chapter-16 Congruence
Exercise-16.1

Solution-01:-

The word 'congruent' means 'Same shape and size', that is, equal in every respect. Thus, if two figures have exactly the same shape and size they are said to be congruent.

→ Two planes figures are congruent, if each when superposed on the others, covers it exactly.

→ we shall use the symbol '≅' to indicate 'is congruent to'.

Two Line segments are congruent, if they have the same length.

That is, Line segment AB ≅ Line segment CD, if AB = CD

Solution-2:-

(i) They are of equal lengths.

(ii) Their measures are equal.

(iii) They have the same side length.

(iv) their dimensions are same.

(v). they have the same radii

Solution-03:-

Yes. ∠POR ≅ ∠QOS.

Solution-04:-

The angle which is congruent to ∠AOC is ∠BOD.

[∵ Two angles are congruent, if they have the same measure]

Solution-05:-

Yes, Two right angles are congruent

[∵ Two angles are congruent, if they have the same measure]

Solution-06:-

∠PYQ [∵ Two angles are congruent, if they have the same measure]

Solution-07

(i) False

(ii) True

(iii) False

(iv) False.

Exercise-16.2 Q1

Exercise - 16.2

Solution - 01 :-

(i). In triangles ABC and DEF, we have

AB = DE = 4.5 cm, BC = EF = 6 cm and (common)

AC = DF = 4 cm.

∴ By SSS condition of congruence, we have

$\Delta ABC \cong \Delta DEF$.

(ii) In triangles ABC and ADB, we have

AC = AD = 5.5 cm, AB = AB = 6 cm and BC = CD = 5 cm

(common)

∴ By SSS condition of congruence, we have

$\Delta ABC \cong \Delta ABD$.

(iii) In triangles ABD and CEF, we have

AB = EF = 5 cm, AD = CF = 10.5 cm and AD = CE = 7 cm

(common)

∴ By SSS condition of congruence, we have

$\Delta ABD \cong \Delta CEF$.

(iv) In triangles OAB and OCD, we have

AB = CD = 4 cm, AO = CO = 2 cm and BO = DO = 3.5 cm

(common)

∴ By SSS condition of congruence, we have

$\Delta OAB \cong \Delta OCD$.

Solution - 02 :-

(i) In triangles ABD and CBD, we have

AD = DC, AB = BC & BD = BD

∴ By SSS condition of congruence, we have

$\Delta ABD \cong \Delta CBD$.

(ii) AB, BC; AD; CD; BD, BD.

Solution - 03 :-

(i) In triangles ABC and CDA, we have

AD = BC, AB = CD & AC = AC

∴ By SSS condition of congruence, we have

$\Delta ABC \cong \Delta CDA$.

(ii) The side - side - side congruence condition

(iii) AC = CA.

Solution - 04 :-

(i) PR is the side of ΔPQR equals ED

(ii) $\angle P$ angle of ΔPQR equals $\angle E$.

Solution - 05:-

In $\triangle ABC$ and $\triangle PQR$ are both isosceles we have

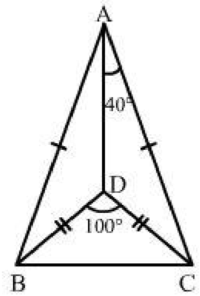
$AB = AC$ & $PQ = QR$ [given]

$AB = PQ$ & $BC = QR$.

Yes, two triangles are congruent;

By side - side - side congruence condition;

$\angle B = \angle R = 50°$. [Two angles are congruent, if they have the same measure]



YES $\triangle ADB \cong \triangle ADC$ (By SSS)

AB = AC , DB = DC AND AD= DA

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

$\angle BAD = \angle CAD$ (c.p.c.t)

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

$2\angle BAD = 40^\circ$

$\angle BAD = \frac{40^\circ}{2} = 20^\circ$

Since $\triangle$ ABC is an isosceles triangle,

$\angle ABC = \angle BCA$

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

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

$\angle ABC = \frac{140^\circ}{2} = 70^\circ$

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

Since $\triangle$ABC is an isosceles triangle,

$\angle DBC = \angle BCD$

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

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

$\angle DBC = \frac{80^\circ}{2} = 40^\circ$

In $\triangle$BAD,

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

$30^\circ + 20^\circ + \angle ADB = 180^\circ$ ($\angle ABD = \angle ABC - \angle DBC$)

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

$\angle ADB = 130^\circ$

$\angle ADB = 130^\circ$

Solution - 06:-

It is given that.

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

Yes, ABC and DBC are congruent.

$AB = DB$, $AC = DC$ & $BC = BC$, we have

$\triangle ABC \cong \triangle DBC$;

By side - side - side congruence condition

Both triangles are congruent

$\angle BAC = 40°$ [Given]

$\angle BDC = 100°$ [Given]

$\therefore \angle ADB = 130°$

Solution-06:-

It is given that.

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

Yes, ABC and DBC are congruent.

$AB = DB$, $AC = DC$ & $BC = BC$, we have

$\Delta ABC \cong \Delta DBC$;

By side-side-side congruence condition Both triangles are congruent

$\angle BAC = 40^\circ$ [Given]

$\angle BDC = 100^\circ$ [Given]

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

Solution-08:-

(i) In triangles ADB and ADC, we have

common Base→AD

$AD = AD$;

$BD = DC$;

$AB = AC$.

By SSS condition of congruence, we have

$\Delta ADB \cong \Delta ADC$.

(ii) a) AB, AC

b) AD, AD

c) BD, DC.

Three Pairs of matching parts.

Solution-09:-

Yes, $\Delta ABC \cong \Delta ACB$.

Three relations are

(i) $AB = AC$

(ii) $BC = CB$

(iii) $AC = AB$

Solution-10:-

In triangles ABC and DBC, we have

common base → BC

i.e $BC = BC$;

$AB = BD$ &

$AC = CD$.

By SSS condition of congruence, we have

$\Delta ABC \cong \Delta DBC$.

→ We use the side-side-side congruence condition.

→ Yes, $\angle ABD = \angle ACD$.

[Two triangles angles are congruent, if they have the same measure].

Exercise-16.3 Q1

Exercise - 16.3

1) Solution :-

(i) In triangles AOB and COD, we have

$AB = DC$, $AO = OC$ & $\angle A = \angle C$

So, By side Angle side congruence condition, we have

$\triangle AOB \cong \triangle COD$.

(ii) In triangles ABD and ACD, we have

$BD = CD$; $AD = AD$ and $\angle ADB = \angle ADC = 90°$.

So, by SAS congruence condition, we have

$\triangle ADB \cong \triangle ADC$.

(iii) In triangles ABD and CDB, we have

$AB = DC$; $AD = BC$ & $\angle BDC = \angle ABD$.

So by side-Angle-side congruence condition.

we have $\triangle ABD \cong \triangle CDB$.

(iv) In triangles ABC and PQR, we have

$AB = PQ$; $BC = QR$ and $\angle ABC = \angle PQR = 90°$.

So, By side-Angle-side congruence condition,

we have

$\triangle ABC \cong \triangle PQR$.

Solution - 02:-

(i) in triangles ABC and ADC, we have

$AB = AD$; $AC = CA$ & $BC = CD$,

So, By side-side-side - congruence condition,

we have

$\triangle ABC \cong \triangle ADC$.

(ii) in triangles ADB and ACB, we have

$AD = CB$; $AC = DB$ & $AB = AB$.

So, By side-side-side congruence condition,

we have

$\triangle ADB \cong \triangle ACB$.

(iii) In triangles ADC and ACB, we have

$AD = DB$; $DC = CB$ & $\angle DAC = \angle CAB$.

So, by side-Angle-side congruence condition,

we have

$\triangle ADC \cong \triangle ACB$.

(iv) In triangles ADC and ACB, we have

$AD = CB$; $AB = DC$ and $\angle CAP = \angle ACB$.

So, by SAS congruence condition, we have

$\triangle ADC \cong \triangle ACB$.

Solution-03:-

→ (i), (ii) i.e $\Delta AOC \cong \Delta DOB$ & $\Delta AOC \cong \Delta BOD$ are true.

AO = BO; CO = DO; ∠AOC, ∠BOD.

By side-Angle-side congruence condition

Solution-04:-

→ OA = OB;

OC = OD;

∠AOC = ∠BOD

→ yes triangles AOC and BOD are congruent

→ in symbolic form

$\Delta AOC \cong \Delta BOD$.

→ we use side-Angle-side congruence condition.

Solution-05:-

i) yes, $\Delta ADB \cong \Delta ADC$

[if two sides and the included angle of the one are respectevely equal to the two sides and included angle of the other.

(ii) AB, AC; AD, AD; ∠BAD = ∠CAD.

5)

(iii) Yes, BD = DC is true statement

Solution-06:-

(i) In symbolic form

$\Delta ABC \cong \Delta ADC$.

(ii) (a) ∠ADC

(b) ∠ACB

(c) ∠A, ∠C.

Solution-07:-

(i) Yes, $\Delta ACB \cong \Delta CAB$

[∵ in triangles ACB, CAB we have AC common base, AB = CD & BC = AD.

By SSS-condition of congruence

ΔACB & ΔCAB are congruent]

(ii) AC, CA; DC, BA; ∠DCA, ∠BAC.

(iii) ∠ACB

(iv) Yes, AD ∥ BC.

Exercise-16.4 Q1

Exercise-16.4 :-

Solution-01:-

(i) In triangles ABO and CDO, we have

$\angle BOA = \angle DOC$ [vertically opposite angles]

$\angle BAO = \angle DCO$

and $AB = DC = 6.1\text{ cm}$.

So, by Angle-side-Angle congruence condition.

we have

$\therefore \triangle AOB \cong \triangle COD$

$\therefore \triangle ABO \cong \triangle CDO$.

(ii) In triangles ADB and ADC, we have

$\angle ABD = \angle ACD$

$\angle DAC = \angle DAB$ and [vertically

$AB = AC$.

So, by Angle-side-Angle congruence condition, we have

$\triangle ADB \cong \triangle ADC$.

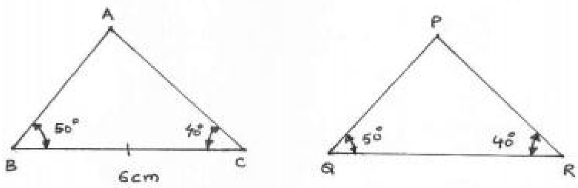
Solution-02:-

(i) Yes, $\triangle ADB \cong \triangle ADC$.

(ii) $\angle BAD$, $\angle CAD$; AD, AD ; $\angle ADB$, $\angle ADC$.

(iii) Yes, $BD = DC$.

Solution-03:-



$\therefore \triangle ABC \cong \triangle PQR$ [$\because$ By ASA congruence condition]

Exercise-16.5

Solution-01:-

(i) In Δ's ADB and BCA, we have

$\angle ADB = \angle BCA = 90°$

AB = AB [Hypotenuse]

and AD = BC = 4cm.

So, by RHS congruence condition, we have.

$\Delta ADB \cong \Delta BCA$ [Two right triangles are congruence if the hypotenuse and one side of the one are respectively equal to the hypotenuse and one side of the other]

(ii) In right angles triangles ADB and ADC, we have

Hyp. AB = Hyp. AC [Given]

AD = AD [Common side]

So, by RHS creterion of congruence

$\Delta ABD \cong \Delta ACD$ [∵ corresponding parts of above congruent Δles are equal]

$\Rightarrow$ BD = DC

(iii) In right triangles ABO and DCO, we have

Hyp AO = Hyp OD

BC = BC.

So, by RHS creterion of congruence

$\Delta AOB \cong \Delta DOC$.

BO = OC.

(iv) In Δs ABC and ADC, we have

$\angle ABC = \angle ADC = 90°$

AC = AC [Hypotenguse]

and BC = DC = 4.5cm

So, by RHS congruence condition, we have

$\Delta ABC \cong \Delta ADC$.

(v) In ΔABD and ΔCBD, we have

$\angle ADB = \angle BDC = 90°$

AB = BC [Hypotenuse]

and AD = DC

So, by RHS congruence condition, we have

$\Delta ABD \cong \Delta CBD$.

Solution-02:-

(i) Yes, $\Delta ABD \cong \Delta ACD$

(ii) AB, AC;

AD, AD;

$\angle ADB$, $\angle ADC$.

(iii) Yes, BD = DC.

Solution-03:-

→ Yes, ΔAB and ΔACD are congruent

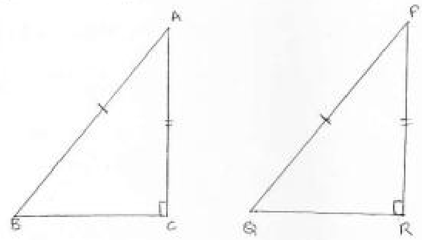
→ In symbolic form $\Delta ABD \cong \Delta ACD$.

→ RHS congruence condition.

→ CD of ΔADC equals BD

→ $\angle CDF$ ΔADC equals $\angle B$.

Solution-04:-



$\Delta ABC \cong \Delta PQR$.

Solution-05:-

(i) Yes, $\Delta BCD \cong \Delta CBE$.

(ii) (a) BD, CE

(b) CB, BC

(c) $\angle BDC$, $\angle CEB$.