

## EXERCISE 16.1

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1. Explain the concept of congruence of figures with the help of certain examples.

**Solution:**

Congruent objects or figures are exact copies of each other or we can say mirror images of each other. The relation of two objects being congruent is called congruence.

Consider Ball 1 and Ball 2. These two balls are congruent.



Ball 1

Ball 2

Now consider the two stars below. Star A and Star B are exactly the same in size, colour and shape. These are congruent stars



Star A

Star B

2. Fill in the blanks:

- (i) Two line segments are congruent if .....
- (ii) Two angles are congruent if .....
- (iii) Two square are congruent if .....
- (iv) Two rectangles are congruent if .....
- (v) Two circles are congruent if .....

**Solution:**

- (i) They are of equal lengths
- (ii) Their measures are the same or equal.
- (iii) Their sides are equal or they have the same side length
- (iv) Their dimensions are same that is lengths are equal and their breadths are also equal.
- (v) They have same radii

3. In Fig. 6,  $\angle POQ \cong \angle ROS$ , can we say that  $\angle POR \cong \angle QOS$

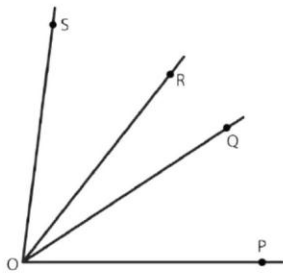


Fig. 6

**Solution:**

Given that

$$\angle POQ \cong \angle ROS$$

Also given that  $\angle ROQ \cong \angle ROQ$

Therefore adding  $\angle ROQ$  to both sides of  $\angle POQ \cong \angle ROS$ ,

We get,  $\angle POQ + \angle ROQ \cong \angle ROQ + \angle ROS$

Therefore,  $\angle PQR \cong \angle QOS$

4. In fig. 7,  $a = b = c$ , name the angle which is congruent to  $\angle AOC$

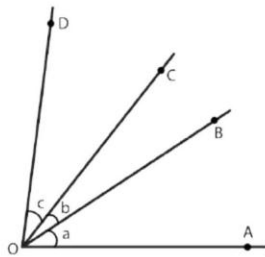


Fig. 7

**Solution:**

From the figure we have

$$\angle AOB = \angle BOC = \angle COD$$

Therefore,  $\angle AOB = \angle COD$

$$\text{Also, } \angle AOB + \angle BOC = \angle BOC + \angle COD$$

$$\angle AOC = \angle BOD$$

Hence,  $\angle BOD \cong \angle AOC$

5. Is it correct to say that any two right angles are congruent? Give reasons to justify your answer.

**Solution:**

Two right angles are congruent to each other because they both measure  $90^\circ$ .

We know that two angles are congruent if they have the same measure.

6. In fig. 8,  $\angle AOC \cong \angle PYR$  and  $\angle BOC \cong \angle QYR$ . Name the angle which is congruent to  $\angle AOB$ .

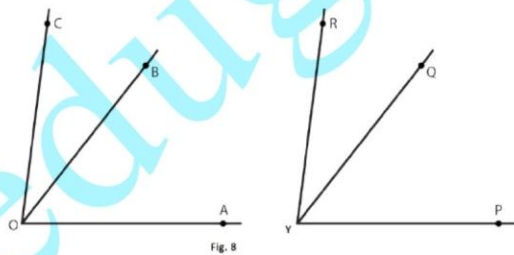


Fig. 8

**Solution:**

Given that  $\angle AOC \cong \angle PYR$

Also given that  $\angle BOC \cong \angle QYR$

Now,  $\angle AOC = \angle AOB + \angle BOC$   $\angle PYR = \angle PYQ + \angle QYR$

By putting the value of  $\angle AOC$  and  $\angle PYR$  in  $\angle AOC \cong \angle PYR$

We get,  $\angle AOB + \angle BOC \cong \angle PYQ + \angle QYR$   $\angle AOB \cong \angle PYQ$  ( $\angle BOC \cong \angle QYR$ )

Hence,  $\angle AOB \cong \angle PYQ$

**7. Which of the following statements are true and which are false;**

(i) All squares are congruent.

(ii) If two squares have equal areas, they are congruent.

(iii) If two rectangles have equal areas, they are congruent.

(iv) If two triangles have equal areas, they are congruent.

**Solution:**

(i) False.

**Explanation:**

All the sides of a square are of equal length. However, different squares can have sides of different lengths. Hence all squares are not congruent.

(ii) True.

**Explanation:**

Two squares that have the same area will have sides of the same lengths. Hence they will be congruent.

(iii) False

**Explanation:**

Area of a rectangle = length  $\times$  breadth

Two rectangles can have the same area. However, the lengths of their sides can vary and hence they are not congruent.

(iv) False

**Explanation:**

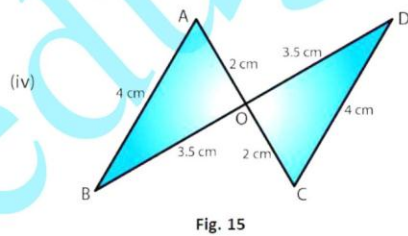
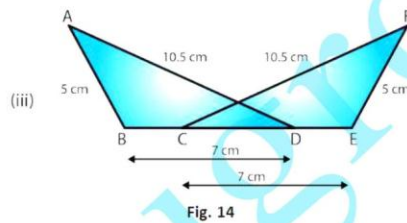
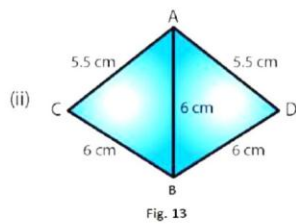
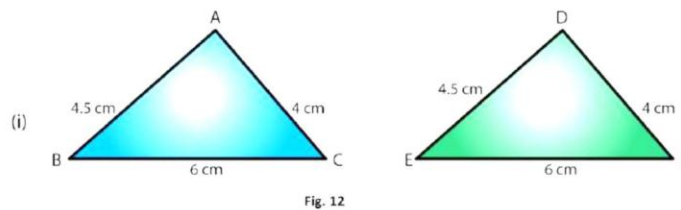
Area of a triangle =  $\frac{1}{2} \times$  base  $\times$  height

Two triangles can have the same area but the lengths of their sides can vary and hence they cannot be congruent.

**EXERCISE 16.2**

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1. In the following pairs of triangle (Fig. 12 to 15), the lengths of the sides are indicated along sides. By applying SSS condition, determine which are congruent. State the result in symbolic form.



**Solution:**

(i) In  $\triangle ABC$  and  $\triangle DEF$

$AB = DE = 4.5$  cm (Side)

$BC = EF = 6$  cm (Side) and

$AC = DF = 4$  cm (Side)

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Therefore, by SSS criterion of congruence,  $\triangle ABC \cong \triangle DEF$

(ii) In  $\triangle ACB$  and  $\triangle ADB$

$AC = AD = 5.5$ cm (Side)

$BC = BD = 5$ cm (Side) and

$AB = AB = 6$ cm (Side)

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Therefore, by SSS criterion of congruence,  $\triangle ACB \cong \triangle ADB$

(iii) In  $\triangle ABD$  and  $\triangle FEC$ ,

$AB = FE = 5$ cm (Side)

$AD = FC = 10.5$ cm (Side)

$BD = CE = 7$ cm (Side)

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Therefore, by SSS criterion of congruence,  $\triangle ABD \cong \triangle FEC$

(iv) In  $\triangle ABO$  and  $\triangle DOC$ ,

$AB = DC = 4$ cm (Side)

$AO = OC = 2$ cm (Side)

$BO = OD = 3.5$ cm (Side)

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Therefore, by SSS criterion of congruence,  $\triangle ABO \cong \triangle ODC$

**2. In fig.16,  $AD = DC$  and  $AB = BC$**

**(i) Is  $\triangle ABD \cong \triangle CBD$ ?**

**(ii) State the three parts of matching pairs you have used to answer (i).**



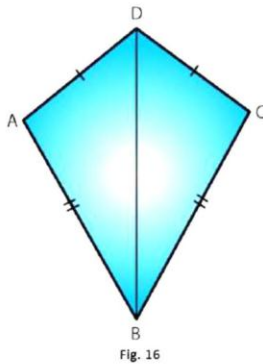


Fig. 16

**Solution:**

(i) Yes  $\triangle ABD \cong \triangle CBD$  by the SSS criterion.

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Hence  $\triangle ABD \cong \triangle CBD$

(ii) We have used the three conditions in the SSS criterion as follows:

$$AD = DC$$

$$AB = BC \text{ and}$$

$$DB = BD$$

3. In Fig. 17,  $AB = DC$  and  $BC = AD$ .

(i) Is  $\triangle ABC \cong \triangle CDA$ ?

(ii) What congruence condition have you used?

(iii) You have used some fact, not given in the question, what is that?

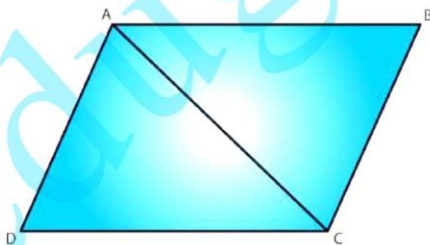


Fig. 17

**Solution:**

(i) From the figure we have  $AB = DC$

$$BC = AD$$

And  $AC = AC$

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

Therefore by SSS criterion  $\triangle ABC \cong \triangle CDA$

(ii) We have used Side congruence condition with one side common in both the triangles.

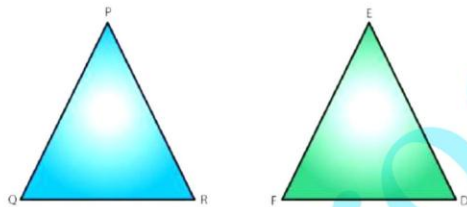
(iii) Yes, have used the fact that  $AC = CA$ .

4. In  $\triangle PQR \cong \triangle EFD$ ,

(i) Which side of  $\triangle PQR$  equals  $ED$ ?

(ii) Which angle of  $\triangle PQR$  equals angle  $E$ ?

**Solution:**



(i)  $PR = ED$

Since the corresponding sides of congruent triangles are equal.

(ii)  $\angle QPR = \angle FED$

Since the corresponding angles of congruent triangles are equal.

5. Triangles  $ABC$  and  $PQR$  are both isosceles with  $AB = AC$  and  $PQ = PR$  respectively. If also,  $AB = PQ$  and  $BC = QR$ , are the two triangles congruent? Which condition do you use?

It  $\angle B = 50^\circ$ , what is the measure of  $\angle R$ ?

**Solution:**

Given that  $AB = AC$  in isosceles  $\triangle ABC$

And  $PQ = PR$  in isosceles  $\triangle PQR$ .

Also given that  $AB = PQ$  and  $QR = BC$ .



Therefore,  $AC = PR$  ( $AB = AC$ ,  $PQ = PR$  and  $AB = PQ$ )

Hence,  $\triangle ABC \cong \triangle PQR$

Now

$\angle ABC = \angle PQR$  (Since triangles are congruent)

However,  $\triangle PQR$  is isosceles.

Therefore,  $\angle PRQ = \angle PQR = \angle ABC = 50^\circ$

**6. ABC and DBC are both isosceles triangles on a common base BC such that A and D lie on the same side of BC. Are triangles ADB and ADC congruent? Which condition do you use? If  $\angle BAC = 40^\circ$  and  $\angle BDC = 100^\circ$ , then find  $\angle ADB$ .**

**Solution:**

Given ABC and DBC are both isosceles triangles on a common base BC

$\angle BAD = \angle CAD$  (corresponding parts of congruent triangles)

$$\angle BAD + \angle CAD = 40^\circ / 2$$

$$\angle BAD = 40^\circ$$

$$\angle BAD = 40^\circ / 2 = 20^\circ$$

$$\angle ABC + \angle BCA + \angle BAC = 180^\circ \text{ (Angle sum property)}$$

Since  $\triangle ABC$  is an isosceles triangle,

$$\angle ABC = \angle BCA$$

$$\angle ABC + \angle ABC + 40^\circ = 180^\circ$$

$$2 \angle ABC = 180^\circ - 40^\circ = 140^\circ$$

$$\angle ABC = 140^\circ / 2 = 70^\circ$$

$$\angle DBC + \angle BCD + \angle BDC = 180^\circ \text{ (Angle sum property)}$$

Since  $\triangle DBC$  is an isosceles triangle,  $\angle DBC = \angle BCD$

$$\angle DBC + \angle DBC + 100^\circ = 180^\circ$$

$$2 \angle DBC = 180^\circ - 100^\circ = 80^\circ$$

$$\angle DBC = 80^\circ / 2 = 40^\circ$$

In  $\triangle BAD$ ,

$$\angle ABD + \angle BAD + \angle ADB = 180^\circ \text{ (Angle sum property)}$$

$$30^\circ + 20^\circ + \angle ADB = 180^\circ \text{ } (\angle ADB = \angle ABC - \angle DBC),$$

$$\angle ADB = 180^\circ - 20^\circ - 30^\circ$$

$$\angle ADB = 130^\circ$$

$$\angle ADB = 130^\circ$$

**7.  $\triangle ABC$  and  $\triangle ABD$  are on a common base AB, and  $AC = BD$  and  $BC = AD$  as shown in Fig. 18. Which of the following statements is true?**

**(i)  $\triangle ABC \cong \triangle ABD$**

(ii)  $\triangle ABC \cong \triangle ADB$

(iii)  $\triangle ABC \cong \triangle BAD$

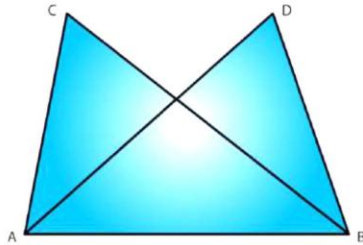


Fig. 18

**Solution:**

In  $\triangle ABC$  and  $\triangle BAD$  we have,

$AC = BD$  (given)

$BC = AD$  (given)

And  $AB = BA$  (corresponding parts of congruent triangles)

Therefore by SSS criterion of congruency,  $\triangle ABC \cong \triangle BAD$

Therefore option (iii) is true.

8. In Fig. 19,  $\triangle ABC$  is isosceles with  $AB = AC$ , D is the mid-point of base BC.

(i) Is  $\triangle ADB \cong \triangle ADC$ ?

(ii) State the three pairs of matching parts you use to arrive at your answer.

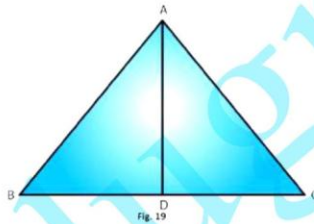


Fig. 19

**Solution:**

(i) Given that  $AB = AC$ .

Also since D is the midpoint of BC,  $BD = DC$

Also,  $AD = DA$

Therefore by SSS condition,

$\triangle ADB \cong \triangle ADC$

(ii) We have used  $AB, AC; BD, DC$  and  $AD, DA$

9. In fig. 20,  $\triangle ABC$  is isosceles with  $AB = AC$ . State if  $\triangle ABC \cong \triangle ACB$ . If yes, state three relations that you use to arrive at your answer.

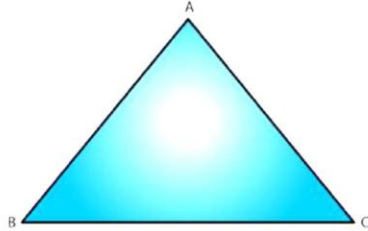


Fig. 20

**Solution:**

Given that  $\triangle ABC$  is isosceles with  $AB = AC$

SSS criterion is two triangles are congruent, if the three sides of triangle are respectively equal to the three sides of the other triangle.

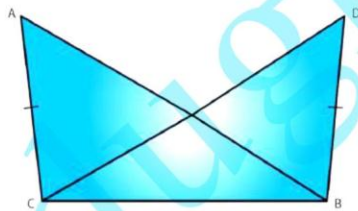
$\triangle ABC \cong \triangle ACB$  by SSS condition.

Since,  $\triangle ABC$  is an isosceles triangle,  $AB = BC$ ,  $BC = CB$  and  $AC = AB$

10. Triangles  $ABC$  and  $DBC$  have side  $BC$  common,  $AB = BD$  and  $AC = CD$ . Are the two triangles congruent? State in symbolic form, which congruence do you use?

Does  $\angle ABD$  equal  $\angle ACD$ ? Why or why not?

**Solution:**



Yes, congruent because given that  $ABC$  and  $DBC$  have side  $BC$  common,  $AB = BD$  and  $AC = CD$

Also from the above data we can say

By SSS criterion of congruency,  $\triangle ABC \cong \triangle DBC$

No,  $\angle ABD$  and  $\angle ACD$  are not equal because  $AB$  not equal to  $AC$

## EXERCISE 16.3

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1. By applying SAS congruence condition, state which of the following pairs (Fig. 28) of triangle are congruent. State the result in symbolic form

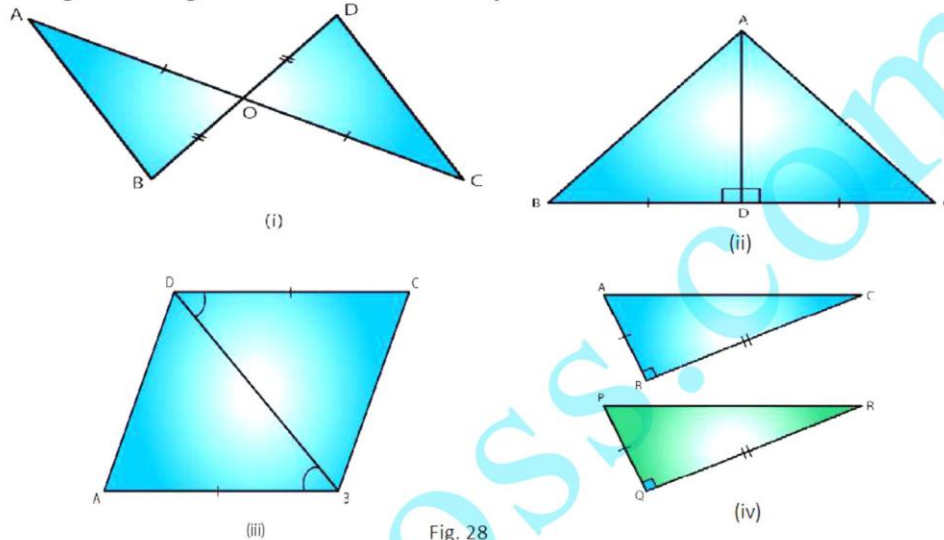


Fig. 28

**Solution:**

(i) From the figure we have  $OA = OC$  and  $OB = OD$  and  $\angle AOB = \angle COD$  which are vertically opposite angles.  
Therefore by SAS condition,  $\triangle AOC \cong \triangle BOD$

(ii) From the figure we have  $BD = DC$   
 $\angle ADB = \angle ADC = 90^\circ$  and  
Therefore, by SAS condition,  $\triangle ADB \cong \triangle ADC$ .

(iii) From the figure we have  $AB = DC$   
 $\angle ABD = \angle CDB$  and  
Therefore, by SAS condition,  $\triangle ABD \cong \triangle CBD$

(iv) We have  $BC = QR$   
 $\angle ABC = \angle PQR = 90^\circ$   
And  $AB = PQ$

Therefore, by SAS condition,  $\triangle ABC \cong \triangle PQR$ .

2. State the condition by which the following pairs of triangles are congruent.

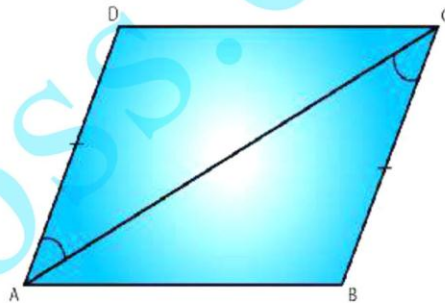
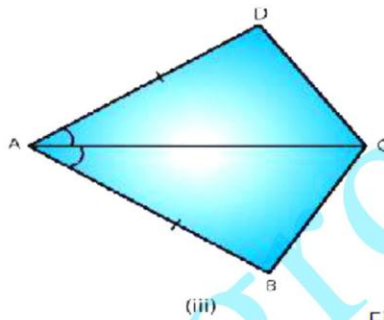
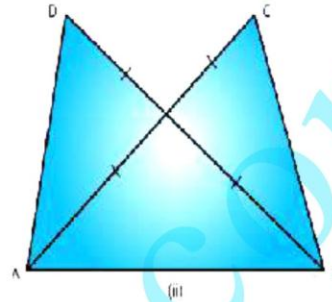
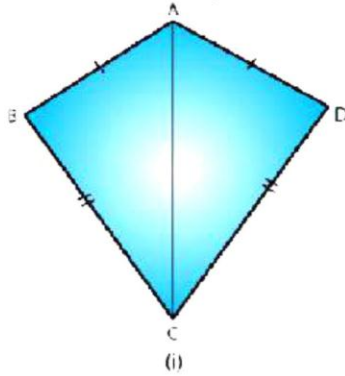


Fig. 29

**Solution:**

(i)  $AB = AD$

$BC = DC$  and  $AC = CA$

Therefore by SSS condition,  $\triangle ABC \cong \triangle ADC$

(ii)  $AC = BD$

$AD = BC$  and  $AB = BA$

Therefore, by SSS condition,  $\triangle ABD \cong \triangle ADC$

(iii)  $AB = AD$

$\angle BAC = \angle DAC$  and

Therefore by SAS condition,  $\triangle BAC \cong \triangle DAC$



(iv)  $AD = BC$

$\angle DAC = \angle BCA$  and

Therefore, by SAS condition,  $\triangle ABC \cong \triangle ADC$

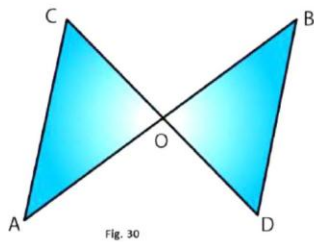
3. In fig. 30, line segments AB and CD bisect each other at O. Which of the following statements is true?

(i)  $\triangle AOC \cong \triangle DOB$

(ii)  $\triangle AOC \cong \triangle BOD$

(iii)  $\triangle AOC \cong \triangle ODB$

State the three pairs of matching parts, you have used to arrive at the answer.



**Solution:**

From the figure we have,

And,  $CO = OD$

Also,  $\angle AOC = \angle BOD$

Therefore, by SAS condition,  $\triangle AOC \cong \triangle BOD$

4. Line-segments AB and CD bisect each other at O. AC and BD are joined forming triangles AOC and BOD. State the three equality relations between the parts of the two triangles that are given or otherwise known. Are the two triangles congruent? State in symbolic form, which congruence condition do you use?

**Solution:**

We have  $AO = OB$  and  $CO = OD$

Since AB and CD bisect each other at O.

Also  $\angle AOC = \angle BOD$

Since they are opposite angles on the same vertex.

Therefore by SAS congruence condition,  $\triangle AOC \cong \triangle BOD$



5.  $\triangle ABC$  is isosceles with  $AB = AC$ . Line segment  $AD$  bisects  $\angle A$  and meets the base  $BC$  in  $D$ .

(i) Is  $\triangle ADB \cong \triangle ADC$ ?

(ii) State the three pairs of matching parts used to answer (i).

(iii) Is it true to say that  $BD = DC$ ?

**Solution:**

(i) We have  $AB = AC$  (Given)

$\angle BAD = \angle CAD$  ( $AD$  bisects  $\angle BAC$ )

Therefore by SAS condition of congruence,  $\triangle ABD \cong \triangle ACD$

(ii) We have used  $AB, AC; \angle BAD = \angle CAD; AD, DA$ .

(iii) Now,  $\triangle ABD \cong \triangle ACD$

Therefore by corresponding parts of congruent triangles  
 $BD = DC$ .

6. In Fig. 31,  $AB = AD$  and  $\angle BAC = \angle DAC$ .

(i) State in symbolic form the congruence of two triangles  $ABC$  and  $ADC$  that is true.

(ii) Complete each of the following, so as to make it true:

(a)  $\angle ABC =$

(b)  $\angle ACD =$

(c) Line segment  $AC$  bisects ..... And .....

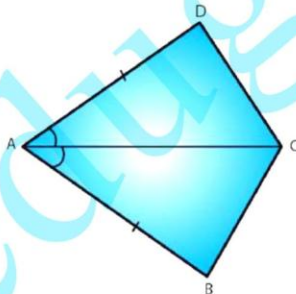


Fig. 31

**Solution:**

i)  $AB = AD$  (given)

$$\angle BAC = \angle DAC \text{ (given)}$$

$$AC = CA \text{ (common)}$$

Therefore by SAS condition of congruency,  $\triangle ABC \cong \triangle ADC$

$$\text{ii) } \angle ABC = \angle ADC \text{ (corresponding parts of congruent triangles)}$$

$$\angle ACD = \angle ACB \text{ (corresponding parts of congruent triangles)}$$

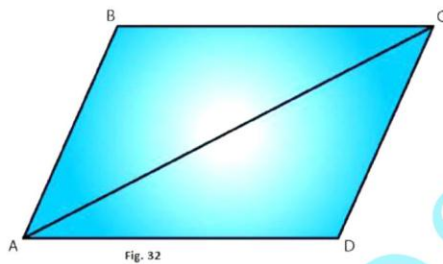
7. In fig. 32,  $AB \parallel DC$  and  $AB = DC$ .

(i) Is  $\triangle ACD \cong \triangle CAB$ ?

(ii) State the three pairs of matching parts used to answer (i).

(iii) Which angle is equal to  $\angle CAD$ ?

(iv) Does it follow from (iii) that  $AD \parallel BC$ ?



**Solution:**

(i) Yes by SAS condition of congruency,  $\triangle DCA \cong \triangle BAC$

(ii) We have used  $AB = DC$ ,  $AC = CA$  and  $\angle DCA = \angle BAC$ .

(iii)  $\angle CAD = \angle ACB$  since the two triangles are congruent.

(iv) Yes this follows from  $AD$  parallel to  $BC$  as alternate angles are equal. If alternate angles are equal the lines are parallel

EXERCISE 16.4

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1. Which of the following pairs of triangle are congruent by ASA condition?

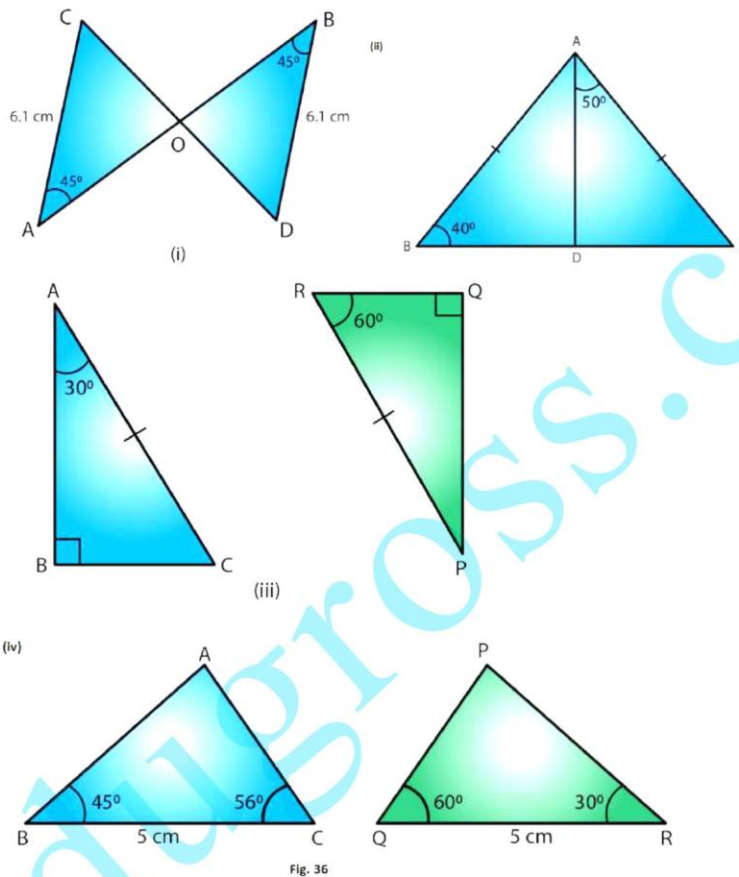


Fig. 36

**Solution:**

(i) We have,

Since  $\angle ABO = \angle CDO = 45^\circ$  and both are alternate angles,  $AB$  parallel to  $DC$ ,  $\angle BAO = \angle DCO$  (alternate angle,  $AB$  parallel to  $CD$  and  $AC$  is a transversal line)

$\angle ABO = \angle CDO = 45^\circ$  (given in the figure) Also,

$AB = DC$  (Given in the figure)

Therefore, by ASA  $\triangle AOB \cong \triangle DOC$

(ii) In  $\triangle ABC$ ,

Now  $AB = AC$  (Given)

$\angle ABD = \angle ACD = 40^\circ$  (Angles opposite to equal sides)

$\angle ABD + \angle ACD + \angle BAC = 180^\circ$  (Angle sum property)

$40^\circ + 40^\circ + \angle BAC = 180^\circ$

$\angle BAC = 180^\circ - 80^\circ = 100^\circ$

$\angle BAD + \angle DAC = \angle BAC$

$\angle BAD = \angle BAC - \angle DAC = 100^\circ - 50^\circ = 50^\circ$

$\angle BAD = \angle CAD = 50^\circ$

Therefore, by ASA,  $\triangle ABD \cong \triangle ADC$

(iii) In  $\triangle ABC$ ,

$\angle A + \angle B + \angle C = 180^\circ$  (Angle sum property)

$\angle C = 180^\circ - \angle A - \angle B$

$\angle C = 180^\circ - 30^\circ - 90^\circ = 60^\circ$

In  $\triangle PQR$ ,

$\angle P + \angle Q + \angle R = 180^\circ$  (Angle sum property)

$\angle P = 180^\circ - \angle Q - \angle R$

$\angle P = 180^\circ - 60^\circ - 90^\circ = 30^\circ$

$\angle BAC = \angle QPR = 30^\circ$

$\angle BCA = \angle PRQ = 60^\circ$  and  $AC = PR$  (Given)

Therefore, by ASA,  $\triangle ABC \cong \triangle PQR$

(iv) We have only

$BC = QR$  but none of the angles of  $\triangle ABC$  and  $\triangle PQR$  are equal.

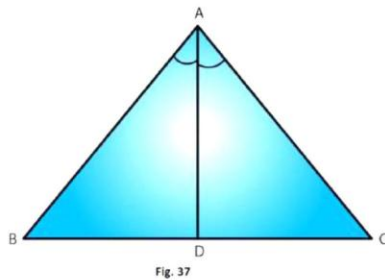
Therefore,  $\triangle ABC$  and  $\triangle PQR$  are not congruent.

**2. In fig. 37, AD bisects  $\angle A$  and  $AD \perp BC$ .**

**(i) Is  $\triangle ADB \cong \triangle ADC$ ?**

**(ii) State the three pairs of matching parts you have used in (i)**

**(iii) Is it true to say that  $BD = DC$ ?**



**Solution:**

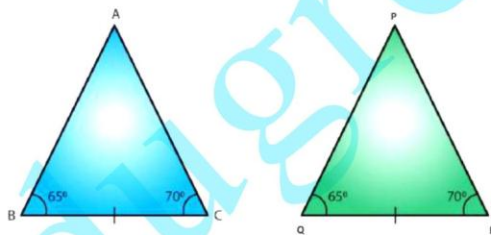
(i) Yes,  $\triangle ADB \cong \triangle ADC$ , by ASA criterion of congruency.

(ii) We have used  $\angle BAD = \angle CAD$   $\angle ADB = \angle ADC = 90^\circ$   
Since,  $AD \perp BC$  and  $AD = DA$

(iii) Yes,  $BD = DC$  since,  $\triangle ADB \cong \triangle ADC$

**3. Draw any triangle ABC. Use ASA condition to construct other triangle congruent to it.**

**Solution:**



We have drawn

$\triangle ABC$  with  $\angle ABC = 65^\circ$  and  $\angle ACB = 70^\circ$

We now construct  $\triangle PQR \cong \triangle ABC$  has  $\angle PQR = 65^\circ$  and  $\angle PRQ = 70^\circ$

Also we construct  $\triangle PQR$  such that  $BC = QR$

Therefore by ASA the two triangles are congruent

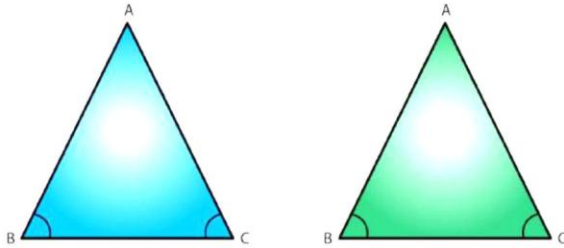
**4. In  $\triangle ABC$ , it is known that  $\angle B = \angle C$ . Imagine you have another copy of  $\triangle ABC$**

(i) Is  $\triangle ABC \cong \triangle ACB$

(ii) State the three pairs of matching parts you have used to answer (i).

(iii) Is it true to say that  $AB = AC$ ?

**Solution:**

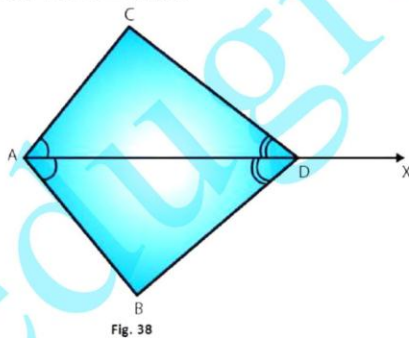


(i) Yes  $\triangle ABC \cong \triangle ACB$

(ii) We have used  $\angle ABC = \angle ACB$  and  $\angle ACB = \angle ABC$  again.  
Also  $BC = CB$

(iii) Yes it is true to say that  $AB = AC$  since  $\angle ABC = \angle ACB$ .

5. In Fig. 38, AX bisects  $\angle BAC$  as well as  $\angle BDC$ . State the three facts needed to ensure that  $\triangle ACD \cong \triangle ABD$



**Solution:**

As per the given conditions,

$\angle CAD = \angle BAD$  and  $\angle CDA = \angle BDA$  (because AX bisects  $\angle BAC$ )



$AD = DA$  (common)

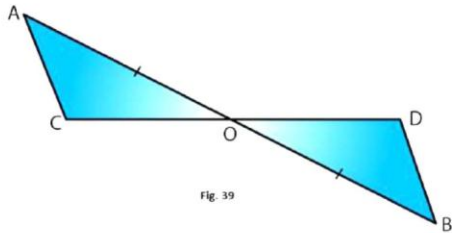
Therefore, by ASA,  $\triangle ACD \cong \triangle ABD$

6. In Fig. 39,  $AO = OB$  and  $\angle A = \angle B$ .

(i) Is  $\triangle AOC \cong \triangle BOD$

(ii) State the matching pair you have used, which is not given in the question.

(iii) Is it true to say that  $\angle ACO = \angle BDO$ ?



**Solution:**

We have

$\angle OAC = \angle OBD$ ,

$AO = OB$

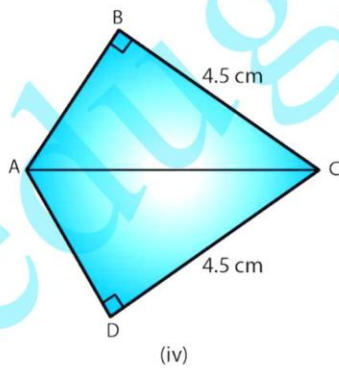
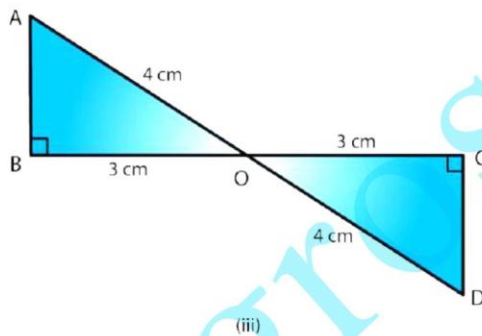
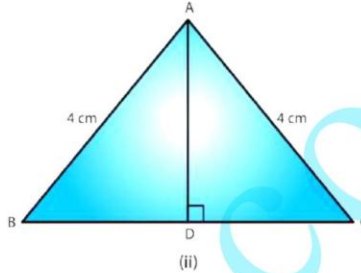
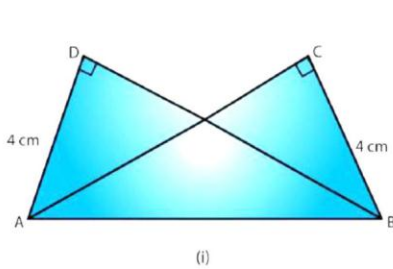
Also,  $\angle AOC = \angle BOD$  (Opposite angles on same vertex)

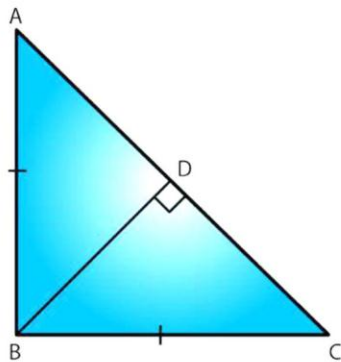
Therefore, by ASA  $\triangle AOC \cong \triangle BOD$

## EXERCISE 16.5

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1. In each of the following pairs of right triangles, the measures of some part are indicated alongside. State by the application of RHS congruence conditions which are congruent, and also state each result in symbolic form. (Fig. 46)





(v)  
Fig. 46

**Solution:**

(i)  $\angle ADC = \angle BCA = 90^\circ$

$AD = DC$  and hypotenuse  $AB =$  hypotenuse  $AB$

Therefore, by RHS  $\triangle ADB \cong \triangle ACB$

(ii)  $AD = AD$  (Common)

Hypotenuse  $AC =$  hypotenuse  $AB$  (Given)

$\angle ADB + \angle ADC = 180^\circ$  (Linear pair)

$\angle ADB + 90^\circ = 180^\circ$

$\angle ADB = 180^\circ - 90^\circ = 90^\circ$

$\angle ADB = \angle ADC = 90^\circ$

Therefore, by RHS  $\triangle ADB \cong \triangle ADC$

(iii) Hypotenuse  $AO =$  hypotenuse  $DO$

$BO = CO$

$\angle B = \angle C = 90^\circ$

Therefore, by RHS,  $\triangle AOB \cong \triangle DOC$

(iv) Hypotenuse  $AC =$  Hypotenuse  $CA$

$BC = DC$

$\angle ABC = \angle ADC = 90^\circ$

Therefore, by RHS,  $\triangle ABC \cong \triangle ADC$

(v)  $BD = DB$

Hypotenuse AB = Hypotenuse BC, as per the given figure,

$$\angle BDA + \angle BDC = 180^\circ$$

$$\angle BDA + 90^\circ = 180^\circ$$

$$\angle BDA = 180^\circ - 90^\circ = 90^\circ$$

$$\angle BDA = \angle BDC = 90^\circ$$

Therefore, by RHS,  $\triangle ABD \cong \triangle CBD$

**2.  $\triangle ABC$  is isosceles with  $AB = AC$ .  $AD$  is the altitude from  $A$  on  $BC$ .**

**(i) Is  $\triangle ABD \cong \triangle ACD$ ?**

**(ii) State the pairs of matching parts you have used to answer (i).**

**(iii) Is it true to say that  $BD = DC$ ?**

**Solution:**

(i) Yes,  $\triangle ABD \cong \triangle ACD$  by RHS congruence condition.

(ii) We have used Hypotenuse  $AB = AC$

$AD = DA$

$\angle ADB = \angle ADC = 90^\circ$  ( $AD \perp BC$  at point  $D$ )

(iii) Yes, it is true to say that  $BD = DC$  (corresponding parts of congruent triangles)

Since we have already proved that the two triangles are congruent.

**3.  $\triangle ABC$  is isosceles with  $AB = AC$ . Also,  $AD \perp BC$  meeting  $BC$  in  $D$ . Are the two triangles  $ABD$  and  $ACD$  congruent? State in symbolic form. Which congruence condition do you use? Which side of  $\triangle ADC$  equals  $BD$ ? Which angle of  $\triangle ADC$  equals  $\angle B$ ?**

**Solution:**

We have  $AB = AC$  ..... (i)

$AD = DA$  (common) ..... (ii)

And,  $\angle ADC = \angle ADB$  ( $AD \perp BC$  at point  $D$ ) ..... (iii)

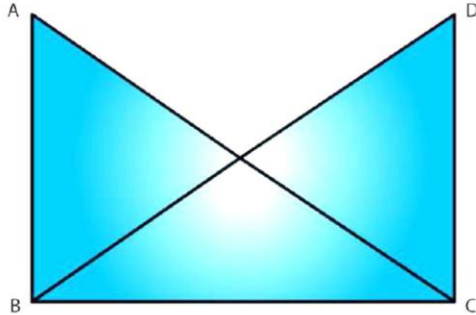
Therefore, from (i), (ii) and (iii), by RHS congruence condition,  $\triangle ABD \cong \triangle ACD$ , the triangles are congruent.

Therefore,  $BD = CD$ .

And  $\angle ABD = \angle ACD$  (corresponding parts of congruent triangles)

**4. Draw a right triangle  $ABC$ . Use RHS condition to construct another triangle congruent to it.**

**Solution:**



Consider

$\triangle ABC$  with  $\angle B$  as right angle.

We now construct another triangle on base BC, such that  $\angle C$  is a right angle and  $AB = DC$

Also,  $BC = CB$

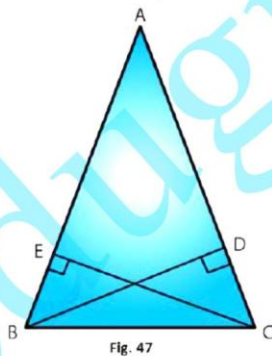
Therefore,  $BC = CB$

Therefore by RHS,  $\triangle ABC \cong \triangle DCB$

5. In fig. 47, BD and CE are altitudes of  $\triangle ABC$  and  $BD = CE$ .

(i) Is  $\triangle BCD \cong \triangle CBE$ ?

(ii) State the three pairs or matching parts you have used to answer (i)



**Solution:**

(i) Yes,  $\triangle BCD \cong \triangle CBE$  by RHS congruence condition.

(ii) We have used hypotenuse  $BC = \text{hypotenuse } CB$   
 $BD = CE$  (Given in question)  
And  $\angle BDC = \angle CBE = 90^\circ$

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