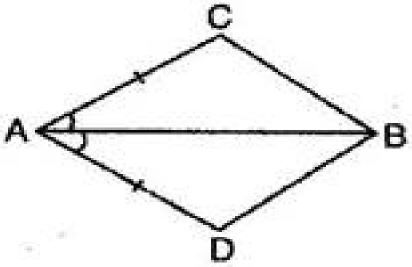
CBSE Class 9 Mathematics

NCERT Solutions

CHAPTER 7

Triangles(Ex. 7.1)

1. In quadrilateral ABCD (See figure). AC = AD and AB bisects $\angle$A. Show that $\triangle$ABC $\cong$ $\triangle$ABD. What can you say about BC and BD?



Ans. Given: In quadrilateral ABCD, AC = AD and AB bisects $\angle$A.

To prove: $\triangle$ABC $\cong$ $\triangle$ABD

Proof: In $\triangle$ABC and $\triangle$ABD,

AC = AD [Given]

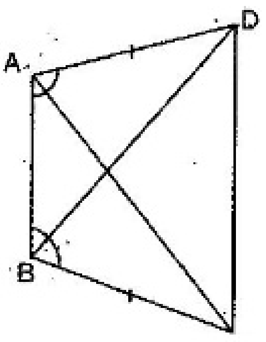
$\angle$BAC = $\angle$BAD [$\because$ AB bisects $\angle$A]

AB = AB [Common]

$\therefore$ $\triangle$ABC $\cong$ $\triangle$ABD [By SAS congruency]

Thus **BC** = **BD** [By C.P.C.T.]

2. ABCD is a quadrilateral in which AD = BC and $\angle$DAB = $\angle$CBA. (See figure). Prove that:



C

(i) $\triangle$ABD $\cong$ $\triangle$BAC

(ii) BD = AC

(iii) $\angle$ ABD = $\angle$ BAC

Ans. (i) In $\triangle$ABC and $\triangle$BAD,

BC = AD [Given]

$\angle$ DAB = $\angle$ CBA [Given]

AB = AB [Common]

$\therefore$ $\triangle$ABC $\cong$ $\triangle$ ABD [By SAS congruency]

Thus AC = BD [By C.P.C.T.]

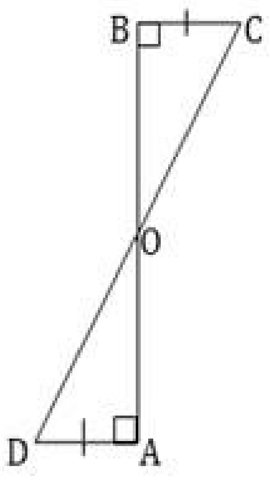
(ii) Since $\triangle$ABC $\cong$ $\triangle$ ABD

$\therefore$ **AC** = **BD** [By C.P.C.T.]

(iii) Since $\triangle$ABC $\cong$ $\triangle$ ABD

$\therefore$ $\angle$ **ABD** = $\angle$ **BAC** [By C.P.C.T.]

3. AD and BC are equal perpendiculars to a line segment AB. Show that CD bisects AB (See figure)



Ans. In $\triangle$BOC and $\triangle$AOD,

$\angle$ OBC = $\angle$ OAD = 90° [Given]

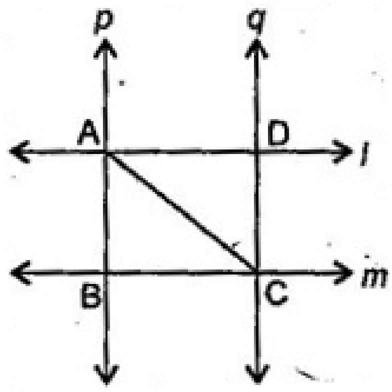
$\angle$BOC = $\angle$AOD [Vertically Opposite angles]

BC = AD [Given]

$\therefore$ ΔBOC $\cong$ ΔAOD [By ASA congruency]

$\Rightarrow$ **OB** = **OA** [By C.P.C.T., Also, OC = OD again by C.P.C.T.]

4. l and m are two parallel lines intersected by another pair of parallel lines p and q (See figure). Show that ΔABC $\cong$ ΔCDA.



Ans. AC being a transversal. [Given]

Therefore $\angle$DAC = $\angle$ACB [Alternate angles]

Now $p \parallel q$ [Given]

And AC being a transversal. [Given]

Therefore $\angle$BAC = $\angle$ACD [Alternate angles]

Now In ΔABC and ΔADC,

$\angle$ACB = $\angle$DAC [Proved above]

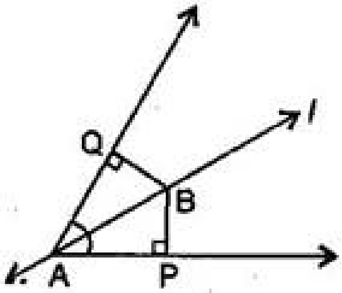
$\angle$BAC = $\angle$ACD [Proved above]

AC = AC [Common]

$\therefore$ Δ**ABC** $\cong$ Δ**CDA** [By ASA congruency]

5. Line l is the bisector of the angle A and B is any point on l. BP and BQ are

perpendiculars from B to the arms of $\angle$A. Show that:



(i) $\triangle$APB $\cong$ $\triangle$AQB

(ii) BP = BQ or B is equidistant from the arms of $\angle$A (See figure).

Ans. Given: Line l bisects $\angle$A.

$\therefore$ $\angle$BAP = $\angle$BAQ

(i) In $\triangle$ABP and $\triangle$ABQ,

$\angle$BAP = $\angle$BAQ [Given]

$\angle$BPA = $\angle$BQA = 90° [Given]

AB = AB [Common]

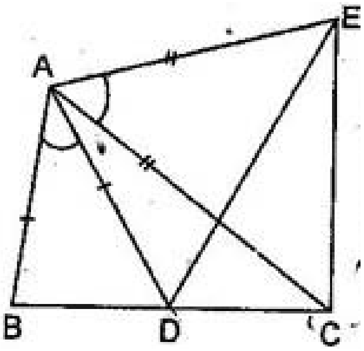
$\therefore$ $\triangle$APB $\cong$ $\triangle$AQB [By AAS congruency]

(ii) Since $\triangle$APB $\cong$ $\triangle$AQB

$\therefore$ BP = BQ [By C.P.C.T.]

$\Rightarrow$ B is equidistant from the arms of $\angle$A.

6. In figure, AC = AE, AB = AD and $\angle$BAD = $\angle$EAC. Show that BC = DE.



Ans. Given that $\angle$ BAD = $\angle$ EAC

Adding $\angle$ DAC on both sides, we get

$\angle$ BAD + $\angle$ DAC = $\angle$ EAC + $\angle$ DAC

$\Rightarrow$ $\angle$ BAC = $\angle$ EAD ....(i)

Now in $\triangle$ABC and $\triangle$ADE,

AB = AD [Given]

AC = AE [Given]

$\angle$ BAC = $\angle$ DAE [From eq. (i)]

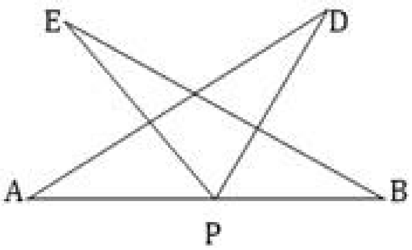
$\therefore$ $\triangle$ABC $\cong$ $\triangle$ADE [By SAS congruency]

$\Rightarrow$ **BC** = **DE** [By C.P.C.T.]

7. AB is a line segment and P is the mid-point. D and E are points on the same side of AB such that $\angle$ BAD = $\angle$ ABE and $\angle$ EPA = $\angle$ DPB. Show that:

(i) $\triangle$DAP $\cong$ $\triangle$EBP

(ii) AD = BE (See figure)



Ans. Given that $\angle$ EPA = $\angle$ DPB

Adding $\angle$ EPD on both sides, we get

$\angle$ EPA + $\angle$ EPD = $\angle$ DPB + $\angle$ EPD

$\Rightarrow$ $\angle$ APD = $\angle$ BPE ....(i)

Now in $\triangle$APD and $\triangle$BPE,

$\angle$ PAD = $\angle$ PBE [$\because$ $\angle$ BAD = $\angle$ ABE (given),

$\therefore$ $\angle$ PAD = $\angle$ PBE]

AP = PB [P is the mid-point of AB]

$\angle$ APD = $\angle$ BPE [From eq. (i)]

$\therefore$ $\triangle$DAP $\cong$ $\triangle$EBP [By ASA congruency]

$\Rightarrow$ **AD** = **BE** [By C.P.C.T.]

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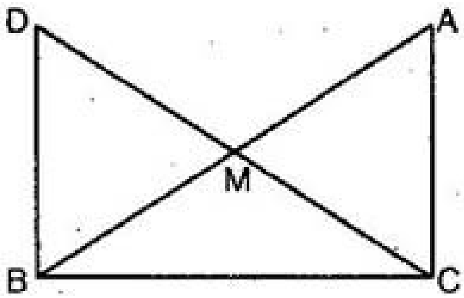
8. In right triangle ABC, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. Point D is joined to point B. (See figure)



Show that:

(i) $\triangle$AMC $\cong$ $\triangle$BMD

(ii) $\angle$ DBC is a right angle.

(iii) $\triangle$DBC $\cong$ $\triangle$ACB

(iv) CM = $\frac{1}{2}$ AB

Ans. (i) In $\triangle$AMC and $\triangle$BMD,
AM = BM [M is the mid-point of AB]
$\angle$ AMC = $\angle$ BMD [Vertically opposite angles]
CM = DM [Given]
$\therefore$ $\triangle$AMC $\cong$ $\triangle$ BMD [By SAS congruency]
$\therefore$ $\angle$ ACM = $\angle$ BDM ....(i)

$\angle$ CAM = $\angle$ DBM and AC = BD [By C.P.C.T.]

(ii) For two lines AC and DB and transversal DC, we have,

$\angle$ ACD = $\angle$ BDC [Alternate angles]

$\therefore$ AC $\parallel$ DB

Now for parallel lines AC and DB and for transversal BC.

$\angle DBC + \angle ACB = 180^0$ [cointerior angles].....(ii)

But $\triangle$ABC is a right angled triangle, right angled at C.

$\therefore$ $\angle$ ACB = 90^0 ....(iii)

Therefore $\angle$ DBC = 90^0 [Using eq. (ii) and (iii)]

$\Rightarrow$ $\angle$ DBC is a right angle.

(iii) Now in $\triangle$DBC and $\triangle$ABC,

DB = AC [Proved in part (i)]

$\angle$ DBC = $\angle$ ACB = 90^0 [Proved in part (ii)]

BC = BC [Common]

$\therefore$ $\triangle$DBC $\cong$ $\triangle$ ACB [By SAS congruency]

(iv) Since $\triangle$DBC $\cong$ $\triangle$ ACB [Proved above]

$\therefore$ DC = AB

$\Rightarrow$ DM + CM = AB

$\Rightarrow$ CM + CM = AB [$\because$ DM = CM]

$\Rightarrow$ 2CM = AB

$\Rightarrow$ **CM** = $\frac{1}{2}$ **AB**