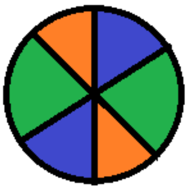
Question:1
Explain the concept of congruence of figures with the help of certain examples.
Solution:
Congruent objects or figures are exact copies of each other or we can say mirror images of each other. The relation of two objects being congruent is called congruence.

Consider Ball A and Ball B. These two balls are congruent.


Ball A

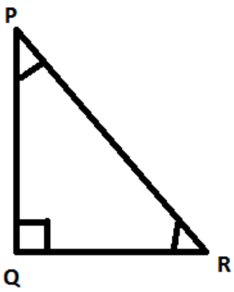

Ball B

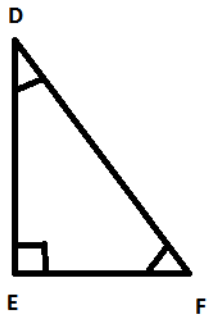
Now consider the two stars below. Star A and Star B are exactly the same in size, colour and shape. These are congruent stars.


STAR A


STAR B

Let us look at the triangles below, Here we have triangle PQR and triangle DEF.
These two triangles have corresponding angles equal and corresponding sides equal. Thus these triangles are congruent to each other.





Question:2
Fill in the blanks:
i Two line segments are congruent if ....
ii Two angles are congruent if ......
iii Two squres are congruent if ....
iv Two rectangles are congruent if ....
v Two circles are congruent if ....
Solution:
1) They have the same length, since they can superpose on each other.

2) Their measures are the same. On superposition, we can see that the angles are equal.

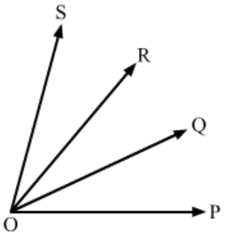
3) Their sides are equal. All the sides of a square are equal and if two squares have equal sides, then all their sides are of the same length. Also angles of a square are 90^{o} which is also the same for both the squares.

4) Their lengths are equal and their breadths are also equal. The opposite sides of a rectangle are equal. So if two rectangles have lengths of the same size and breadths of the same size, then they are congruent to each other.

5) Their radii are of the same length. Then the circles will have the same diameter and thus will be congruent to each other.

Question:3

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



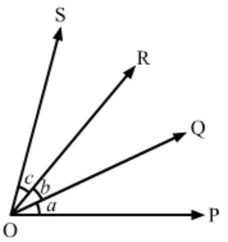
Solution:

We have,

$\angle \mathrm{POQ} \cong \angle \mathrm{ROS} \quad (1) \text{Also, } \angle \mathrm{ROQ} \cong \angle \mathrm{ROQ} \quad (\text{same angle}) \text{Therefore, adding } \angle \mathrm{ROQ} \text{ to both sides of } (1), \text{ we get:} \angle \mathrm{POQ} + \angle \mathrm{ROQ} \cong \angle \mathrm{ROQ} + \angle \mathrm{ROS} \text{There}$

Question:4

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



Solution:

We have,

$\angle \mathrm{AOB} = \angle \mathrm{BOC} = \angle \mathrm{COD} \text{Therefore, } \angle \mathrm{AOB} = \angle \mathrm{COD} \text{Also, } \angle \mathrm{AOB} + \angle \mathrm{BOC} = \angle \mathrm{BOC} + \angle \mathrm{COD} \angle \mathrm{AOC} = \angle \mathrm{BOD} \text{Hence, } \angle \mathrm{AOC} \cong \angle \mathrm{BOD} \angle \mathrm{BOD} \text{ is congruent to}$

Question:5

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

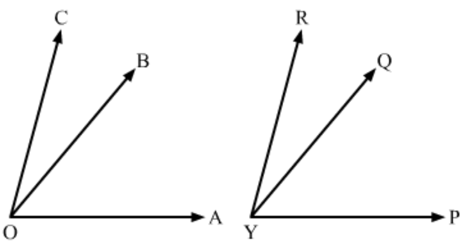
Solution:

Two right angles are congruent to each other because they both measure 90 degrees.

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

Question:6

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



Solution:

$\angle AOC \cong \angle PYR.........(i) Also,\ \angle BOC \cong \angle QYR Now,\ \angle AOC = \angle AOB + \angle BOC\ and\ \angle PYR = \angle PYQ + \angle QYR By\ putting\ the\ value\ of \angle AOC\ an$

Question: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 area, they are congruent.

iv If two triangles are equal in area, they are congruent.

Solution:

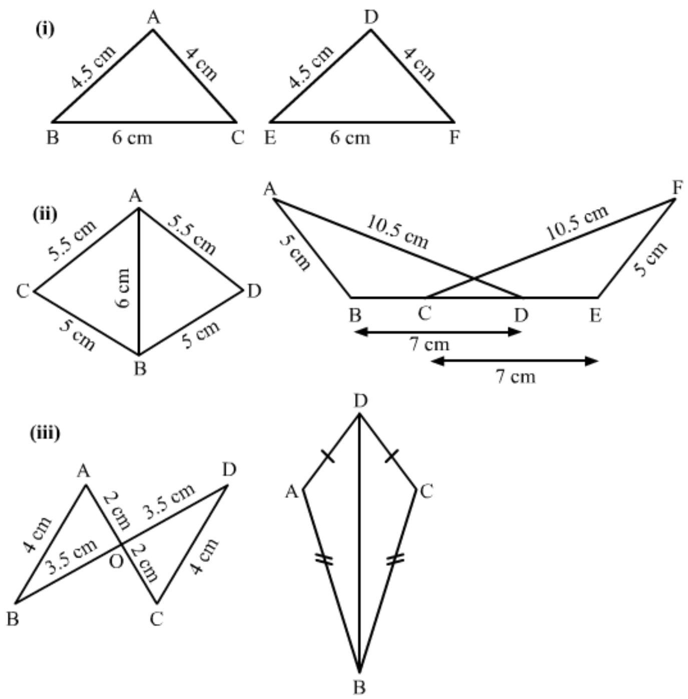
i) False. All the sides of a square are of equal length. However, different squares can have sides of different lengths. Hence all squares are not congruent.

ii) True
Area of a square = side $\times$side
Therefore, two squares that have the same area will have sides of the same lengths. Hence they will be congruent.

iii) False
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.
Example: Suppose rectangle 1 has sides 8 m and 8 m and area 64 metre square.
Rectangle 2 has sides 16 m and 4 m and area 64 metre square.
Then rectangle 1 and 2 are not congruent.

iv) False
Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height}$
Two triangles can have the same area but the lengths of their sides can vary and hence they cannot be congruent.

Question:8
In the following pairs of triangles $Fig.12to15$, the lengths of the sides are indicated along sides. By applying SSS condition, determine which are congruent. State the result in symbolic form.



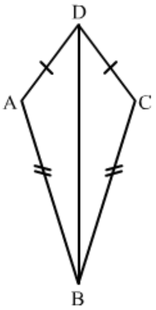
Solution:
1) In $\Delta\text{ABC and }\Delta\text{DEF}$
AB = DE = 4.5 cm $Side$
BC = EF = 6 cm $Side$
and AC = DF = 4 cm $Side$

Therefore, by SSS criterion of congruence, $\triangle \text{ ABC} \cong \triangle \text{ DEF}$.

2)
$\text{In } \triangle \text{ ACB and } \triangle \text{ ADBAC =AD (Side)BC = BD (Side)and AB =AB (Side)}$
Therefore, by SSS criterion of congruence, $\triangle \text{ ACB} \cong \triangle \text{ ADB}$.

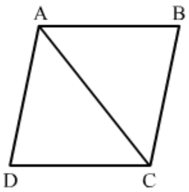
3)
$\text{In } \triangle \text{ ABD and } \triangle \text{ FEC, AB} = \text{FE (Side)AD} = \text{FC (Side)BD} = \text{CE (Side)}$
Therefore, by SSS criterion of congruence, $\triangle \text{ ABD} \cong \triangle \text{ FEC}$.

Question:9
In Fig. 16, *AD* = *DC* and *AB* = *BC*.
i Is Δ *ABD* ≅ Δ *CBD*?
ii State the three parts of matching pairs you have used to answer i.



Solution:
Yes $\triangle ABD \cong \triangle CBD$ by the SSS criterion.
We have used the three conditions in the SSS criterion as follows:
AD = DC
AB = BC
and DB = BD

Question:10
In Fig. 17, *AB* = *DC* and *BC* = *AD*.



i Is Δ *ABC* ≅ Δ *CDA*?
ii What congruence condition have you used?
iii You have used some fact, not given in the question, what is that?
Solution:
We have AB = DC
BC = AD
and AC = AC
Therefore by SSS $\triangle ABC \cong \triangle CDA$.

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

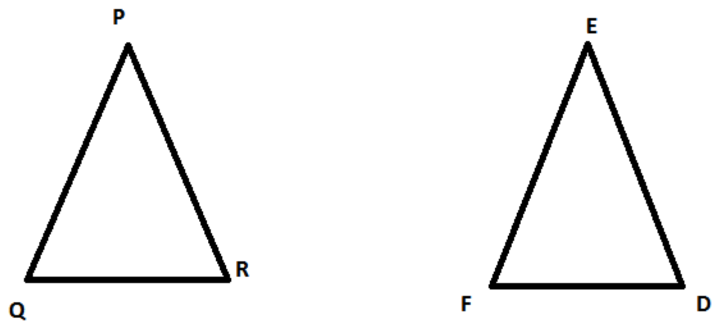
Yes, we have used the fact that AC = CA.

Question:11
If Δ *PQR* ≅ Δ EFD,
i Which side of Δ *PQR* equals *ED*?
ii Which angle of Δ *PQR* equals ∠*E*?
Solution:

△PQR ≅ △EDF

1) Therefore PR = ED since the corresponding sides of congruent triangles are equal.

2) $\angle QPR = \angle FED$ since the corresponding angles of congruent triangles are equal.

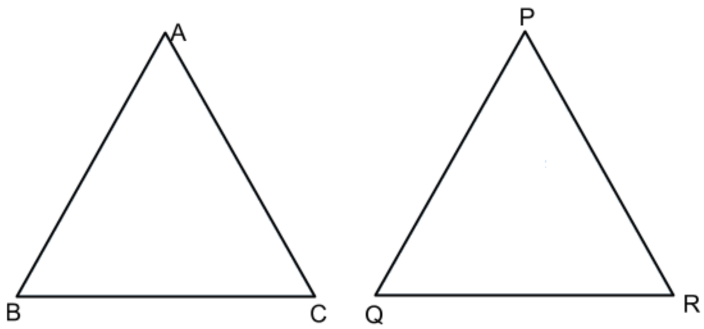


Question:12

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?

If $\angle B = 50°$, what is the measure of $\angle R$?

Solution:



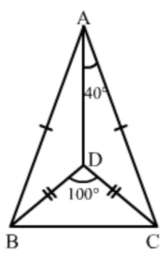
We have AB = AC in isosceles △ABC
and PQ = PR in isosceles △PQR.
Also, we are given that AB = PQ and QR = BC.

Therefore, AC = PR $AB = AC, PQ = PR and AB = PQ$
Hence, $\triangle \mathrm{ABC} \cong \triangle \mathrm{PQR}$.
Now
$\angle \mathrm{ABC} = \angle \mathrm{PQR}$ (Since triangles are congruent)However, △PQR is isosceles. Therefore, $\angle \mathrm{PRQ} = \angle \mathrm{PQR} = \angle \mathrm{ABC} = 50^\circ$

Question:13

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 $\angle BAC = 40°$ and $\angle BDC = 100°$; then find $\angle ADB$.

Solution:



YES $\triangle \mathrm{ADB} \cong \triangle \mathrm{ADC}$ (By SSS)
AB = AC , DB = DC AND AD= DA

$\angle \mathrm{BAD} = \angle \mathrm{CAD}$ (c.p.c.t)$\angle \mathrm{BAD} + \angle \mathrm{CAD} = 40^\circ 2\angle \mathrm{BAD} = 40^\circ \angle \mathrm{BAD} = \frac{40^\circ}{2} = 20^\circ$

$\angle\text{ABC}+\angle\text{BCA}+\angle\text{BAC}=180^\circ\ \left(\text{Angle sum property}\right)\text{Since}\ \Delta\,\text{ABC is an isosceles triangle},\ \angle\text{ABC}=\angle\text{BCA}\angle\text{ABC}+\angle\text{ABC}+40^\circ=180^\circ 2\angle\text{ABC}=180^\circ$

$\angle\text{DBC}+\angle\text{BCD}+\angle\text{BDC}=180^\circ\ \left(\text{Angle sum property}\right)\text{Since}\ \Delta\text{ABC is an isosceles triangle},\ \angle\text{DBC}=\angle\text{BCD}\angle\text{DBC}+\angle\text{DBC}+100^\circ=180^\circ 2\angle\text{DBC}=180^\circ$

$\text{In}\ \Delta\text{BAD},\ \angle\text{ABD}+\angle\text{BAD}+\angle\text{ADB}=180^\circ(\text{Angle sum property})30^\circ+20^\circ+\angle\text{ADB}=180^\circ\ \left(\angle\text{ABD}=\angle\text{ABC-}\angle\text{DBC}\right)\angle\text{ADB}=180^\circ-20^\circ-30^\circ\angle\text{ADB}=$

$\angle ADB\ =130^\circ$

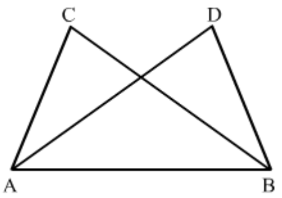
Question:14

Δ *ABC* and Δ *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 Δ *ABC* ≅ Δ *ABD*

ii Δ *ABC* ≅ Δ *ADB*

iii Δ *ABC* ≅ Δ *BAD*



Solution:

In △ABC and △BAD we have,

AC = BD $given$

BC = AD $given$

and AB = BA $common$

Therefore by SSS criterion of congruency, △ABC ≅△BAD.

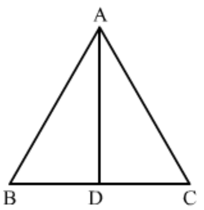
There option iii is true.

Question:15

In Fig. 19, Δ *ABC* is isosceles with *AB* = *AC*, *D* is the mid-point of base *BC*.

i Is Δ *ADB* ≅ Δ *ADC*?

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



Solution:

We have AB = AC.

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

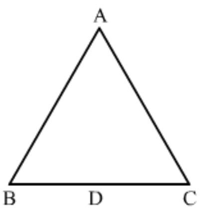
And AD = DA.

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

We have used AB, AC : BD, DC and AD, DA.

Question:16

In Fig. 20, Δ *ABC* is isosceles with *AB* = *AC*. State if Δ *ABC* ≅ Δ *ACB*. If yes, state three relations that you use to arrive at your answer.



Solution:

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

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

Question:17

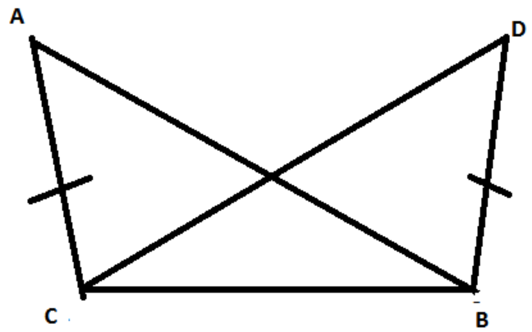
Triangles *ABC* and *DBC* have side *BC* common, *AB* = *BD* and *AC* = *CD*. Are the two triangles congruent? State in symbolic form. Which congruence condition do you use? Does $\angle ABD$ equal $\angle ACD$? Why or why not?

Solution:

Yes.

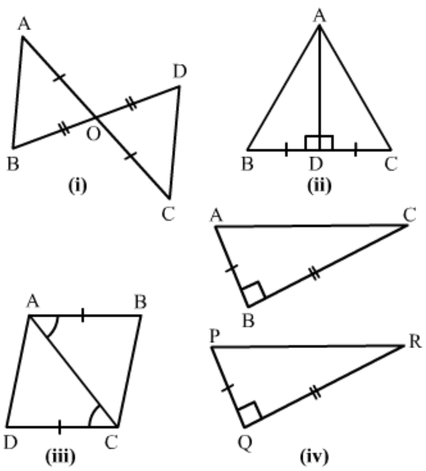
$\text{In } \Delta \text{ABC and } \Delta \text{DBC} \text{AB=DB (Given)} \text{AC=DC (Given)} \text{BC=BC (Common)} \text{By SSS criterion of congruency, } \Delta \text{ABC} \cong \Delta \text{DBC}$

No, $\angle \text{ABD and} \angle \text{ACD are not equal}$
because AB $\neq$ AC.



Question:18

By applying SAS congruence condition, state which of the following pairs $Fig. 28$ of triangles are congruent. State the result in symbolic form



Solution:

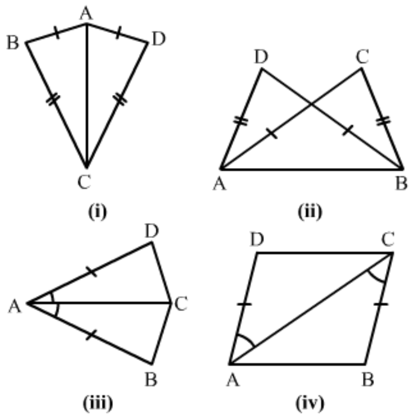
1) We have OA = OC and OB = OD and∠AOB =∠COD which are vertically opposite angles.
Therefore by SAS condition, △AOC ≅ △BOD.

2) We have BD = DC
∠ADB =∠ADC = 90°
and AD = AD
Therefore by SAS condition, △ADB ≅ △ADC.

3) We have AB = DC
∠ABD = ∠CDB and BD = DB
Therefore by SAS condition, △ABD ≅ △CBD.

4) We have BC = QR
$\angle ABC = \angle PQR = 90°$
and AB = PQ
Therefore by SAS condition, $\triangle ABC \cong \triangle PQR$.

Question:19
State the condition by which the following pairs of triangles are congruent.



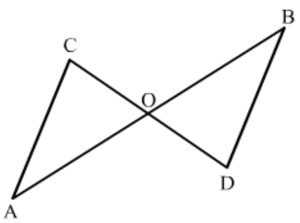
Solution:
1) AB = AD
BC = CD
and AC = CA
Therefore by SSS condition, $\triangle ABC \cong \triangle ADC$.

2) AC = BD
AD = BC and AB = BA
Therefore by SSS condition, $\triangle ABD \cong \triangle BAC$.

3) AB = AD
$\angle BAC = \angle DAC$
and AC = AC
Therefore by SAS condition, $\triangle BAC \cong \triangle DAC$.

4) AD = BC
$\angle DAC = \angle BCA$
and AC = CA
Therefore by SAS condition, $\triangle ABC \cong \triangle ADC$.

Question:20
In Fig. 30, line segments *AB* and *CD* bisect each other at *O*. Which of the following statements is true?
i $\Delta AOC \cong \Delta DOB$
ii $\Delta AOC \cong \Delta BOD$
iii $\Delta AOC \cong \Delta ODB$.
State the three pairs of matching parts, yut have used to arive at the answer.

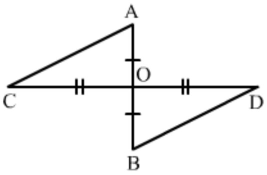


Solution:
We have AO = OB.
And CO = OD

Also $\angle AOC = \angle BOD$
Therefore by SAS condition, $\triangle AOC \cong \triangle BOD$.

Therefore, statement ii is true.

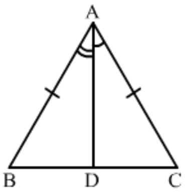
Question:21
Line-segments *AB* and *CD* bisect each other at *O. AC* and *BD* are joined forming triangles *AOC* and *BOD*. State the three equality relations between the parts of the two triangles, that are given or otherwise known. Are the two triangles congruent? State in symbolic form. Which congruence 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, $\triangle AOC \cong \triangle BOD$.

Question:22
Δ *ABC* is isosceles with *AB* = *AC*. Line segment *AD* bisects ∠*A* and meets the base *BC* in *D*.
i Is Δ *ADB* ≅ Δ *ADC*?
ii State the three pairs of matching parts used to answer i.
iii Is it true to say that *BD* = *DC*?
Solution:

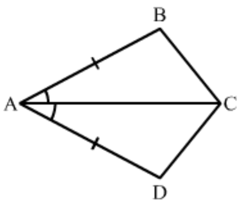


i We have AB = AC $given$
$\angle BAD = \angle CAD$ (AD bisects $\angle BAC$)
and AD = AD $common$
Therefore by SAS condition of congruence, $\triangle ABD \cong \triangle ACD$.

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

iii Now $\triangle ABD \cong \triangle ACD$ therefore by c.p.c.t BD = DC.

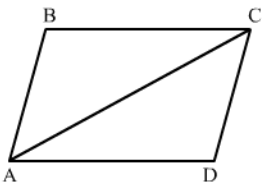
Question:23
In Fig. 31, *AB* = *AD* and ∠*BAC* = ∠*DAC*.
i State in symbolic form the congruence of two triangles *ABC* and *ADC* that is true.
ii Complete each of the following, so as to make it true:
a ∠*ABC* = ...
b ∠*ACD* = ...
c Line segment *AC* bisects ..... and .....



Solution:
i) AB = AD $given$
$\angle BAC = \angle DAC$ $given$
AC = CA $common$
Therefore by SAS conditionof congruency, $\triangle ABC \cong \triangle ADC$.

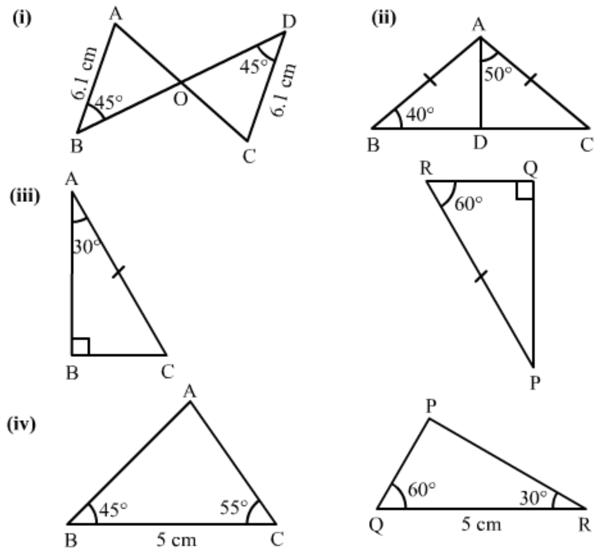
ii) $\angle ABC = \angle ADC$ $c.p.c.t$
$\angle ACD = \angle ACB$ $c.p.c.t$

Question:24
In Fig. 32, *AB* || *DC* and *AB* = *DC*.
i Is Δ *ACD* ≅ Δ *CAB*?
ii State the three pairs of matching parts used to answer i.
iii Which angle is equal to ∠*CAD*?
iv Does it follow from iii that *AD* || *BC*?



Solution:
i Yes $\triangle ACD \cong \triangle CAB$ by SAS condition of congruency.
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||BC as alternate angles are equal.If alternate angles are equal the lines are parallel.

Question:25
Which of the following pairs of triangles are congruent by ASA condition?



Solution:
1) We have

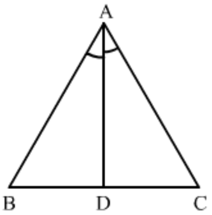
$\text{Since } \angle\text{ABO} = \angle\text{CDO} = 45^\circ \text{ and both are alternate angles, } \text{AB} \parallel \text{DC} \angle\text{BAO} = \angle\text{DCO} \text{ (alternate angle , AB} \parallel \text{CD and AC is a transversal line)} \angle\text{AB}$

2)
$\text{In } \triangle\text{ABC ,Now AB} = \text{AC (Given)} \angle\text{ABD} = \angle\text{ACD} = 40^\circ \text{ (Angles opposite to equal sides)} \angle\text{ABD} + \angle\text{ACD} + \angle\text{BAC} = 180^\circ \text{ (Angle sum property)} 40^\circ + 40^\circ$
3)

$\text{In}\Delta\text{ABC}, \angle\text{A} + \angle\text{B} + \angle\text{C} = 180^\circ \text{(Angle sum property)} \angle\text{C} = 180^\circ - \angle\text{A} - \angle\text{B} \angle\text{C} = 180^\circ - 30^\circ - 90^\circ = 60^\circ \text{In}\Delta\text{PQR}, \angle\text{P} + \angle\text{Q} + \angle\text{R} = 180^\circ \text{(Angle sum property)} \angle\text{P} = 1$

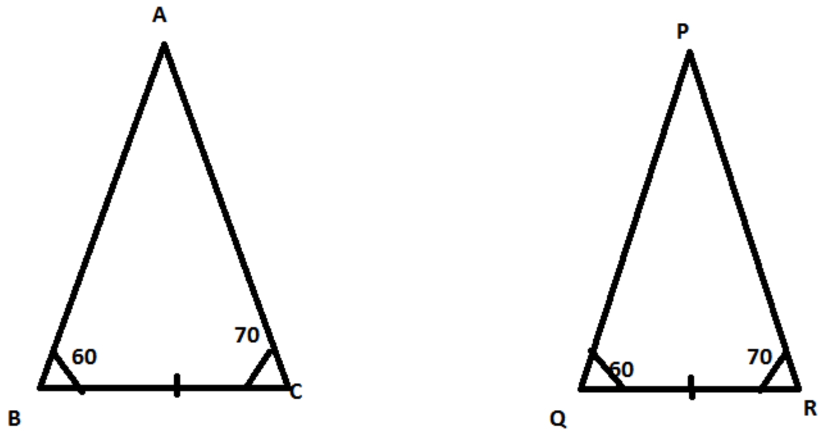
4)
$\text{We have only BC} = \text{QR but none of the angles of } \triangle\text{ABC AND } \triangle\text{PQR are equal.Therefore, } \triangle\text{ABC} \ncong \triangle\text{PRQ}$

Question:26
In Fig. 37, *AD* bisects ∠*A* and *AD* ⊥ *BC*.
i Is Δ *ADB* ≅ Δ *ADC*?
ii State the three pairs of matching parts you have used in i.
iii Is it true to say that *BD* = *DC*?

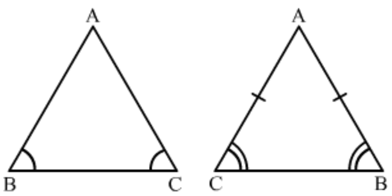


Solution:
(i) Yes, $\triangle$ADB $\cong \triangle$ADC, by ASA criterion of congruency (ii) We have used $\angle$BAD $=\angle$CAD$\angle$ADB=$\angle$ADC $= 90^\circ$ since AD$\perp$BCand AD = DA(iii) Y

Question:27
Draw any triangle *ABC*. Use ASA condition to construct another triangle congruent to it.
Solution:
We have drawn
$\triangle$ ABC with $\angle$ABC $=$ 60° and $\angle$ACB $=$ 70° We now construct $\triangle$ PQR $\cong\triangle$ ABC $\triangle$ PQR has $\angle$PQR $=60^\circ$ and $\angle$PRQ $=$ 70° Also we constru



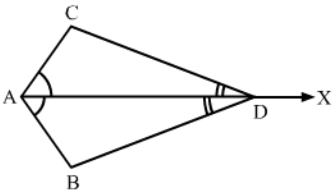
Question:28
In Δ *ABC*, it is known that $\angle B = \angle C$. Imagine you have another copy of Δ *ABC*
i Is Δ *ABC* $\cong$ Δ *ACB*?
ii State the three pairs of matching parts you have used to answer i.
iii Is it true to say that *AB* = *AC*?
Solution:



i Yes $\triangle$ ABC $\cong\triangle$ ACB.
ii We have used $\angle ABC = \angle ACB \; and \; \angle ACB \; = \angle ABC \; again.$
Also BC = CB

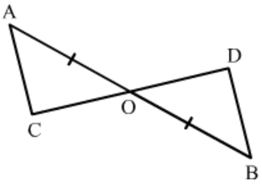
iii Yes, it is true to say that AB = AC since $\angle ABC = \angle ACB$.

Question:29
In Fig. 38, AX bisects $\angle BAC$ as well as $\angle BDC$. State the three facts needed to ensure that Δ *ABD* $\cong$ Δ *ACD*.



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, $\triangle ACD \cong \triangle ABD$

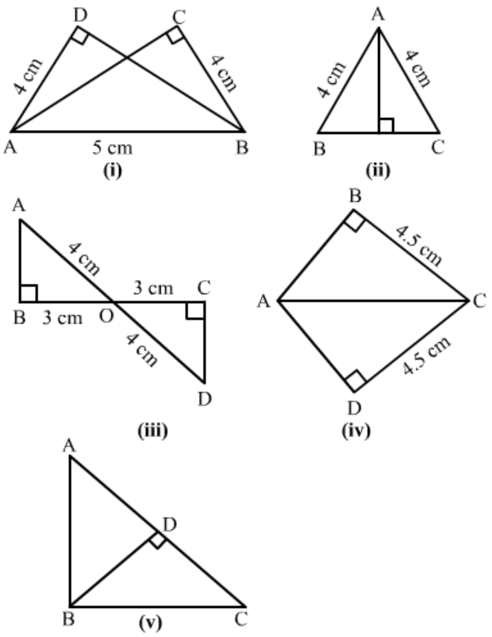
Question:30
In Fig. 39, $AO = OB$ and $\angle A = \angle B$.



i Is $\Delta\ AOC \cong \Delta\ BOD$?
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 $\triangle AOC \cong \triangle BOD$

Question:31
In each of the following pairs of right triangles, the measures of some parts are indicated along side. State by the application of RHS congruence condition which are congruent. State each result in symbolic form. $Fig. 46$



Solution:
i) $\angle ADC = \angle BCA = 90^\circ$ $AD = BC$ and hyp AB = hyp AB Therefore, by RHS, $\triangle ADB \cong \triangle ACB$.

ii)

$AD = AD$ (Common) hyp AC = hyp AB (Given) $\angle ADB + \angle ADC = 180^\circ$ (Linear pair) $\angle ADB + 90^\circ = 180^\circ$ $\angle ADB = 180^\circ - 90^\circ = 90^\circ$ $\angle ADB = \angle ADC$

iii)
hyp AO = hyp DO $BO = CO$ $\angle B = \angle C = 90^\circ$ Therefore, by RHS, $\triangle AOB \cong \triangle DOC$

iv)
Hyp AC = Hyp CA $BC = DC$ $\angle ABC = \angle ADC = 90^\circ$ Therefore, by RHS, $\triangle ABC \cong \triangle ADC$

v)
$BD = DB$ Hyp AB = Hyp BC, as per the given figure. $\angle BDA + \angle BDC = 180^\circ$ $\angle BDA + 90^\circ = 180^\circ$ $\angle BDA = 180^\circ - 90^\circ = 90^\circ$ $\angle BDA = \angle BDC = 9$

Question:32

Δ *ABC* is isosceles with *AB* = *AC*. *AD* is the altitude from *A* on *BC*.
i Is Δ *ABD* ≅ *ACD*?
ii State the pairs of matching parts you have used to answer i.
ii Is it true to say that *BD* = *DC*?

Solution:

iYes, $\triangle\ ABD \cong \triangle\ ACD$ by RHS congruence condition.

ii We have used Hyp AB = Hyp AC
AD = DA
and $\angle ADB\ =\ \angle ADC\ =\ 90^\circ$ (AD⊥BC at point D)

iiiYes, it is true to say that BD = DC $c.p.c.t$ since we have already proved that the two triangles are congruent.

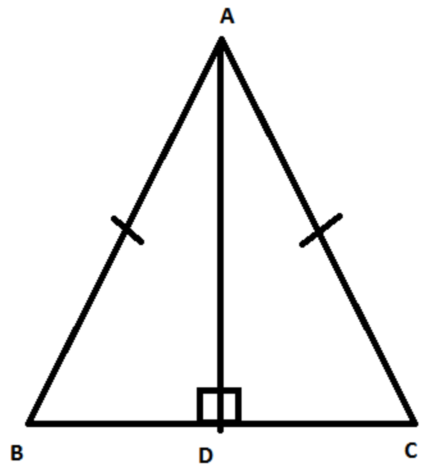
Question:33

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

Solution:

We have AB = AC 1
AD = DA $common$........2
and $\angle ADC = \angle ADB$ (AD⊥BC at point D)........3

Therefore from 1, 2 and 3, by RHS congruence condition,
$\triangle\mathrm{ABD} \cong \triangle\mathrm{ACDNow, the\ triangles\ are\ congruent\ .\quad Therefore,\ BD =\ CD.And\ \angle ABD = \angle ACD\ (c.p.c.t).}$

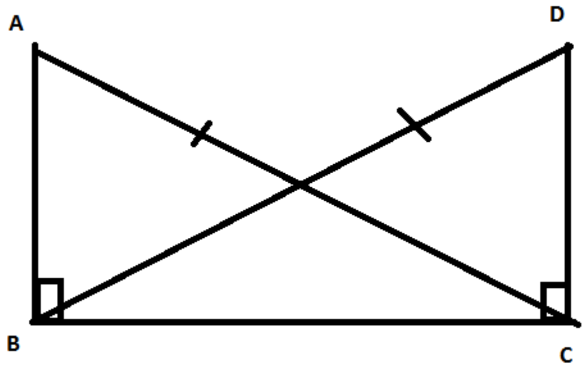


Question:34

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

Solution:

Consider
$\triangle\mathrm{ABC\ with\ \angle B\ as\ right\ angle. We\ now\ construct\ another\ right\ triangle\ on\ base\ BC,\ such\ that\quad \angle C\ is\ a\ right\ angle\ and\quad AB\ =\ DCAlso,\ BC\ =\ CBTh}$

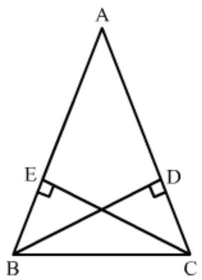


Question:35

In Fig. 47, *BD* and *CE* are altitudes of Δ *ABC* and *BD* = *CE*.

i Is Δ *BCD* ≅ Δ *CBE*?

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



Solution:

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

ii We have used hyp BC = hyp CB

BD = CE $given in question$

and $\angle BDC = \angle CEB = 90^\circ$.