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**Congruence Of Triangles And Inequalities in a Triangle**  
**CHAPTER 9**

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**Exercise - 9 (A)**

Answer1)

**Given:**  $AB \parallel CD$

**To prove:** i) O is the midpoint of AD

ii)  $\triangle AOB \cong \triangle DOC$

**Proof:**

In  $\triangle AOB$  and  $\triangle DOC$

$OA = OD$  (Given)

$\angle AOB = \angle COD$  (vertically opposite angles)

$\angle OAB = \angle ODC$  (alternate angles)

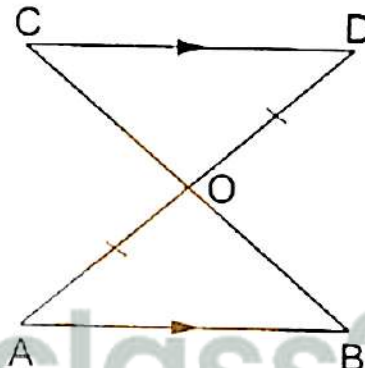
Therefore;

$\triangle AOB \cong \triangle DOC$  (A.A.S. criteria)

Hence;

$OB = OC$  (c.p.c.t.)

Hence proved.



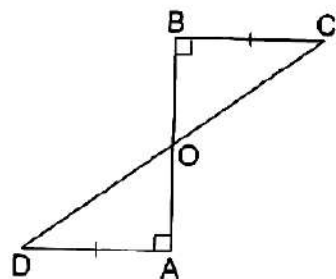
Answer2)

**Given:**  $AD = BD$

**To prove:** CD bisects AB i.e.  $OA = OB$

**Proof:**

In  $\triangle BOC$  and  $\triangle AOD$



$$AD=BC \quad (\text{Given})$$

$$\angle OAD = \angle OBC = 90 \quad (\text{Given})$$

$$\angle AOD = \angle BOC \quad (\text{vertically opp. Angles})$$

Therefore  $\triangle BOC \cong \triangle AOD$  (A..A.S criteria)

Hence  $OA=OB$  i.e CD bisects AB

Hence proved.

**Answer3)**

**Given:** (i)  $l \parallel m$

(ii)  $p \parallel q$

**To prove:**  $\triangle ABC \cong \triangle CDA$

**Proof:**

Taking  $l$  parallel to  $m$   $AC$  is the transversal

$$\angle ACB = \angle CAD \quad (\text{Alternate angles})$$

Taking  $p$  parallel to  $q$

$$\angle BAC = \angle DCA \quad (\text{Alternate angles})$$

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

Therefore;

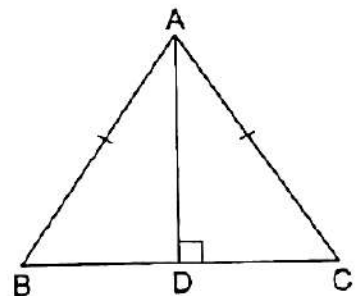
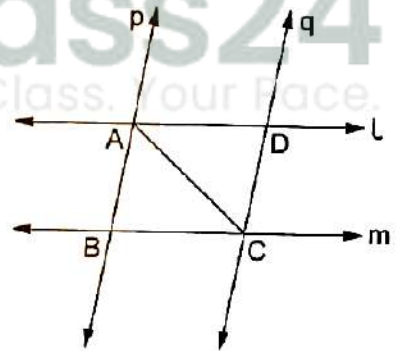
$$\triangle ABC \cong \triangle CDA \quad (\text{ASA criteria})$$

Hence Proved.

**Answer4) Given:**  $AB=AC$

**To prove:** (i)  $AD$  bisects  $BC$  (i.e.  $BD=DC$ )

(ii)  $AD$  bisects  $\angle A$



**Prove:**

In right angled  $\triangle ADB$  and  $\triangle ADC$  we have,

Hypotenuse  $AB = \text{hypotenuse } AC$  (Given)

$AD = AD$  (common)

Therefore  $\triangle ADB \cong \triangle ADC$  (RHS criteria)

Hence  $BD = DC$

$\angle BAD = \angle CAD$

Hence  $AD$  bisects  $\angle A$

Answer 5)

Given:  $BE = CF$

To Prove: i)  $\triangle ABE \cong \triangle ACF$

ii)  $AB = AC$

**Proof:**

In  $\triangle ABE$  and  $\triangle ACF$

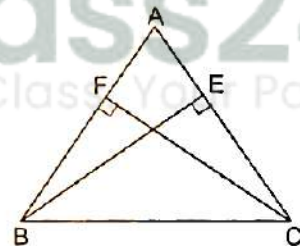
$\angle AEB = \angle AFC = 90$  (Given)

$\angle BAE = \angle CAF$  (common)

$BE = CF$  (Given)

Therefore  $\triangle ABE \cong \triangle ACF$  (A.A.S Criteria)

$AB = AC$  (c.p.c.t)



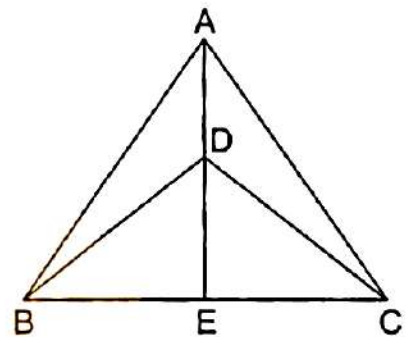
**Answer6)**

**Given:**

- (i)  $\triangle ABC$  and  $\triangle DBC$  are two isosceles triangles in which  $AB=AC$  &  $BD=DC$ .

**To Prove:**

- (i)  $\triangle ABD \cong \triangle ACD$   
(ii)  $\triangle ABE \cong \triangle ACE$   
(iii)  $AE$  bisects  $\angle A$  as well as  $\angle D$ .  
(iv)  $AE$  is the perpendicular bisector of  $BC$ .



**Proof:**

- (i) In  $\triangle ABD$  and  $\triangle ACD$ ,  
 $AD = AD$  (Common)  
 $AB = AC$  (Given) .  
 $BD = CD$  (Given)

Therefore,  $\triangle ABD \cong \triangle ACD$  (SSS criteria)

$\angle BAD = \angle CAD$ (C.P.C.T)

$\angle BAE = \angle CAE$

- (ii) In  $\triangle ABE$  &  $\triangle ACE$

$AE = AE$  (Common)

$\angle BAE = \angle CAE$

(Proved above)

$AB = AC$  (Given)

Therefore,

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$\triangle ABE \cong \triangle ACE$  (SAS criteria).

(iii)  $\angle BAD = \angle CAD$  (proved in part i)

Hence, AE bisects  $\angle A$ .

also,

In  $\triangle BED$  and  $\triangle CED$

ED = ED (Common)

BD = CD (Given)

BE = CE

( $\triangle ABE \cong \triangle ACE$  so by c.p.c.t)

Therefore,  $\triangle BED \cong \triangle CED$  (SSS criteria)

Thus,

$\angle BDE = \angle CDE$  (c.p.c.t)

Hence, we can say that AE bisects  $\angle A$  as well as  $\angle D$ .

(iv)  $\angle BED = \angle CED$

(by CPCT as  $\triangle BED \cong \triangle CED$ )

Therefore;

BE = CE (c.p.c.t)

$\angle BED + \angle CED = 180^\circ$  (BC is a straight line)

$\Rightarrow 2\angle BED = 180^\circ$

$\Rightarrow \angle BED = 90^\circ$

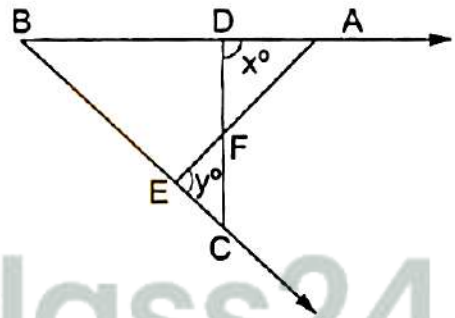
Hence, AE is the perpendicular bisector of BC.

Answer7)

Given: (i)  $x = y$

(ii)  $AB = CB$

**To prove:**  $AE = CD$



**Proof:**

Consider the triangles AEB and CDB.

$\angle EBA = \angle DBC$   $\angle EBA = \angle DBC$  (Common angle) ... (i)

Further, we have:

$\angle BEA = 180 - y$

$\angle BDC = 180 - x$

Since  $x = y$ ,

we have:

$180 - x = 180 - y$

$\Rightarrow \angle BEA = \angle BDC$  ... (ii)

$AB = CB$  (Given) ... (iii)

From (i), (ii) and (iii),

we have:

$\triangle BDC \cong \triangle BEA$  (AAS criterion)

$\therefore AE = CD$  (CPCT)

Hence, proved.

**Answer8)**

**Given:** (i)  $l$  is the bisector of an  $\angle A$

(ii)  $BP$  and  $BQ$  are perpendiculars

**To Prove:**  $\triangle APB \cong \triangle AQB$

**Proof:**

In  $\triangle APB$  and  $\triangle AQB$

$\angle P = \angle Q$  (Right angles)

$\angle BAP = \angle BAQ$  ( $l$  is the bisector)

$AB = AB$  (Common)

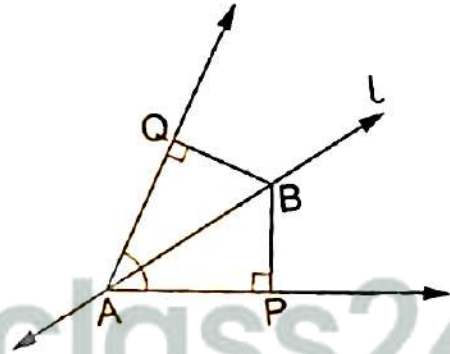
$\triangle APB \cong \triangle AQB$  (A.A.S criteria)

Hence, Proved.

(ii)  $BP = BQ$  (By c.p.c.t)

Therefore,

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

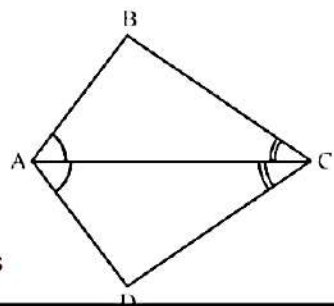


**Answer9)**

**Given:**  $AC$  bisects angles  $A$  and  $C$ .

**To prove:** (i)  $AB = AD$

(ii)  $CB = CD$



**Proof:**

$\Delta ABC$  and  $\Delta ADC$ ,

we have:

$$\angle CAB = \angle CAD$$

$$\angle BCA = \angle DCA$$

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

$$\Delta ABC \cong \Delta ADC$$

Therefore,

$$AD = AB \quad (\text{c.p.c.t})$$

$$CD = BC \quad (\text{c.p.c.t})$$

**Answer 10) Given:**  $AB = AC$

**To prove:**  $AC + AD = BC$

**Proof:**

Let  $AB = AC = a$  and  $AD = b$

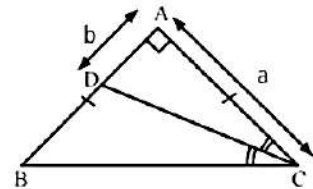
In a right angled triangle  $ABC$ ,  $BC^2 = AB^2 + AC^2$

$$BC^2 = a^2 + a^2$$

$$BC = a\sqrt{2}$$

Given  $AD = b$ , we get

$$DB = AB - AD \text{ or } DB = a - b$$



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We have to prove that  $AC + AD = BC$  or  $(a + b) = a\sqrt{2}$ .

By the angle bisector theorem, we get

$$AD/DB = AC/BC$$

$$b/(a - b) = a/a\sqrt{2}$$

$$b/(a - b) = 1/\sqrt{2}$$

$$b = (a - b)/\sqrt{2}$$

$$b\sqrt{2} = a - b$$

$$b(1 + \sqrt{2}) = a$$

$$b = a/(1 + \sqrt{2})$$

Rationalizing the denominator with  $(1 - \sqrt{2})$

$$b = a(1 - \sqrt{2}) / (1 + \sqrt{2}) \times (1 - \sqrt{2})$$

$$b = a(1 - \sqrt{2}) / (-1)$$

$$b = a(\sqrt{2} - 1)$$

$$b = a\sqrt{2} - a$$

$$b + a = a\sqrt{2}$$

or  $AD + AC = BC$  [we know that  $AC = a$ ,  $AD = b$  and  $BC = a\sqrt{2}$ ]

Hence it is proved.

**Answer11)**

**Given:** (i)  $OA=OB$

(ii)  $OP=OQ$

**To Prove:** (i)  $PX=QX$

(ii)  $AX=BX$

**Proof:**

In  $\Delta PBO$  and  $\Delta AOQ$

$OB=OA$  (Given)

$OP=OQ$  (Given)

$\angle O=\angle O$  (common)

Therefore;

$\Delta PBO \cong \Delta AOQ$  (S.A.S criteria)

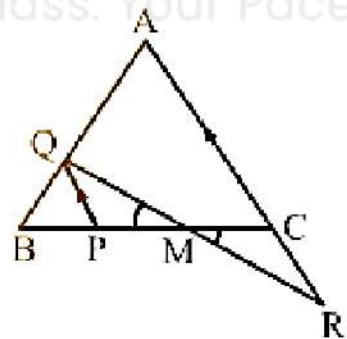
$\angle B=\angle A$  (C.P.C.T)

In  $\Delta BXQ$  and  $\Delta AXP$

$\angle B=\angle A$  (proved above)

$PX=QX$  (C.P.C.T.)

Hence proved



**Answer12)**

**Given:** (i)  $ABC$  is an equilateral triangle,

(ii)  $PQ \parallel AC$

(iii)  $CR=BP$

**To prove:**  $QR$  bisects  $PC$  or  $PM = MC$

**Proof:**

Since,  $\triangle ABC$  is equilateral triangle,

$$\angle A = \angle ACB = 60^\circ$$

Since,  $PQ \parallel AC$  and corresponding angles are equal,

$$\angle BPQ = \angle ACB = 60^\circ$$

In  $\triangle BPQ$ ,

$$\angle B = \angle ACB = 60^\circ$$

$$\angle BPQ = 60^\circ$$

Hence,  $\triangle BPQ$  is an equilateral triangle.

$$\therefore PQ = BP = BQ$$

Since we have  $BP = CR$ ,

We say that  $PQ = CR$  ... (1)

Consider the  $\triangle PMQ$  and  $\triangle CMR$ ,

$$\angle PQM = \angle CRM \quad (\text{alternate angles})$$

$$\angle PMQ = \angle CMR \quad (\text{vertically opposite angles})$$

$$PQ = CR \quad \dots \text{ from 1}$$

$$\triangle PMQ \cong \triangle CMR \quad (\text{AAS criteria})$$

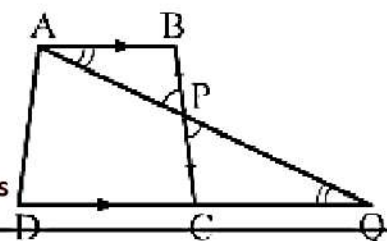
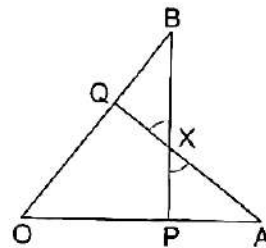
$$\therefore PM = MC \quad (\text{c.p.c.t})$$

Hence proved.

**Answer13)**

**Given:** (i)  $AB \parallel DC$

(ii)  $P$  is the midpoint of  $BC$ .



**To Prove :** (i)  $AB = CQ$

(ii)  $DQ = DC + AB$

so,  $AB \parallel DQ$

so,  $\angle BAQ = \angle DQA$  (alternate angles)

or  $\angle BAP = \angle CQP$  -----(1)

Now, in triangle  $ABP$  and triangle  $QCP$ ,

$\angle BAP = \angle CQP$  (from (1))

$\angle BPA = \angle CPQ$  (vertically opposite angles)

$BP = CP$  (since  $P$  is the midpoint of  $BC$ )

so, triangle  $ABP$  congruent triangle  $QCP$  (by AAS congruency)

or  $AB = CQ$  (by CPCT) [proved] -----(2)

again,  $DQ = DC + CQ = DC + AB$  (from (2)) [proved]

Answer14)

**Given:**  $ABCD$  is a square and  $PB=PD$

**To prove:**  $CPA$  is a straight line

**Proof:**

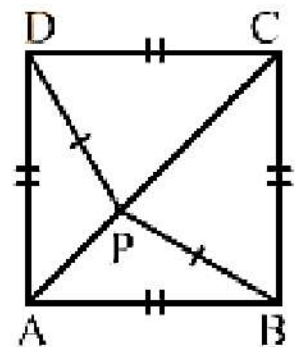
$\triangle APD$  and  $\triangle APB$ ,

$DA = AB$  ... (as  $ABCD$  is square)

$AP = AP$  ... (common side)

$PB = PD$  ... (Given)

$\triangle APD \cong \triangle APB$  (SSS criteria)



Hence, we know that, corresponding parts of the congruent triangles are equal

$\angle APD = \angle APB$  ...(1)

Now consider  $\triangle CPD$  and  $\triangle CPB$ ,

$CD = CB$  ... ABCD is square

$CP = CP$  ... common side

$PD = PB$  ... Given

Thus by SSS property of congruence,

$\triangle CPD \cong \triangle CPB$

$\angle CPD = \angle CPB$  ... (C.P.C.T.).....(2)

Now,

Adding both sides of 1 and 2,

$\angle CPD + \angle APD = \angle APB + \angle CPB$  ... (3)

Angles around the point P add upto  $360^\circ$

$\therefore \angle CPD + \angle APD + \angle APB + \angle CPB = 360^\circ$  .....(4)

From 4,

$$2(\angle CPD + \angle APD) = 360^\circ$$

$$\angle CPD + \angle APD = 180^\circ$$

This proves that CPA is a straight line.

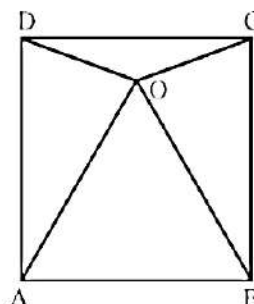
**Answer15) Given:** In square ABCD,  $\triangle OAB$  is an equilateral triangle.

**To prove:**  $\triangle OCD$  is an isosceles triangle.

**Proof:**

$\therefore \angle DAB = \angle CBA = 90^\circ$  (Angles of square ABCD)

And,  $\angle OAB = \angle OBA = 60^\circ$  (Angles of equilateral  $\triangle OAB$ )



$$\therefore \angle DAB - \angle OAB = \angle CBA - \angle OBA = 90^\circ - 60^\circ$$

$$\Rightarrow \angle OAD = \angle OBC = 30^\circ \quad \dots(i)$$

$$\therefore \angle DAB = \angle CBA = 90^\circ \quad \text{Angles of square ABCD}$$

$$\text{And, } \angle OAB = \angle OBA = 60^\circ$$

Angles of equilateral  $\triangle OAB$

$$\therefore \angle DAB - \angle OAB = \angle CBA - \angle OBA = 90^\circ - 60^\circ$$

$$\Rightarrow \angle OAD = \angle OBC = 30^\circ \quad \dots(i)$$

Now, in  $\triangle DAO$  and  $\triangle CBO$ ,

$$AD = BC \quad (\text{Sides of square ABCD})$$

$$\angle DAO = \angle CBO \quad [\text{From (i)}]$$

$$AO = BO \quad (\text{Sides of equilateral } \triangle OAB)$$

$\therefore$  By SAS congruence criteria,

$$\triangle DAO \cong \triangle CBO$$

$$\text{So, } OD = OC \quad (\text{CPCT})$$

Hence,  $\triangle OCD$  is an isosceles triangle.

**Answer16)**

**Given:**  $AX = AY$ .

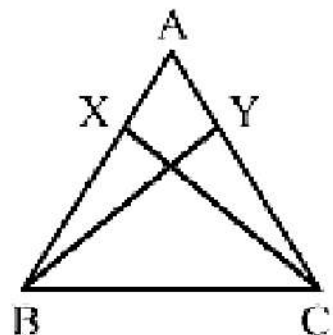
**To prove:**  $CX = BY$

**Proof:**

In  $\triangle CXA$  and  $\triangle BYA$ ,

$$AX = AY \quad \dots \text{Given}$$

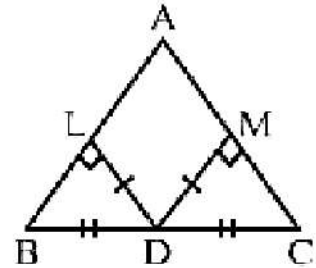
$$\angle XAC = \angle YAB \quad \dots \text{common angle}$$



$AC = AB$  ... Given,

$\triangle CXA \cong \triangle BYA$  (S.A.S. criteria)

$CX = BY$  (C.P.C.T.)



Answer17)

**Given:**  $BD = DC$  and  $DL \perp AB$  and  $DM \perp AC$  such that  $DL = DM$

**To prove:**  $AB = AC$

**Proof:**

In right angled triangles  $\triangle BLD$  and  $\triangle CMD$ ,

$\angle BLD = \angle CMD = 90^\circ$

$BD = CD$  ... Given

$DL = DM$  ... Given

Thus by right angled hypotenuse side property of congruence,

$\triangle BLD \cong \triangle CMD$

Hence, we know that, corresponding parts of the congruent triangles are equal

$\angle ABD = \angle ACD$

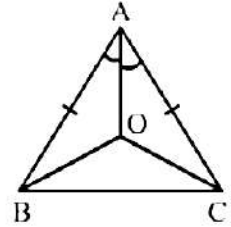
In  $\triangle ABC$ , we have,

$\angle ABD = \angle ACD$

$\therefore AB = AC$  .... Sides opposite to equal angles are equal

Answer18)

**Given:** In  $\triangle ABC$ ,  $AB=AC$  and the bisectors of  $\angle B$  and  $\angle C$  meet at a point  $O$ .



**To prove:**  $BO=CO$  and  $\angle BAO = \angle CAO$

**Proof:**

In  $\triangle ABC$  we have,

$$\angle OBC = \frac{1}{2} \angle B$$

$$\angle OCB = \frac{1}{2} \angle C$$

But  $\angle B = \angle C$  ... Given

$$\text{So, } \angle OBC = \angle OCB$$

Since the base angles are equal, sides are equal

$$\therefore OC = OB \dots(1)$$

Since  $OB$  and  $OC$  are bisectors of angles  $\angle B$  and  $\angle C$  respectively, we have

$$\angle ABO = \frac{1}{2} \angle B$$

$$\angle ACO = \frac{1}{2} \angle C$$

$$\therefore \angle ABO = \angle ACO \dots(2)$$

Now in  $\triangle ABO$  and  $\triangle ACO$

$$AB = AC \dots \text{Given}$$

$$\angle ABO = \angle ACO \dots \text{from (2)}$$

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$BO = OC$  ... from (1)

Thus by SAS property of congruence,

$\triangle ABO \cong \triangle ACO$

Hence, we know that, corresponding parts of the congruent triangles are equal

$\angle BAO = \angle CAO$

ie. AO bisects  $\angle A$  ; Hence proved.

**Answer19)**

**Given:** (i) ABCD is a trapezium

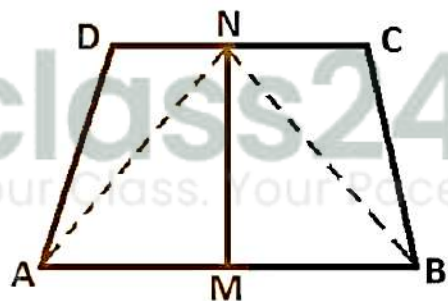
(ii) M is the mid point of AB

(iii) N is the mid point of CD

**To Prove:**  $AD = BC$ .

**Construction :** (i) Join B to N

(ii) Join A to N



**Proof:**

Consider  $\triangle AMN$  and  $\triangle BMN$

$\angle AMN = \angle BMN = 90^\circ$

$AM = BM$  (M is the midpoint of AB)

$MN = MN$  (common)

$\triangle AMN$  congruent to  $\triangle BMN$  (SAS congruence rule)

Consider  $\triangle ADN$  and  $\triangle BCN$

$DN = CN$  (N is the midpoint of CD)

$AN = BN$  (CPCT)

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$$\angle MNA = \angle BNM \text{ (CPCT) } \dots(1)$$

$$\angle MNC = \angle MND = 90 \dots(2)$$

Subtracting Eq(2) from Eq(1)

$$\angle MND - \angle MNA = \angle MNC - \angle BNM$$

$$\angle AND = \angle BNC$$

$\Delta AND$  congruent to  $\Delta BNC$

$$AD = BC \text{ (CPCT)}$$

Hence proved

Answer 20)

**Given:** Bisectors of the angles B and C of an isosceles triangle with  $AB = AC$  intersect each other at O.

**To prove:**  $\angle MOC = \angle ABC$

**Proof:**

In  $\Delta ABC$ ,

$$AB = AC \text{ (Given)}$$

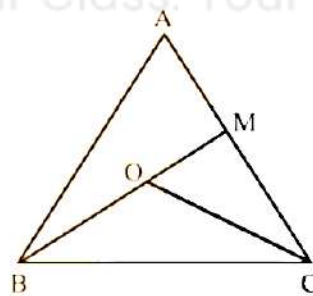
$$\Rightarrow \angle ACB = \angle ABC \text{ (opposite angles to equal sides are equal)}$$

$$\frac{1}{2} \angle ACB = \frac{1}{2} \angle ABC \text{ (divide both sides by 2)}$$

$$\Rightarrow \angle OCB = \angle OBC \dots(1) \text{ (As OB and OC are bisector of } \angle B \text{ and } \angle C)$$

Now,  $\angle MOC = \angle OBC + \angle OCB$  (as exterior angle is equal to sum of two opposite interior angle)

$$\Rightarrow \angle MOC = \angle OBC + \angle OBC \text{ (from (1))}$$



$$\Rightarrow \angle MOC = 2\angle OBC$$

$$\Rightarrow \angle MOC = \angle ABC \text{ (because OB is bisector of } \angle B)$$

Hence proved.

**Answer21)**

**Given:** (i) In an isosceles  $\triangle ABC$ ,

(ii)  $AB = AC$ ,

(iii)  $BO$  and  $CO$  are the bisectors of  $\angle ABC$  and  $\angle ACB$ .

**To prove:**  $\angle ABD = \angle BOC$

**Construction:** Produce  $CB$  to point  $D$ .

**Proof:**

In  $\triangle ABC$ ,

$$\because AB = AC \quad \text{(Given)}$$

$$\therefore \angle ACB = \angle ABC \quad \text{(Angle opposite to equal sides are equal)}$$

$$\Rightarrow \frac{1}{2}\angle ACB = \frac{1}{2}\angle ABC$$

$$\Rightarrow \angle OCB = \angle OBC \quad \dots(i)$$

(Given,  $BO$  and  $CO$  are angle bisector of  $\angle ABC$  and  $\angle ACB$ , respectively)

$$\Rightarrow \frac{1}{2}\angle ACB = \frac{1}{2}\angle ABC$$

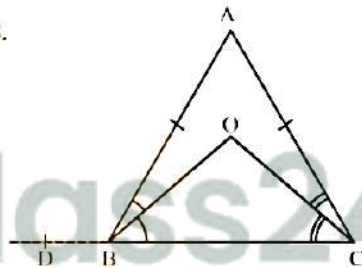
$$\Rightarrow \angle OCB = \angle OBC \quad \dots(i)$$

(Given,  $BO$  and  $CO$  are angle bisector of  $\angle ABC$  and  $\angle ACB$ , respectively)

In  $\triangle BOC$ ,

$$\angle OBC + \angle OCB + \angle BOC = 180^\circ \quad \text{(By angle sum property of triangle)}$$

$$\Rightarrow \angle OBC + \angle OBC + \angle BOC = 180^\circ \quad \text{[From (i)]}$$



$$\Rightarrow 2\angle OBC + \angle BOC = 180^\circ$$

$$\Rightarrow \angle ABC + \angle BOC = 180^\circ \quad (\text{BO is the angle bisector of } \angle ABC) \quad \dots(\text{ii})$$

$$\angle OBC + \angle OCB + \angle BOC = 180^\circ \quad \text{By angle sum property of triangle}$$

$$\Rightarrow \angle OBC + \angle OBC + \angle BOC = 180^\circ \quad \text{From (i)}$$

$$\Rightarrow 2\angle OBC + \angle BOC = 180^\circ$$

$$\Rightarrow \angle ABC + \angle BOC = 180^\circ \quad \text{BO is the angle bisector of } \angle ABC \quad \dots(\text{ii})$$

Also, DBC is a straight line.

$$\text{So, } \angle ABC + \angle DBA = 180^\circ \quad (\text{Linear pair}) \quad \dots(\text{iii})$$

$$\angle ABC + \angle DBA = 180^\circ \quad (\text{Linear pair}) \quad \dots(\text{iii})$$

From (ii) and (iii), we get

$$\angle ABC + \angle BOC = \angle ABC + \angle DBA$$

$$\therefore \angle BOC = \angle DBA$$

mc24

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Your Class. Your Pace.

Answer22)

Given: P is the point on the bisector of an angle  $\angle ABC$ , and  $PQ \parallel AB$

To Proof: BPQ is isoscele

Since,

$$BP \text{ is the bisector of } \angle ABC = \angle ABP = \angle PBC \quad (\text{i})$$

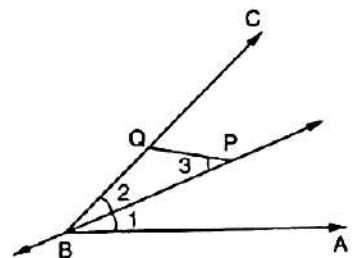
Now,

$$PQ \parallel AB$$

$$\angle BPQ = \angle ABP \quad (\text{ii}) \quad [\text{Alternate angles}]$$

From (i) and (ii), we get

$$\angle BPQ = \angle PBC$$



Or,

$$\angle BPQ = \angle PBQ$$

Now, in  $\triangle BPQ$

$$\angle BPQ = \angle PBQ$$

$\triangle BPQ$  is an isosceles triangle

Hence Proved.

**Answer23)** Given: A is an object in front of mirror LM,

B is the image of A and the observer is at D

AB intersects LM at T

To Prove: A and B are equidistant from LM

$$AT = BT$$

Construction: Join BD. Let it intersect LM at C

Join AC. CN be the normal at C.

Proof:

$$\angle i = \angle r \quad \dots(1)$$

$$AB \parallel NC \quad \dots[\text{Both are perpendicular to LM}]$$

$$\angle CAT = \angle CAN = \angle i \quad \dots(2)[\text{Alternate angles}]$$

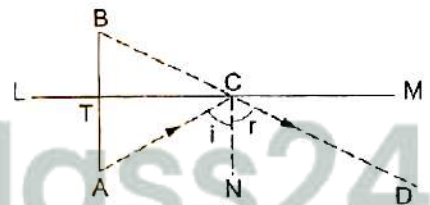
$$\angle CBA = \angle DCN = \angle r \quad \dots(3)[\text{Corresponding angles}]$$

From (1), (2) and (3), we get

$$\angle CAT = \angle CBA \quad \dots(4)$$

In  $\triangle CAT$  and  $\triangle CBT$ ,

$$\angle CAT = \angle CBT \quad \dots[\text{From (4)}]$$



$$\angle ATC = \angle BTC \quad \dots[\text{Each } 90^\circ]$$

$$CT = CT \quad \dots[\text{Common side}]$$

Therefore;

$$\triangle CAT \cong \triangle CBT \quad \dots[\text{AAA Criteria}]$$

$$AT = BT \quad \dots[\text{C.P.C.T}]$$

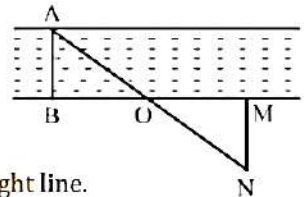
Hence Proved.

**Answer 24)**

Let AB be the breadth of the river.

M is any point situated on the bank of the river.

Let O be the mid point of BM.



Moving along perpendicular to point such that A, O and N are in straight line.

Then MN is the required breadth of the river.

In  $\triangle OBA$  and  $\triangle OMN$ ,

we have:  $OB = OM$  (O is midpoint)

$$\angle OBA = \angle OMN \quad (\text{Each } 90^\circ)$$

$$\angle AOB = \angle NOM \quad (\text{Vertically opposite angle})$$

$$\therefore \triangle OBA \cong \triangle OMN \quad (\text{ASA criterion})$$

In  $\triangle OBA$  and  $\triangle OMN$ ,

we have:  $OB = OM$  (O is midpoint)

$$\angle OBA = \angle OMN \quad (\text{Each } 90^\circ)$$

$$\angle AOB = \angle NOM \quad (\text{Vertically opposite angle})$$

$$\therefore \triangle OBA \cong \triangle OMN \quad (\text{ASA criterion})$$

Thus,  $MN = AB$  (CPCT)

If MN is known, one can measure the width of the river without actually crossing it.

**Answer 25)** Given: D is the midpoint of AC  
 $BD = \frac{1}{2} AC$

To Prove:  $\angle ABC$  is  $90^\circ$

In  $\triangle ADB$ ,  $AD = BD$

$\angle DAB = \angle DBA = \angle x$  ( Opposite angles)

In  $\triangle DCB$ ,  $BD = CD$

$\angle DBC = \angle DCB = \angle y$

In  $\triangle ABC$  we will use the angle sum property

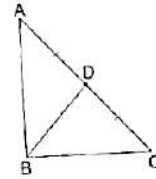
$\angle ABC + \angle BCA + \angle CAB = 180^\circ$

$2(\angle x + \angle y) = 180^\circ$

$\angle x + \angle y = 90^\circ$

$\angle ABC = 90^\circ$

This means that  $\triangle ABC$  is the right angled triangle.



**Answer 26)** No, because in the congruent rule, the two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle, that is, SAS criteria.

**Answer 27)** No,

Corresponding sides must be equal.

---

### EXERCISE-9(B)

**Answer1)** (i) No, because the sum of two sides of a triangle is not greater than the third side.

$$5 + 4 = 9$$

(ii) Yes, because the sum of two sides of a triangle is greater than the third side.

$$7 + 4 > 8; 8 + 7 > 4; 8 + 4 > 7$$

(iii) Yes, because the sum of two sides of a triangle is greater than the third side.

$$5 + 6 > 10; 10 + 6 > 5; 5 + 10 > 6$$

(iv) Yes, because the sum of two sides of a triangle is greater than the third side.

$$2.5 + 5 > 7; 5 + 7 > 2.5; 2.5 + 7 > 5$$

(v) No, because the sum of two sides of a triangle is not greater than the third side.

$$3 + 4 < 8$$

**Answer2) Given:** In  $\triangle ABC$ ,  $\angle A = 50^\circ$  and  $\angle B = 60^\circ$

In  $\triangle ABC$ ,

$$\angle A + \angle B + \angle C = 180^\circ \quad (\text{Angle sum property of a triangle})$$

$$\Rightarrow 50^\circ + 60^\circ + \angle C = 180^\circ$$

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

---

$$\Rightarrow \angle C = 180^\circ - 110^\circ$$

$$\Rightarrow \angle C = 70^\circ$$

Hence, the longest side will be opposite to the largest angle ( $\angle C = 70^\circ$ ) i.e. AB.

And, the shortest side will be opposite to the smallest angle ( $\angle A = 50^\circ$ ) i.e. BC.

**Answer3) (i) Given:** In  $\triangle ABC$ ,  $\angle A = 90^\circ$

So, sum of the other two angles in triangle  $\angle B + \angle C = 90^\circ$

i.e.  $\angle B, \angle C < 90^\circ$

Since,  $\angle A$  is the greatest angle.

So, the longest side is BC.

(ii) Given:  $\angle A = \angle B = 45^\circ$

Using angle sum property of triangle,

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

Since,  $\angle C$  is the greatest angle.

So, the longest side is AB.

(iii) Given:  $\angle A = 100^\circ$  and  $\angle C = 50^\circ$

Using angle sum property of triangle,

$$\angle B = 30^\circ$$

Since,  $\angle A$  is the greatest angle.

So, the shortest side is BC.

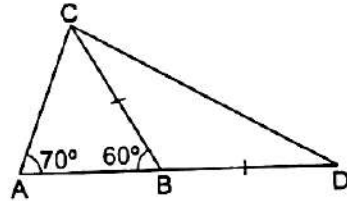
**Answer4) Given:**  $\triangle ABC$ , side AB is produced to D so that  $BD = BC$  and  $\angle B = 60^\circ$ ,  $\angle A = 70^\circ$

**To Prove:**

(i)  $AD > CD$

And, (ii)  $AD > AC$

**Proof:**



First join C and D

Now,

In  $\triangle ABC$

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

(Sum of all angles of triangle)

$$\angle C = 180^\circ - 70^\circ - 60^\circ = 50^\circ$$

$$\angle C = 50^\circ$$

$$\angle ACB = 50^\circ \text{ (i)}$$

And also in  $\triangle BDC$

$$\angle DBC = 180^\circ - \angle ABC$$

$$= 180^\circ - 60^\circ = 120^\circ$$

$$BD = BC \text{ (Given)}$$

$$\angle BCD = \angle BDC$$

(Therefore, angle opposite to equal sides are equal)

Now,

$$\angle DBC + \angle BCD + \angle BDC = 180^\circ$$

(Sum of all sides of triangle)

$$120^\circ + \angle BCD + \angle BDC = 180^\circ$$

$$2\angle BCD = 180^\circ - 120^\circ$$

$$2\angle BCD = 60^\circ$$

$$\angle BCD = 30^\circ$$

Therefore,  $\angle BCD = \angle BDC = 30^\circ$  (ii)

Now, consider  $\triangle BDC$ ,

---

$$\angle BAC = \angle DAC = 70^\circ \text{ (Given)}$$

$$\angle BDC = \angle ADC = 30^\circ \text{ [From (ii)]}$$

$$\angle ACD = \angle ACB + \angle BCD$$

$$= 50^\circ + 30^\circ \text{ [From (i) and (ii)]}$$

$$= 80^\circ$$

Now,

$$\angle ADC < \angle DAC < \angle ACD$$

$AC < DC < AD$  (Therefore, side opposite to greater angle is longer and smaller angle is smaller)

$$AD > CD$$

And,

$$AD > AC$$

Hence Proved.

We have,

$$\angle ACD > \angle DAC$$

And,

$$\angle ACD > \angle ADC$$

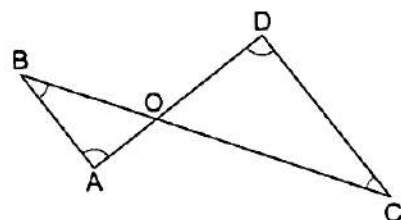
$$AD > DC$$

$AD > AC$  (Therefore, side opposite to greater angle is longer and smaller angle is smaller)

**Answer 5) GIVEN:**

$$\angle B < \angle A$$

$$\angle C < \angle D$$



**TO PROVE:**

$$AD < BC$$

**PROOF:**

$$\angle B < \angle A$$

SO,

$$OA < OB \quad \dots(1) \quad (\text{SIDE OPPOSITE TO SMALLER ANGLE IS SMALL})$$

NOW,

$$\angle C < \angle D$$

SO,

$$OD < OC \quad \dots(2) \quad (\text{SIDE OPPOSITE TO SMALLER ANGLE IS SMALL})$$

NOW,

ADDING 1 AND 2

$$OA + OD < OB + OC$$

ADDING WE GET,

$$AD < BC$$

HENCE PROVED.

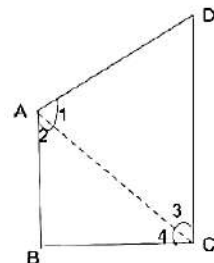
**Answer6) Given:**

In quadrilateral ABCD, AB smallest & CD is longest sides.

**To Prove:**  $\angle A > \angle C$

&  $\angle B > \angle D$

**Construction:** Join AC.



Mark the angles as shown in the figure..

**Proof:**

In  $\triangle ABC$ , AB is the shortest side.

$$BC > AB$$

$$\angle 2 > \angle 4 \dots (i)$$

[Angle opposite to longer side is greater]

In  $\triangle ADC$ , CD is the longest side

$$CD > AD$$

$$\angle 1 > \angle 3 \dots (ii)$$

[Angle opposite to longer side is greater]

Adding (i) and (ii), we have

$$\angle 2 + \angle 1 > \angle 4 + \angle 3$$

$$\Rightarrow \angle A > \angle C$$

Similarly, by joining BD, we can prove that

$$\angle B > \angle D$$

**Answer 7) To Prove:**  $(AB + BC + CD + DA) > (AC + BD)$

**Proof:**

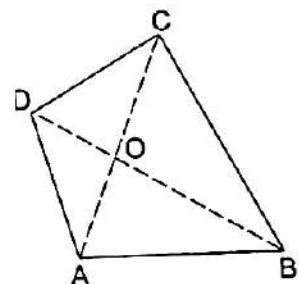
ABCD is a quad. Its diagonals are AC and BD.

$$\text{In triangle ACB, } AB + BC > AC \dots (1)$$

$$\text{In triangle BDC, } BC + CD > BD \dots (2)$$

$$\text{In triangle ACD, } AD + DC > AC \dots (3)$$

$$\text{In triangle BAD, } AB + AD > BD \dots (4)$$



Adding 1,2,3 and 4,

$$AB + BC + BC + CD + AD + DC + AB + AD > AC + BD + AC + BD$$

$$2AB + 2BC + 2CD + 2AD > 2AC + 2BD$$

$$AB + BC + CD + AD > AC + BD. \quad \text{HENCE PROVED.}$$

**Answer8)** Since, the sum of lengths of any two sides in a triangle should be greater than the length of third side

Therefore, In  $\triangle AOB$ ,  $AB < OA + OB$  .....(i)

In  $\triangle BOC$ ,  $BC < OB + OC$  .....(ii)

In  $\triangle COD$ ,  $CD < OC + OD$  .....(iii)

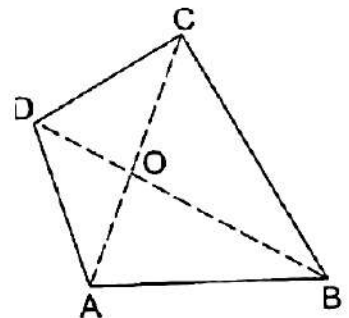
In  $\triangle AOD$ ,  $DA < OD + OA$  .....(iv)

$$\Rightarrow AB + BC + CD + DA < 2OA + 2OB + 2OC + 2OD$$

$$\Rightarrow AB + BC + CD + DA < 2[(AO + OC) + (DO + OB)]$$

$$\Rightarrow AB + BC + CD + DA < 2(AC + BD)$$

Hence Proved.



**Answer9) Given:** In  $\triangle ABC$ ,  $\angle B = 35^\circ$ ,  $\angle C = 65^\circ$  and  $\angle BAX = \angle XAC$

**To find:** Relation between AX, BX and CX in descending order.

In  $\triangle ABC$ , by the angle sum property, we have

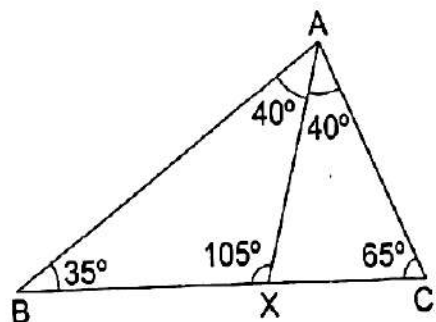
$$\angle A + \angle B + \angle C = 180^\circ$$

$$\angle A + 35^\circ + 65^\circ = 180^\circ$$

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

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

$$\text{But } \angle BAX = \angle XAC = 40^\circ$$



---

Now in  $\triangle ABX$ ,

$$\angle B = 35^\circ$$

$$\angle BAX = 40^\circ$$

$$\text{And } \angle BXA = 180^\circ - 35^\circ - 40^\circ$$

$$= 105^\circ$$

So, in  $\triangle ABX$ ,

$\angle B$  is smallest, so the side opposite is smallest, i.e.  $AX$  is smallest side.

$$\therefore AX < BX \dots(1)$$

Now consider  $\triangle AXC$ ,

$$\angle CAX = \angle A = 40^\circ$$

$$\angle AXC = 180^\circ - 40^\circ - 65^\circ$$

$$= 180^\circ - 105^\circ = 75^\circ$$

Hence, in  $\triangle AXC$  we have,

$$\angle CAX = 40^\circ, \angle C = 65^\circ, \angle AXC = 75^\circ$$

$\therefore \angle CAX$  is smallest in  $\triangle AXC$

So the side opposite to  $\angle CAX$  is shortest

i.e.  $CX$  is shortest

$$\therefore CX < AX \dots (2)$$

From 1 and 2 ,

$$BX > AX > CX$$

**Answer10) Given:**  $PQ > PR$

$QS$  and  $RS$  are bisector of  $\angle Q$  and  $\angle R$  Respectively

**To Prove:**  $SQ > SR$

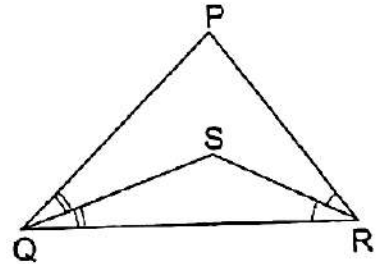
**Proof:**

$\angle R > \angle Q$  (angle opposite to greater side is greater)

$\frac{1}{2} \angle R > \frac{1}{2} \angle Q$

$\angle SRQ > \angle SQR$

$SQ > SR$  (Side opposite to greater angle is greater)



**Answer11) Given:**  $AB = AC$

**To prove:**  $BD > CD$

**Proof:**

Since  $AB = AC$

$\angle ABC =$

$\angle ACB$

(Isosceles Triangle property) ----(i)

Here clearly,

$\angle ABC > \angle CBD$

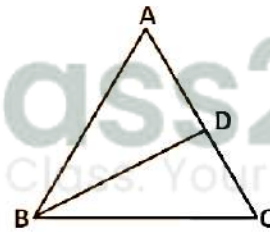
$\angle ACB > \angle CBD$  ---from (i)

$\angle DCB > \angle CBD$

$BD > CD$

(Angle opposite to greater side is greater in a triangle)

Hence Proved.



(By

**Answer12)** Let  $\triangle ABC$  be a triangle in which  $AC$  is the longest side.

**To prove:** Angle opposite the longest side is greater than  $2/3$  of right angle.

**Proof:**  $\angle B > \angle A$  ....(i)

And  $\angle B > \angle C$  ....(ii)

Adding (i) and (ii), we get

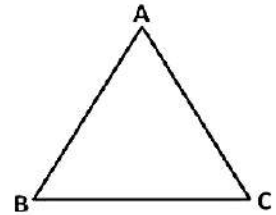
$$\rightarrow \angle B + \angle B > \angle A + \angle C$$

$$\rightarrow 2 \angle B > \angle A + \angle C$$

$$\rightarrow 2 \angle B + \angle B > \angle A + \angle B + \angle C$$

$$\rightarrow 3 \angle B > 180^\circ = \angle B > 60^\circ$$

$$\rightarrow \angle B > 2/3 \times \text{right angle.} \quad [60^\circ = 2/3 \times 90^\circ]$$



**Answer13)**

(i) **To Prove:**  $CD + DA + AB > BC$

**Proof:**

$\triangle ABC$ , we have

$$CD + DA > AC$$

Add  $AB$  on both sides, we get

$$CD + DA + AB > AC + AB > BC$$

$$CD + DA + AB > BC$$

Hence proved.

(ii) **To Prove:**  $CD + DA + AB + BC > 2AC$

**Proof:**

In  $\triangle ABC$ , we have



---

$$AB + BC > AC \quad \dots(1)$$

In  $\triangle ADC$ , we have

$$CD + DA > AC \quad \dots(2)$$

Adding (1) and (2), we get

$$AB + BC + CD + DA > AC + AC$$

$$CD + DA + AB + BC > 2 AC$$

Hence Proved.

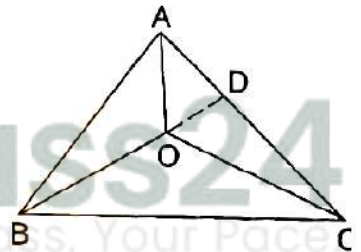
Answer14)

**Given:**

In triangle ABC, O is any interior point.

We know that any segment from a point O inside a triangle to any vertex of the triangle cannot be longer than the two sides adjacent to the vertex.

Thus, OA cannot be longer than both AB and CA (if this is possible, then O is outside the triangle).



**To Prove:**

- (i)  $AB + AC > OB + OC$
- (ii)  $AB + BC + CA > OA + OB + OC$
- (iii)  $OA + OB + OC > \frac{1}{2} (AB + BC + CA)$

**Proof:**

(i) OA cannot be longer than both AB and CA

$$AB > OB \quad \dots(1)$$

$$AC > OC \quad \dots(2)$$

Thus,

$$AB + AC > OB + OC \quad \dots[\text{Adding (1) and (2)}]$$

$$AB > OB \quad \dots(1)$$

---

$$AC > OC \quad \dots(2)$$

Thus,

$$AB + AC > OB + OC \quad \dots[\text{Adding (1) and (2)}]$$

$$(ii) AB > OA \dots(3)$$

$$BC > OB \dots(4)$$

$$CA > OC \dots(5)$$

Adding the above three equations, we get:

$$\text{Thus, } AB + BC + CA > OA + OB + OC \quad \dots(6)$$

OA cannot be longer than both AB and CA.

$$AB > OB \dots(5)$$

$$AC > OC \dots(6)$$

$$AB + AC > OB + OC \dots[\text{On adding (5) and (6)}]$$

Thus, the first equation to be proved is shown correct.

(iii) Now, consider the triangles OAC, OBA and OBC.

We have:

$$OA + OC > AC$$

$$OA + OB > AB$$

$$OB + OC > BC$$

Adding the above three equations, we get:

$$OA + OC + OA + OB + OB + OC > AB + AC + BC$$

$$\Rightarrow 2(OA + OB + OC) > AB + AC + BC$$

Thus,  $OA + OB + OC > \frac{1}{2}(AB + BC + CA)$ .

**Answer15) Given :** (i)  $AD \perp BC$

(ii)  $CD > BD$

**To Prove:**  $AC > AB$

**Proof:**

In  $\triangle ABD$  ;  $\angle ABD + \angle BAD + \angle BDA = 180^\circ$

$\angle ABD + \angle BAD + 90^\circ = 180^\circ$

$\angle ABD + \angle BAD = 90^\circ$

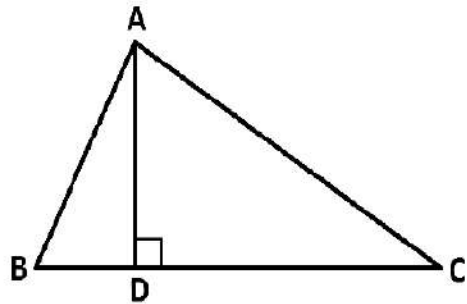
Similarly; In  $\triangle ADC$  ;  $\angle ACB + \angle CAD = 90^\circ$

Since;  $BD < CD$  ;  $\angle BAD < \angle CAD$

$\angle ABD > \angle ACB$

$AC > AB$

( sides opposite to greater angles are greater)



**Answer16) Given:**  $CD = DE$

**To prove:**  $AB + AC > BE$

**Proof:**

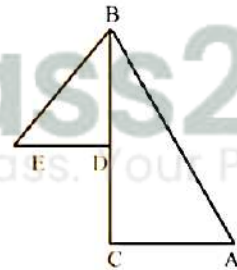
In  $\triangle ABC$ ,

$AB + AC > BC$  ... (1)

$AB + AC > BC$  ... 1

In  $\triangle BED$ ,

$BD + CD > BE \Rightarrow BC > BE$  ... (2)



---

$$BD + CD > BE \Rightarrow BC > BE \quad \dots 2$$

From (1) and (2), we get

$$AB + AC > BE.$$

Hence Proved.



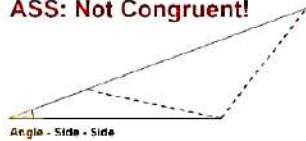
## MULTIPLE CHOICE QUESTIONS

Answer1) (a)

SSA is not a criteria for congruency of triangles. SSA would mean for example, that in triangles ABC and DEF, angle A = angle D, AB = DE, and BC = EF.

With these assumptions it is *not* true that triangle ABC is congruent to triangle DEF. In general there are two sets of congruent triangles with the same SSA data.

**ASS: Not Congruent!**



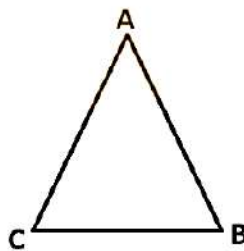
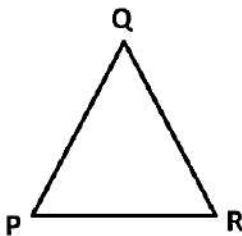
Answer2) (c)

Given: (i)  $AB = QR$

(ii)  $BC = RP$

(iii)  $CA = PQ$

From the above given information following figures can be drawn.



---

Hence,  $\Delta PQR \cong \Delta CAB$ .

Answer3 (a)

Given:  $\Delta ABC \cong \Delta PQR$

From the above given information following figures can be drawn.



If  $\Delta ABC \cong \Delta PQR$ , then  $BC=QR$ .

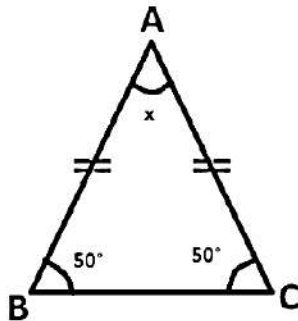
$BC = RQ$  is not correct.

Answer4 (c)

Given: (i)  $AB = AC$

(ii)  $\angle B=50^\circ$

From the above given information following figure can be drawn.



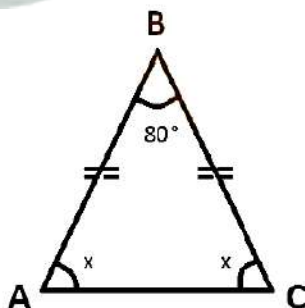
Since;  $\Delta ABC$  is an isosceles triangle  
Hence;  $\angle B = \angle C = 50^\circ$

$$\begin{aligned}\angle A + \angle B + \angle C &= 180^\circ \\ \angle x + 50^\circ + 50^\circ &= 180^\circ \\ \angle x + 100^\circ &= 180^\circ \\ \angle x &= 180^\circ - 100^\circ \\ \angle x &= \angle A = 80^\circ\end{aligned}$$

Answer5) (a)

**Given:** (i)  $BC = AB$   
(ii)  $\angle B = 80^\circ$

From the above given information following figure can be drawn.



Since;  $\Delta ABC$  is an isosceles triangle  
 $\angle A = \angle C = \angle x$

Hence;  $\angle A + \angle B + \angle C = 180^\circ$

$$\begin{aligned}\angle x + \angle x + 80^\circ &= 180^\circ \\ 2\angle x &= 180^\circ - 80^\circ \\ \angle x &= \frac{100^\circ}{2} \\ \angle x &= 50^\circ \\ \angle x = \angle A &= 50^\circ\end{aligned}$$

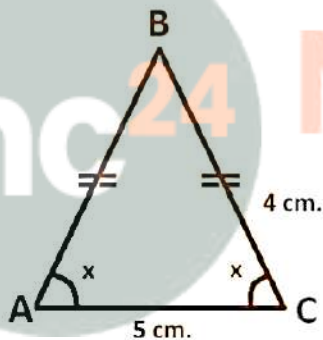
Answer6) (a)

Given: (i)  $\angle A = \angle C$

(ii)  $BC = 4 \text{ cm}$

(iii)  $AC = 5 \text{ cm}$

From the above given information following figure can be drawn.



Since;  $\angle A = \angle C$  are equal.

Hence;  $\Delta ABC$  is an isosceles triangle.

So;  $AB = BC = 4 \text{ cm}$ .

Answer7) (b)

Given: (i) side 1 = 4 cm.

(ii) side 2 = 2.5 cm.

Since; the sum of two sides in a triangle must be greater than the third side.

---

So; the third side should be less than the sum of the other two sides.

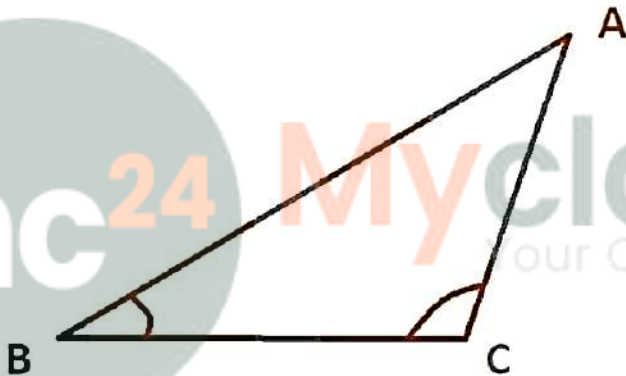
the third side should be  $< 4 \text{ cm} + 2.5 \text{ cm}$  , i.e.  $6.5 \text{ cm}$ .

Hence; the third side cannot be  $6.5 \text{ cm}$ .

**Answer 8) (b)**

Given:  $\angle C > \angle B$

From the above given information following figure can be drawn.



From the above figure it can be determined that

$AB > AC$

**Answer9) (b)**

Given: (i)  $\triangle ABC \cong \triangle FDE$

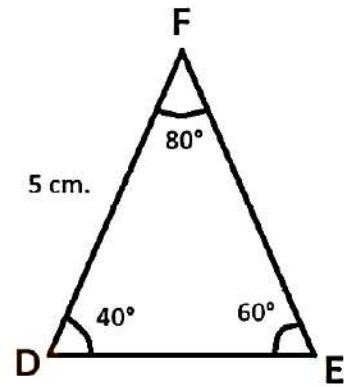
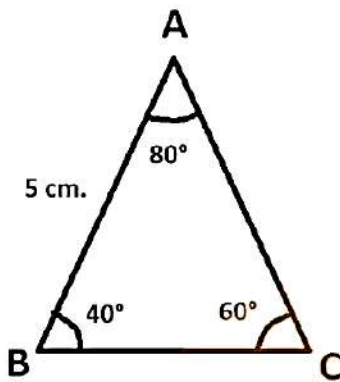
(ii)  $AB = 5 \text{ cm}$ .

(iii)  $\angle A = 80^\circ$

(iv)  $\angle B = 40^\circ$

---

From the above given information following figures can be drawn .



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

$$80^\circ + 40^\circ + \angle C = 180^\circ$$

$$\angle C = 180^\circ - 120^\circ$$

$$\angle C = 60^\circ$$

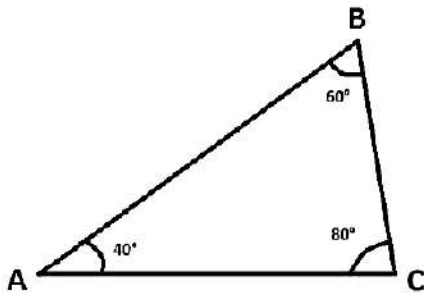
Corresponding angle the  $\Delta FDE$  is  $\angle E = 60^\circ$ .

**Answer10) (c)**

**Given:** (i)  $\angle A = 40^\circ$

(ii)  $\angle B = 60^\circ$

From the above given information following figure can be drawn.



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

$$40^\circ + 60^\circ + \angle C = 180^\circ$$

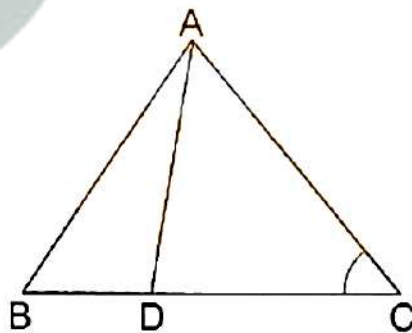
$$\angle C = 180^\circ - 100^\circ$$

$$\angle C = 80^\circ$$

Since; side opposite of greater angle is greater. So, the side AB is greatest.

Answer11 (c)

Given:  $AB > AC$



We know that the angle opposite to the larger side is larger.

So,  $AB > AC = \angle ACB > \angle ABC$

$$= \angle ACD > \angle ABD . \quad \dots(i)$$

Again side CD of  $\Delta ACD$  has been produced to B.

---

So, ext.  $\angle ADB > \angle ACD$ .

From (i) and (ii), we get

$$\angle ADB > \angle ACD > \angle ABD$$

$$\angle ADB > \angle ABD$$

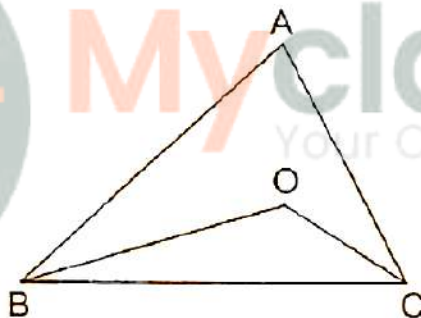
$AB > AD$  (side opposite of greater angle is greater).

Hence,  $AB > AD$ .

**Answer12) (b)**

**Given:** (i)  $AB > AC$ .

(ii)  $BO$  and  $CO$  are the bisectors of  $\angle B$  and  $\angle C$ .



$$\angle ACB > \angle ABC$$

Angles opposite to greater sides are greater.

$$\frac{\angle ACB}{2} > \frac{\angle ABC}{2}$$

$$\angle OCB > \angle OBC$$

Hence,  $OB > OC$ .

**Answer13) (a)**

**Given:** (i)  $AB = AC$

(ii)  $OB = OC$ .

It is given in the question that,

In  $\triangle OAB$  and  $\triangle OAC$ , we have

$AB = AC$

$OB = OC$

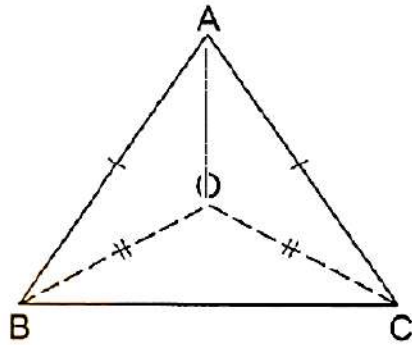
$OA = OA$  (Common)

$\therefore$  By SSS congruence criterion

$\triangle OAB \cong \triangle OAC$

$\therefore \angle ABO = \angle ACO$

So,  $\angle ABO : \angle ACO = 1 : 1$



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Answer14) (b)

Given: (i)  $BL \perp AC$

(ii)  $CM \perp AB$

(iii)  $BL = CM$ .

In  $\triangle ABL$  and  $\triangle ACM$ , we have

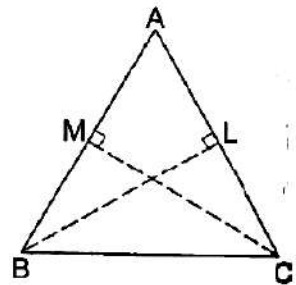
$BL = CM$  (given)

$\angle BAL = \angle CAM$  (common)

$\angle ALB = \angle AMC$  (each  $90^\circ$ )

$\triangle ABL \cong \triangle ACM$  and hence  $AB = AC$ .

$\triangle ABC$  is isosceles.

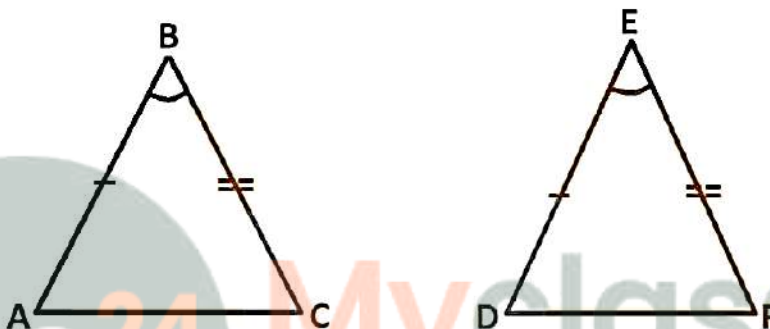


Answer15) (b)

Given: (i)  $AB = DE$

(ii)  $BC = EF$

From the above given information following figures can be drawn.



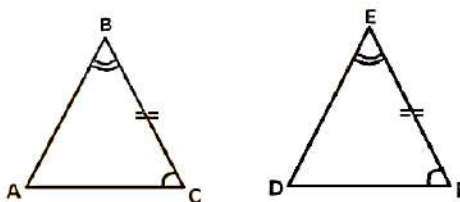
For  $\triangle ABC \cong \triangle DEF$ ,  $\angle B$  should be equal to  $\angle E$ .

Hence if  $\angle B = \angle E$ , then  $\triangle ABC \cong \triangle DEF$  by S.A.S. criterion.

Answer16) (c)

Given: (i)  $\angle B = \angle E$

(ii)  $\angle C = \angle F$



From the above given information following figures can be drawn.

For  $\triangle ABC \cong \triangle DEF$ ,  $BC$  should be equal to  $EF$ .

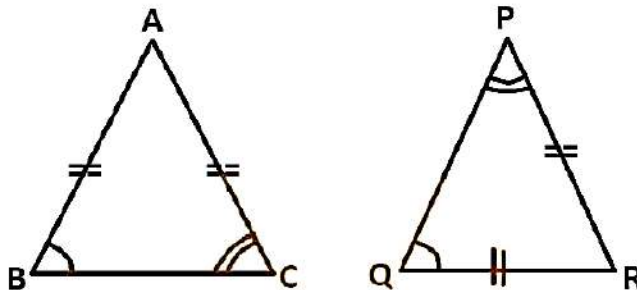
Hence if  $BC = EF$ , then  $\triangle ABC \cong \triangle DEF$  by A.S.A. criterion.

Answer17) (a)

Given: (i)  $AB = AC$

(ii)  $\angle C = \angle P$

(iii)  $\angle B = \angle Q$



$AB = AC$

$\angle C = \angle B$

$\angle P = \angle Q$  (since  $\angle C = \angle P$  and  $\angle B = \angle Q$ )

$QR = PQ$

Thus both the triangles are isosceles but not congruent.

Answer18) (c)

Two right angles would add up to  $180^\circ$  so the third angle becomes zero. This is not possible. Therefore, the triangle cannot have two right angles. A triangle can't have two obtuse angles as obtuse angle means more than  $90^\circ$ . So, the sum of the two sides exceeds more than  $180^\circ$  which is not possible. As the sum of all three angles of a triangle is  $180^\circ$ . A triangle can have two acute angles as acute angle means less than  $90^\circ$ . And *External angle of triangle is greater than either opposite angles.*

Answer19) a) (Sum of any sides of a triangle) **greater than ( $>$ )** (third side).

b) (Difference of any two sides of a triangle) **less than ( $<$ )** (third side).

c) (Sum of three altitudes of a triangle) **less than ( $<$ )** (sum of three sides).

d) (Sum of any two sides of a triangle) **greater than ( $>$ )** (twice the median to the third side).

e) (Perimeter of a triangle) **greater than ( $>$ )** (sum of its three median).

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Answer 20) a) Each angle of an equilateral triangle measures  $60^\circ$ .

b) MediAnswer of an equilateral triangle are equal.

c) In a right angle triangle, the hypotenuse is the longest side.

d) Drawing a  $\Delta ABC$  with  $AB = 3$  cm.,  $BC = 4$  cm. and  $CA = 7$  cm. is not possible.



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