS condition, ΔADC ≅ ΔCBA.

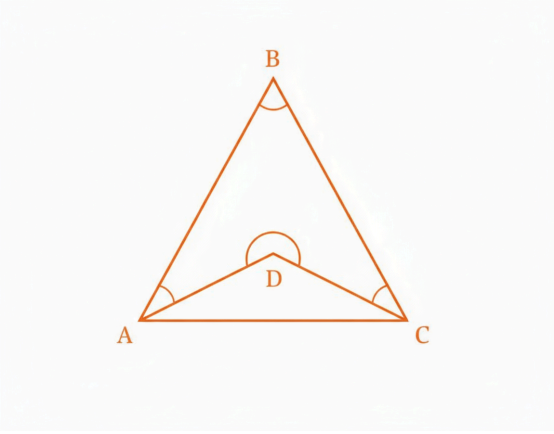
Hence, ∠1 = ∠3 and ∠2 = ∠4.

Since AC acts as a transversal for lines AB and DC, and the alternate angles ∠1 and ∠3 are equal,
∴ AB // DC.

Similarly, AC acts as a transversal for lines AD and BC, and the alternate angles ∠2 and ∠4 are equal,
∴ AD // BC.

Therefore, by definition, ABCD is a parallelogram.

10. Will the sum of the angles in a quadrilateral, such as the following one, also be 360°? Find the answer using geometric reasoning as well as by constructing this figure and measuring.



Answer:

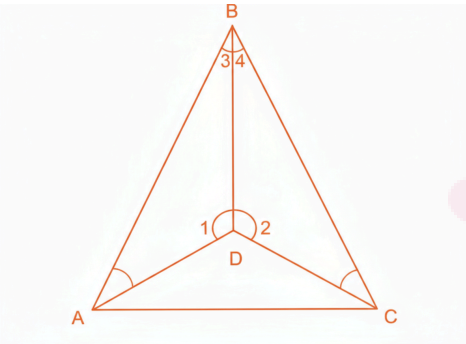
In the given quadrilateral, join BD.

In ΔABD, we have

$\angle A + \angle 3 + \angle 1 = 180^\circ$

In ΔCBD, we have

$\angle C + \angle 4 + \angle 2 = 180^\circ$



Adding the equations, we get:

$(\angle A + \angle 3 + \angle 1) + (\angle C + \angle 4 + \angle 2) = 180^\circ + 180^\circ$

$\Rightarrow \angle A + (\angle 3 + \angle 4) + \angle C + (\angle 1 + \angle 2) = 360^\circ$

$\Rightarrow \angle A + \angle B + \angle C + \angle D = 360^\circ$

∴ The sum of the interior angles of the quadrilateral **ABCD** is **360°**.

By measurement using a protractor, we also find that the total of all angles equals **360°**.

11. State whether the following statements are true or false. Justify your answers.

(i) A quadrilateral whose diagonals are equal and bisect each other must be a square.

(ii) A quadrilateral having three right angles must be a rectangle.

(iii) A quadrilateral whose diagonals bisect each other must be a parallelogram.

(iv) A quadrilateral whose diagonals are perpendicular to each other must be a rhombus.

(v) A quadrilateral in which the opposite angles are equal must be a parallelogram.

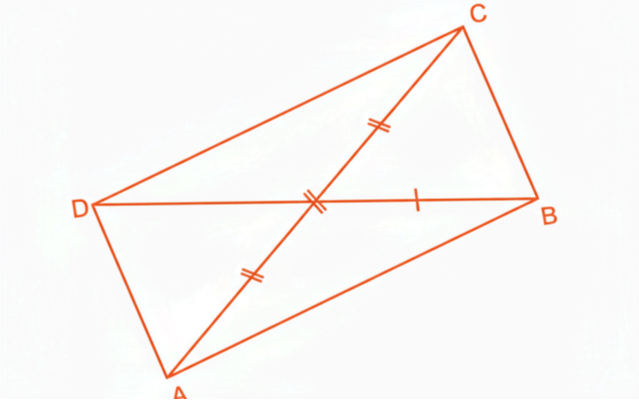
(vi) A quadrilateral in which all the angles are equal is a rectangle.

(vii) Isosceles trapeziums are parallelograms.

Answer:

(i) A quadrilateral having diagonals that are equal and bisect each other is not necessarily a square.

In the given figure, the diagonals AC and BD are equal and bisect each other — therefore, the quadrilateral formed is a rectangle.



∴ The given statement is false.

(ii) Let ABCD be a quadrilateral with three right angles at A, D, and C.

We know that ∠A + ∠B + ∠C + ∠D = 360°.

⇒ 90° + ∠B + 90° + 90° = 360°

⇒ ∠B = 360° – 270°

⇒ ∠B = 90°

∴ All four angles of ABCD are 90°.

Hence, the given quadrilateral is a rectangle.

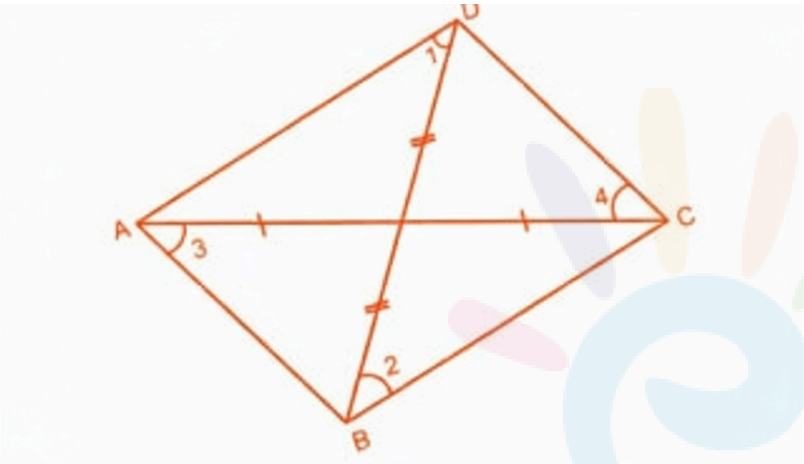


∴ The given statement is true.

(iii) In the quadrilateral ABCD, the diagonals AC and BD bisect each other.

Here, ΔAOD and ΔCOB are congruent.

∴ ∠1 = ∠2



∴ BC is parallel to AD.

Also, ΔAOB and ΔCOD are congruent.

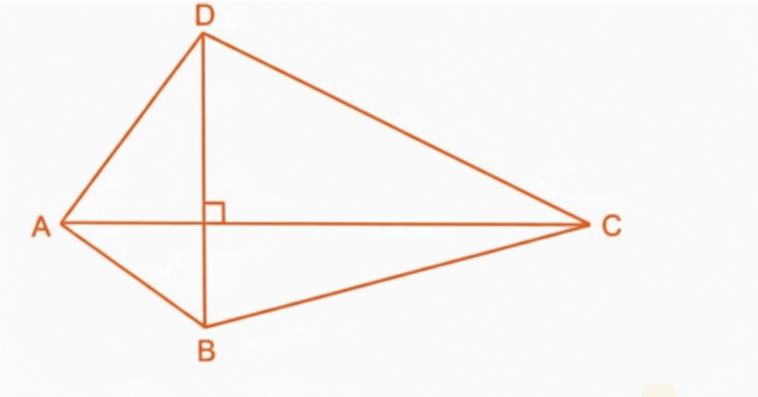
∴ ∠3 = ∠4

∴ AB is parallel to DC.

Since opposite sides of ABCD are parallel, it must be a parallelogram.

∴ The given statement is true.

(iv) Let ABCD be a quadrilateral whose diagonals AC and BD are perpendicular to each other.



This quadrilateral cannot be considered a rhombus because its diagonals, AC and BD, may not bisect each other.

∴ Therefore, the given statement is false.

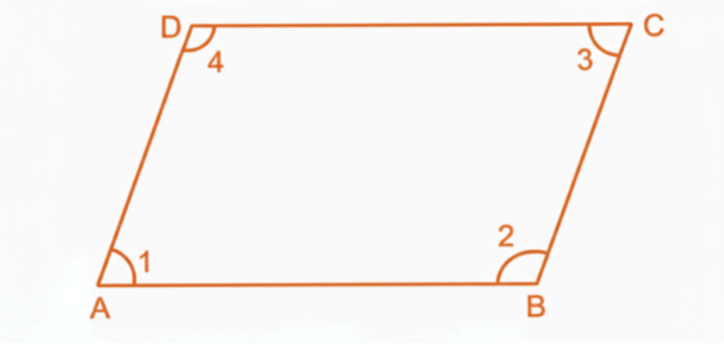
(v) Let ABCD be a quadrilateral in which $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$.

We have, $\angle 1 + \angle 2 + \angle 3 + \angle 4 = 360°$.

$\Rightarrow \angle 1 + \angle 2 + \angle 1 + \angle 2 = 360°$

$\Rightarrow 2(\angle 1 + \angle 2) = 360°$

$\Rightarrow \angle 1 + \angle 2 = 180°$



AB acts as a transversal to the lines AD and BC, and the sum of the interior

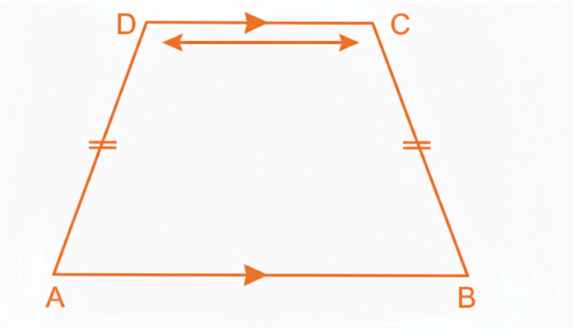
angles ∠1 and ∠2 on the same side is 180°.
∴ Lines **AD** and **BC** are parallel.

Also,
∠1 + ∠2 + ∠3 + ∠4 = 360°
⇒ ∠3 + ∠2 + ∠3 + ∠2 = 360°
⇒ 2(∠2 + ∠3) = 360°
⇒ ∠2 + ∠3 = 180°

Since **BC** is a transversal to **AB** and **DC**, and the sum of interior angles ∠2 and ∠3 on the same side is 180°,
∴ Lines **AB** and **DC** are also parallel.

Hence, both pairs of opposite sides of quadrilateral **ABCD** are parallel.
∴ **ABCD** is a parallelogram, and the given statement is **true**.

(vi) Let ABCD be a quadrilateral, where ∠1, ∠2, ∠3, and ∠4 are all equal.
We have ∠1 + ∠2 + ∠3 + ∠4 = 360°
∴ ∠1 + ∠1 + ∠1 + ∠1 = 360°
⇒ 4∠1 = 360°
⇒ ∠1 = 90°



∴ ∠2 = 90°, ∠3 = 90°, and ∠4 = 90°.

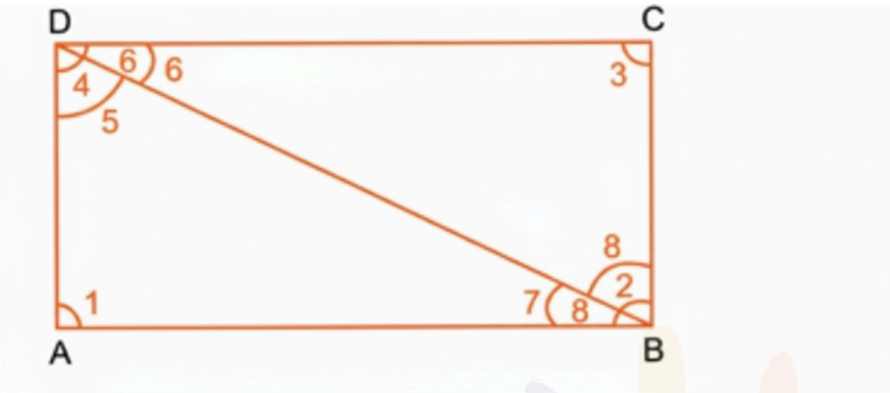
We know that $\angle 5 + \angle 6 = 90^\circ$
and $\angle 6 + 90^\circ + \angle 8 = 180^\circ$
$\Rightarrow \angle 5 + \angle 6 = \angle 6 + \angle 8$
$\Rightarrow \angle 5 = \angle 8$

Also, $\angle 7 + 90^\circ + \angle 5 = 180^\circ$
$\Rightarrow \angle 7 + \angle 5 = 90^\circ$
$\Rightarrow \angle 5 + \angle 6 = \angle 7 + \angle 5$
$\Rightarrow \angle 6 = \angle 7$

In ΔDAB and ΔBCD, we have $\angle 5 = \angle 8$, $\angle 7 = \angle 6$, and BD is the common side.
$\therefore$ By the ASA condition, $\Delta DAB \cong \Delta BCD$.
$\therefore$ DA = BC and AB = CD.

Hence, the opposite sides of quadrilateral ABCD are equal.
$\therefore$ ABCD is a rectangle.
$\therefore$ The given statement is true.

(vii) An isosceles trapezium ABCD can not be a parallelogram because it has two non-parallel equal lines AD and BC.



∴ The given statement is false.