



MATHS

BOOKS - ICSE

TRIANGLES

Exercise 9 A

1. Which of the following pairs of triangles are congruent ? In each case, state the condition of congruency :

(a) In $\triangle ABC$ and $\triangle DEF$, $AB = DE$, $BC = EF$ and $\angle B = \angle E$.

(b) In $\triangle ABC$ and $\triangle DEF$, $\angle B = \angle E = 90^\circ$, $AC = DF$ and $BC = EF$.

(c) In $\triangle ABC$ and $\triangle QRP$, $AB = QR$, $\angle B = \angle R$ and $\angle C = \angle P$.

(d) In $\triangle ABC$ and $\triangle PQR$, $AB = PQ$, $AC = PR$ and $BC = QR$.

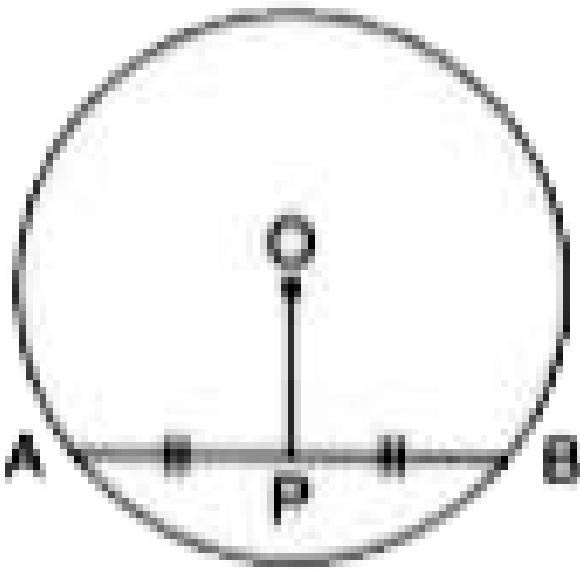
(e) In $\triangle ABC$ and $\triangle PQR$, $BC = QR$,

$\angle A = 90^\circ$, $\angle C = \angle R = 40^\circ$ and $\angle Q = 50^\circ$.



2. The given figure shows a circle with centre O . P is mid-point of chord AB .

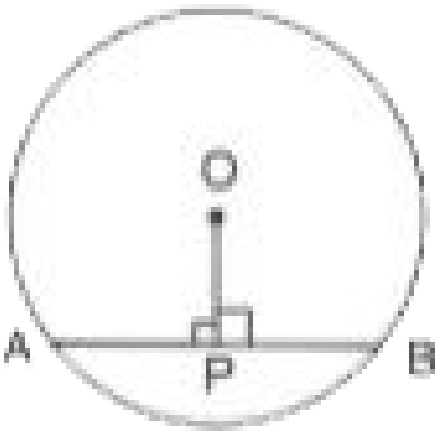
Show that OP is perpendicular to AB .



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3. The following figure shows a circle with centre O .

If OP is perpendicular to AB , prove that $AP = BP$.



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4. In a triangle ABC , D is mid-point of BC , AD is produced upto E so that $DE = AD$. Prove that :

- (i) $\triangle ABD$ and $\triangle ECD$ are congruent.
- (ii) $AB = EC$
- (iii) AB is parallel to EC .

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5. A triangle ABC has $\angle B = \angle C$. Prove that :

(i) the perpendiculars from the mid-point of BC to AB and AC are equal.

(ii) the perpendicular from B and C to the opposite sides are equal.



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6. The perpendicular bisectors of the sides of a triangle ABC meet at I.

Prove that : $IA = IB = IC$.



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7. A line segment AB is bisected at point P and through point P another line segment PQ, which is perpendicular to AB, is drawn. Show that : $QA = QB$.



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8. If AP bisects angle BAC and M is any point on AP, prove that the perpendiculars drawn from M to AB and AC are equal.

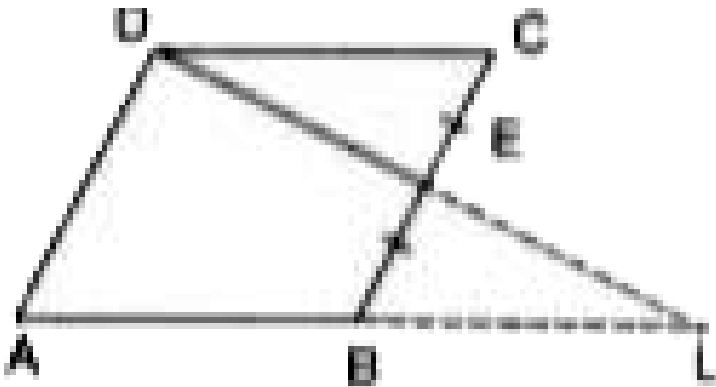
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9. From the given diagram, in which ABCD is a parallelogram, ABL is a line segment and E is mid point of BC. Prove that :

(i) $\triangle DCE \cong \triangle LBE$

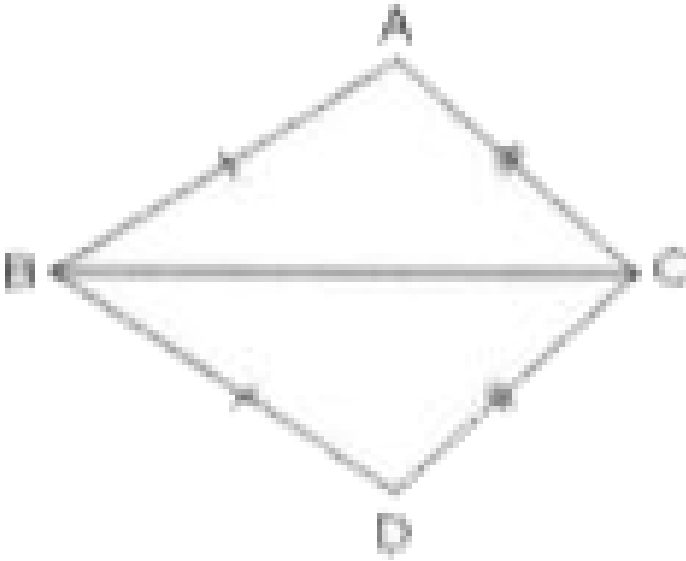
(ii) $AB = BL$

(iii) $AL = 2DC$



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10. In the given figure, $AB = DB$ and $AC = DC$. If $\angle ABD = 58^\circ$, $\angle DBC = (2x - 4)^\circ$, $\angle ACB = y + 15^\circ$ and $\angle DCB = 63^\circ$, find the values of x and y .

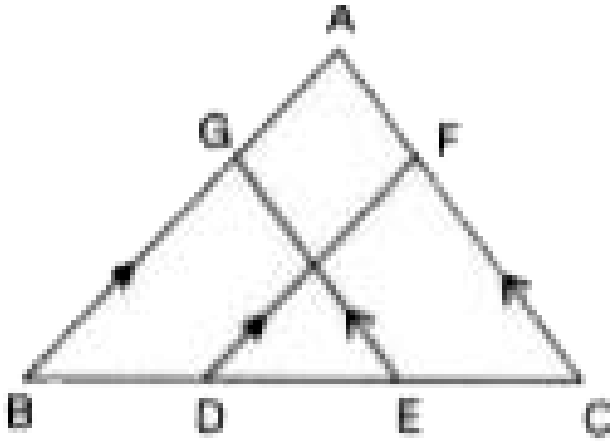


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11. In the given figure : $AB \parallel FD$, $AC \parallel GE$ and $BD = CE$, prove that :

(i) $BG = DF$

(ii) $CF = EG$

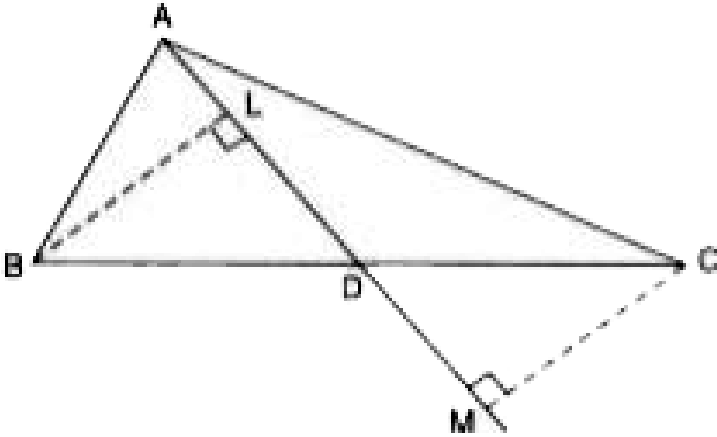


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12. In a triangle ABC , $AB = AC$. Show that the altitude AD is median also.

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13. In the following figure, $BL = CM$.



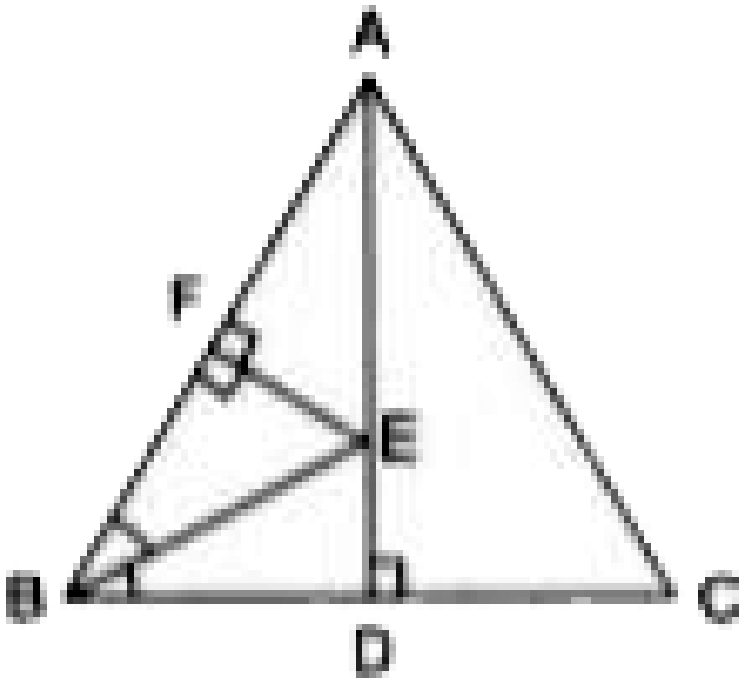
Prove that AD is a median of triangle ABC.

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14. In the following figure, $AB = AC$ and AD is perpendicular to BC. BE bisects angle B and EF is perpendicular to AB. Prove that :

(i) $BD = CD$

(ii) $ED = EF$

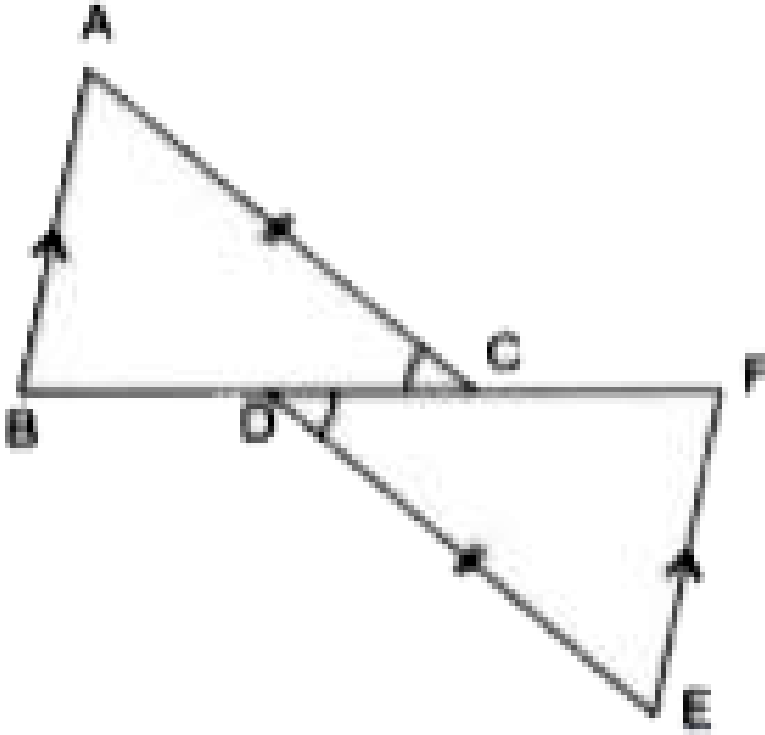


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15. Use the information in the given figure to prove :

(i) $AB = FE$

(ii) $BD = CF$



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Exercise 9 B

1. On the sides AB and AC of triangle ABC , equilateral triangles ABD and ACE are drawn. Prove that :

(i) $\angle CAD = \angle BAE$

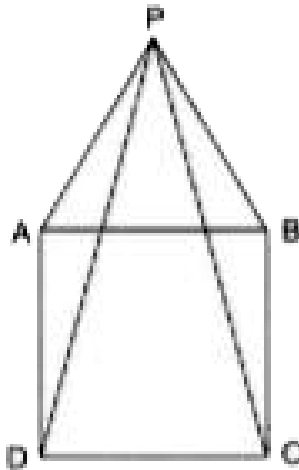
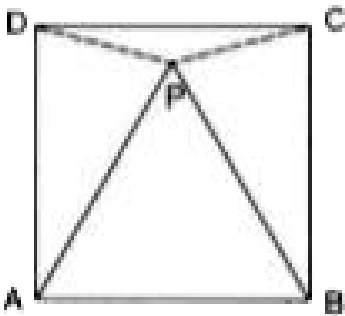
(ii) $CD = BE$

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2. In the following diagrams, ABCD is a square and APB is an equilateral triangle. In each case,

(i) Prove that : $\triangle APD \cong \triangle BPC$

(ii) Find the angles of $\triangle DPC$

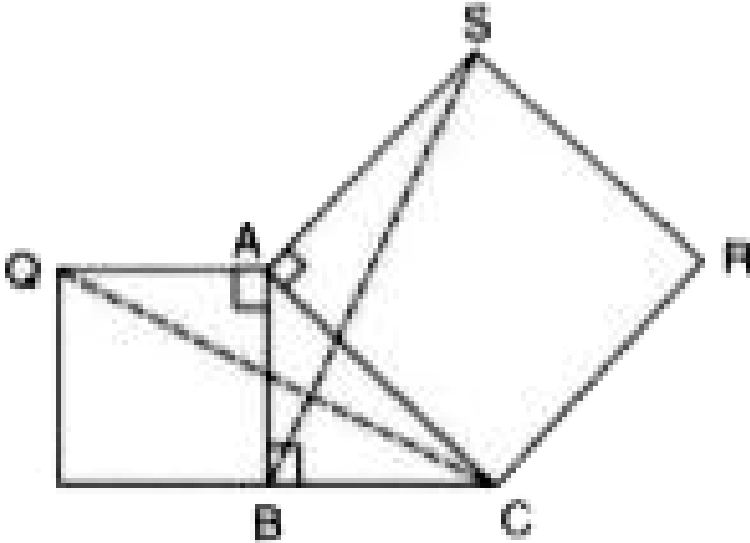


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3. In the figure, given below, triangle ABC is right-angled at B . $ABPQ$ and $ACRS$ are squares. Prove that :

(i) $\triangle ACQ$ and $\triangle ASB$ are congruent.

(ii) $CQ = BS$



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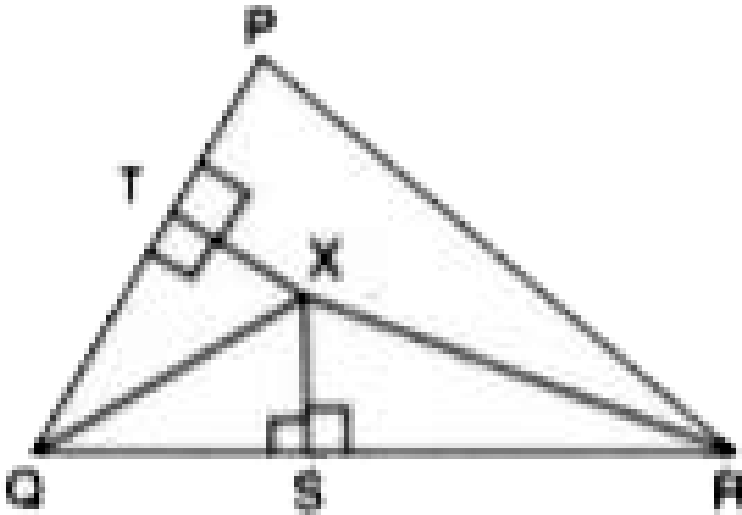
4. In a $\triangle ABC$, BD is the median to the side AC , BD is produced to E such that $BD = DE$. Prove that : AE is parallel to BC .

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5. In the adjoining figure, QX and RX are the bisectors of the angles Q and R respectively of the triangle PQR .

If $XS \perp QR$ and $XT \perp PQ$, prove that :

$$\Delta XTQ \cong \Delta XSQ$$



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6. In the parallelogram ABCD, the angles A and C are obtuse. Points X and Y are taken on the diagonal BD such that the angles XAD and YCB are right angles. Prove that : $XA = YC$



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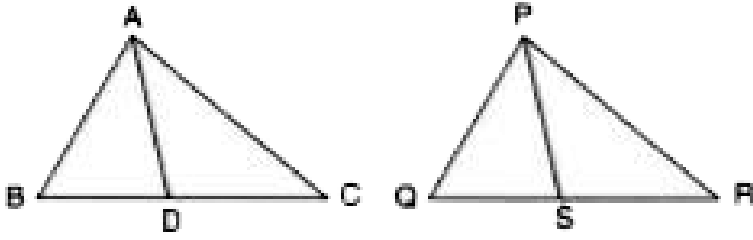
7. ABCD is a parallelogram. The sides AB and AD are produced to E and F respectively, such that $AB = BE$ and $AD = DF$. Prove that : $\triangle BEC \cong \triangle DCF$.



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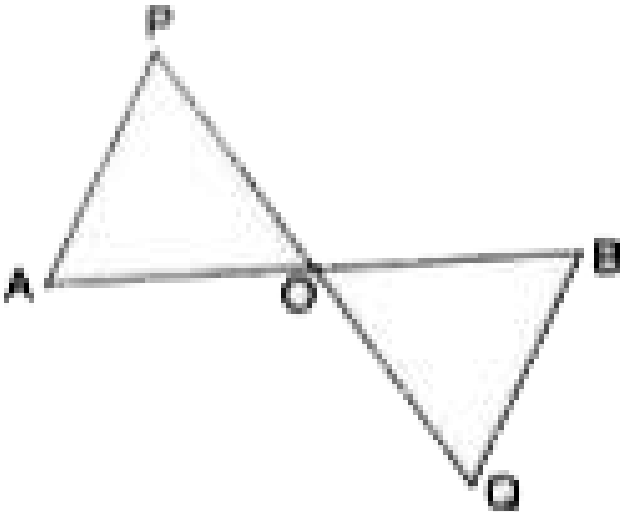
8. In the following figures, the sides AB and BC and the median AD of triangle ABC are respectively equal to the sides PQ and QR and median PS

of the triangle PQR . Prove that $\triangle ABC$ and $\triangle PQR$ are congruent.



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9. In the following diagram, AP and BQ are equal and parallel to each other.



Prove that :

(i) $\triangle AOP \cong \triangle BOQ$

(ii) AB and PQ bisect each other.

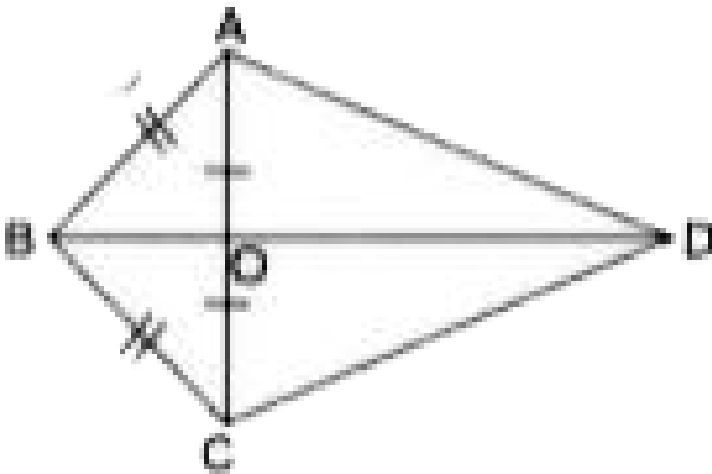
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10. In the following figure, $OA = OC$ and $AB = BC$. Prove that :

(i) $\angle AOB = 90^\circ$

(ii) $\triangle AOD \cong \triangle COD$

(iii) $AD = CD$



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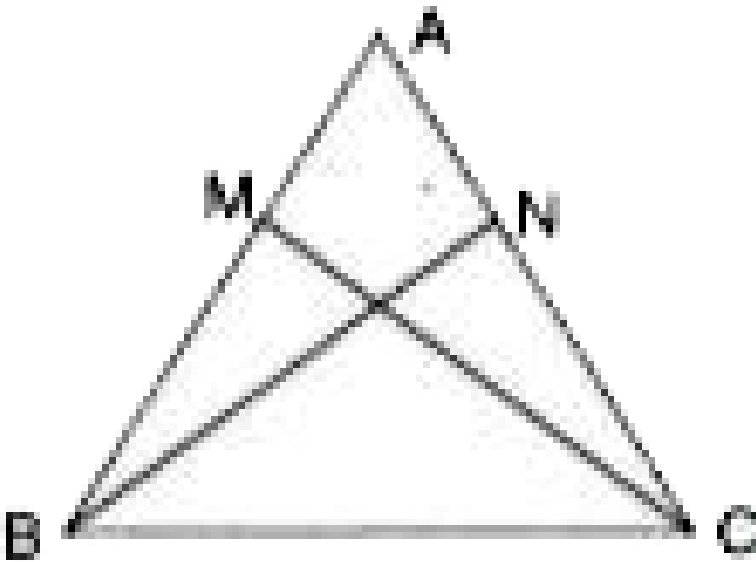
11. The following figure shows a triangle ABC in which $AB = AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that :

(i) $AM = AN$

(ii) $\triangle AMC \cong \triangle ANB$

(iii) $BN = CM$

(iv) $\triangle BMC \cong \triangle CNB$



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12. In a triangle ABC , $AB = BC$, AD is perpendicular to side BC and CE is perpendicular to side AB . Prove that : $AD = CE$.



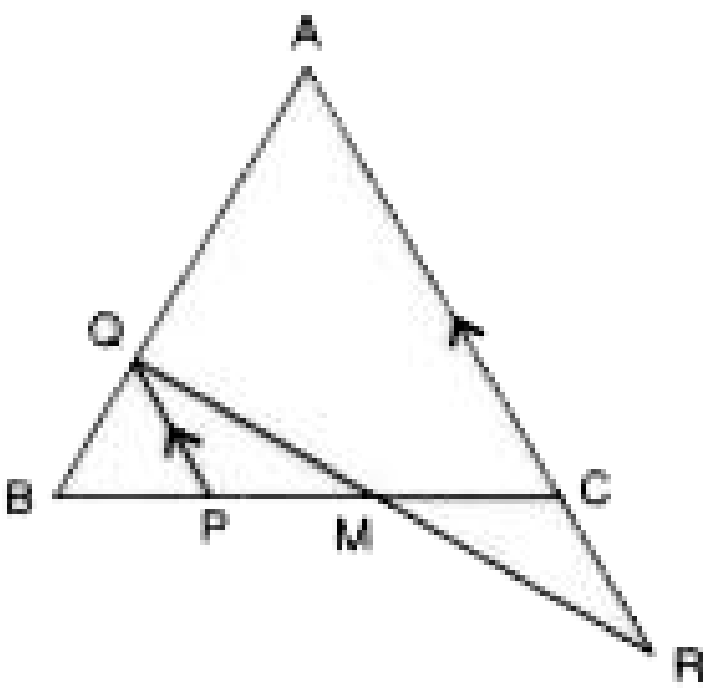
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13. $PQRS$ is a parallelogram. L and M are points on PQ and SR respectively such that $PL = MR$. Show that LM and QS bisect each other.



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14. In the following figure, ABC is an equilateral triangle in which QP is parallel to AC . Side AC is produced upto point R so that $CR = BP$.

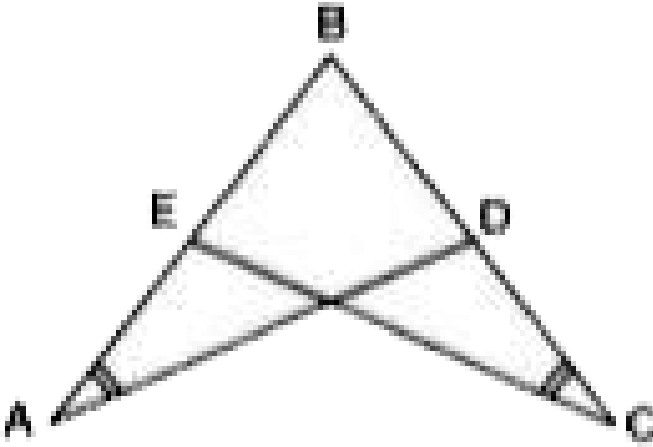


Prove that QR bisects PC .



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15. In the following figure, $\angle A = \angle C$ and $AB = BC$.



Prove that : $\triangle ABD \cong \triangle CBE$

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16. AD and BC are equal perpendiculars to a line segment AB. If AD and BC are on different sides of AB prove that CD bisects AB.

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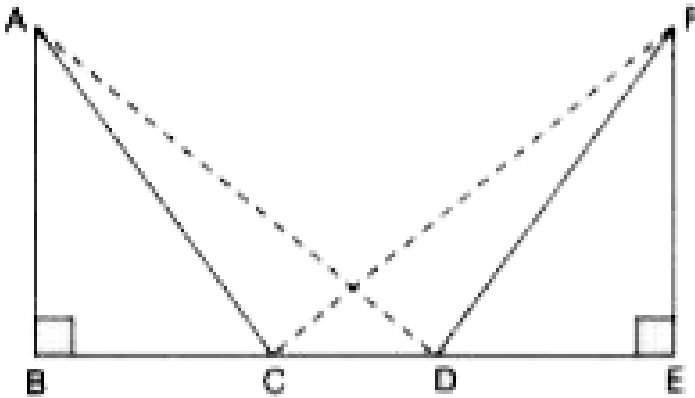
17. In $\triangle ABC$, $AB = AC$ and the bisectors of angles B and C intersect at point O. Prove that :

(i) $BO = CO$

(ii) AO bisects angle BAC.

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18. In the following figure, $AB = EF$, $BC = DE$ and $\angle B = \angle E = 90^\circ$.



Pove that $AD = FC$.

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19. A point O is taken inside a rhombus ABCD such that its distances from the vertices B and D are equal. Show that AOC is a straight line.

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20. In quadrilateral ABCD, $AD = BC$ and $BD = CA$. Prove that :

(i) $\angle ADB = \angle BCA$

(ii) $\angle DAB = \angle CBA$

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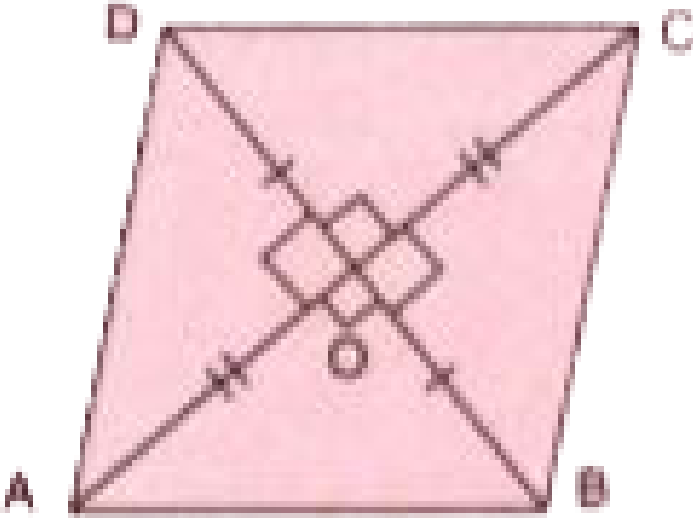
Questions

1. P is any point in the angle ABC such that the perpendicular drawn from P on AB and BC are equal. Prove that BP bisects angle ABC.

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2. If the diagonals of a quadrilateral bisect each other at right angle, prove that the quadrilateral is a rhombus.

A rhombus has all its four sides equal.

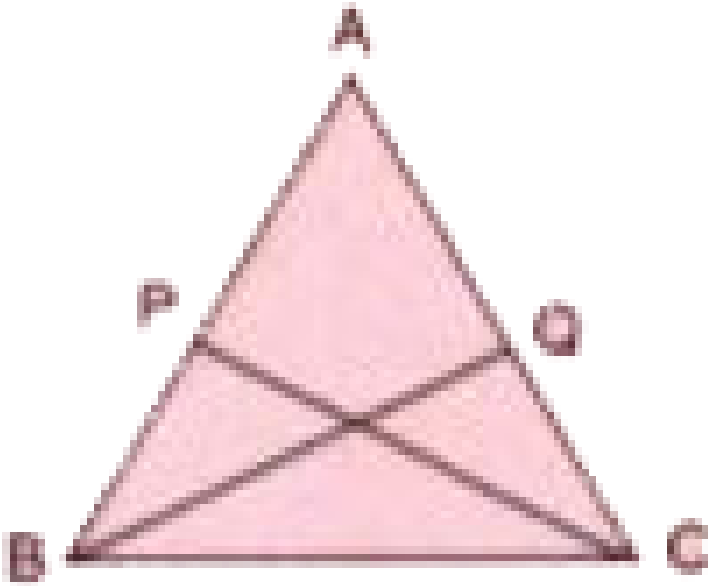


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3. In triangle ABC, the sides AB and AC are equal. If P is a point on AB and Q is a point on AC such that $AP = AQ$, prove that :

(i) triangle APC and AQB are congruent.

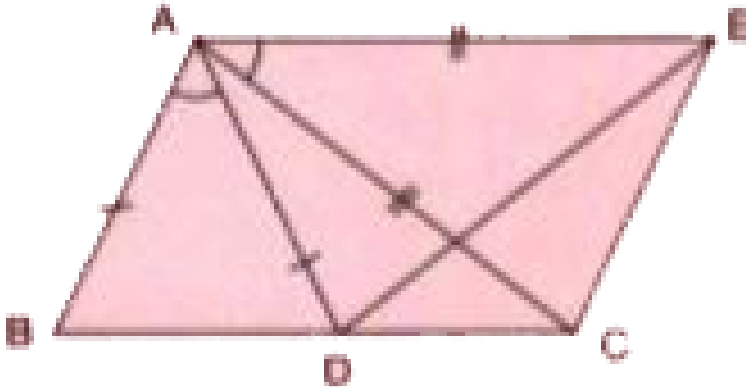
(ii) triangle BPC and CQB are congruent.



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4. In the given figure, $AC = AE$, $AB = AD$ and $\angle BAD = \angle EAC$. Show that :

$BC = DE$.

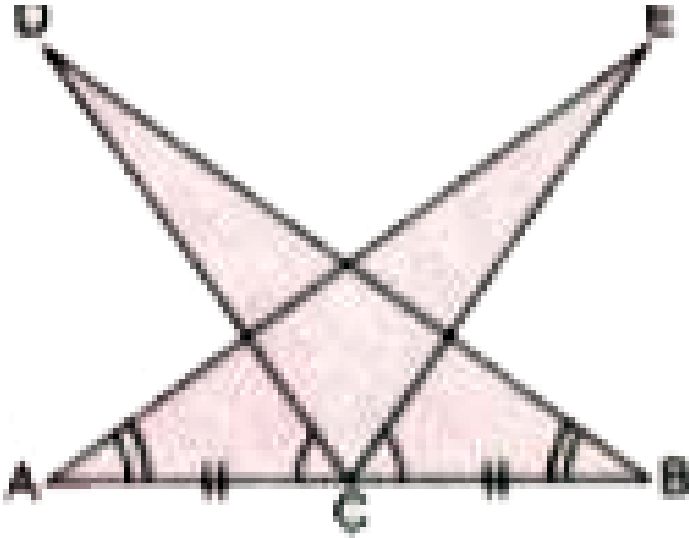


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5. Use the information given in the adjoining figure, to prove :

(i) $\triangle DBC \cong \triangle EAC$.

(ii) $DC = EC$.

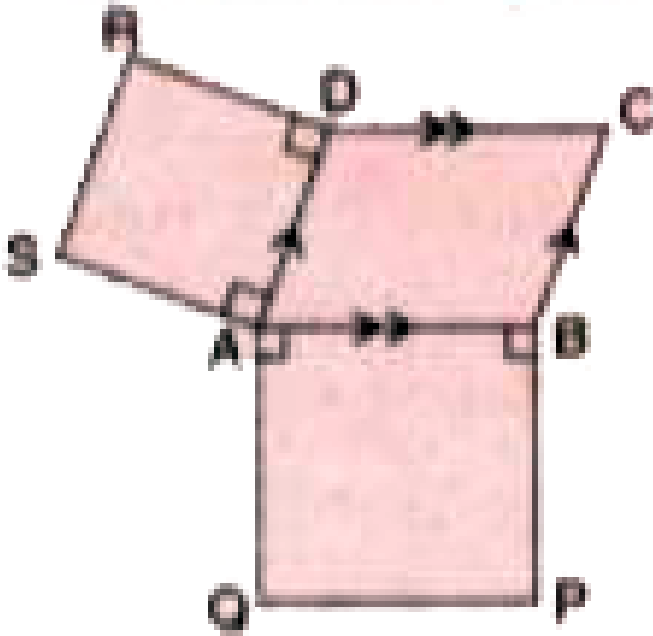


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6. The given figure shows a parallelogram ABCD. Squares ABPQ and ADRS are drawn on sides AB and AD of the parallelogram ABCD. Prove that :

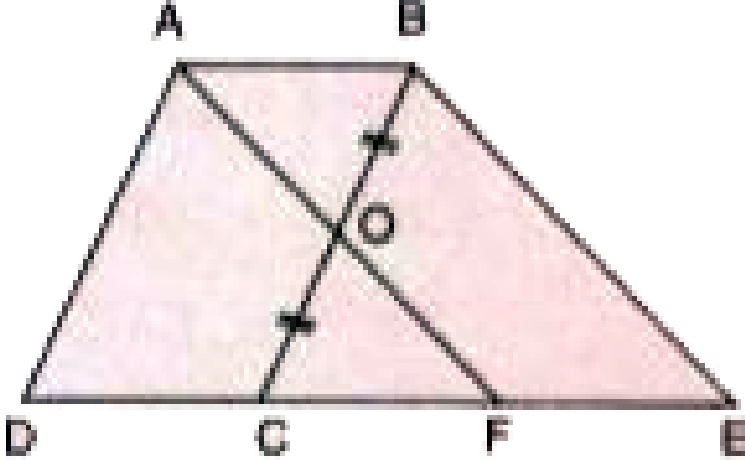
(i) $\angle SAQ = \angle ABC$

(ii) $SQ = AC$



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7. In the given figure, $ABCD$ and $ABEF$ are parallelograms. If O is the mid-point of BC , show that : $DC = CF = FE$.

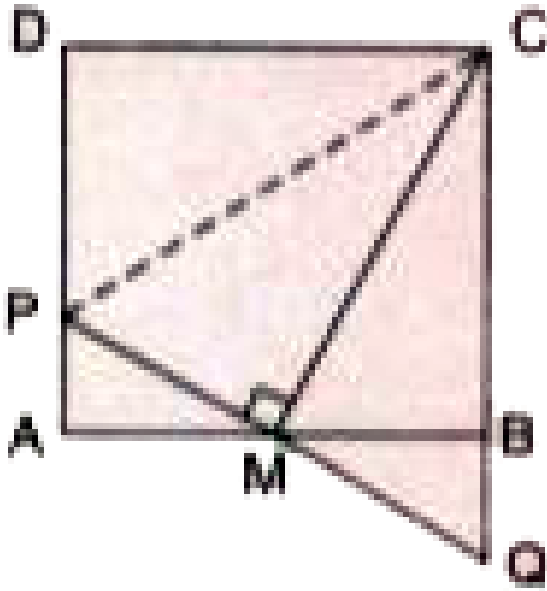


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8. In the given figure, ABCD is a square. M is the mid-point of AB and PQ is perpendicular to CM. CB produced meets PQ at point Q. Prove that :

(i) $PA = BQ$

(ii) $CP = AB + PA$



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3 Marks Questions

1. The perpendicular bisectors of the sides of a triangle ABC meet at I .

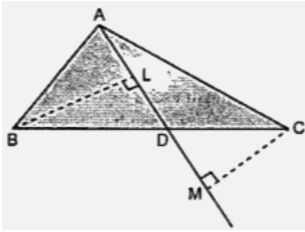
Prove that : $IA = IB = IC$.

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2. If AP bisects angle BAC and M is any point on AP, prove that the perpendiculars drawn from M to AB and AC are equal.

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3. In the following figure, $BL = CM$



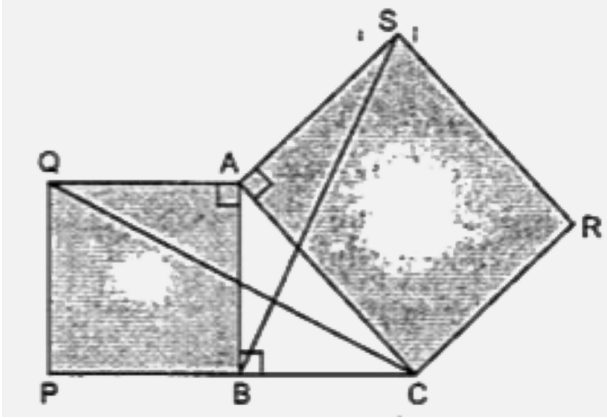
Prove that AD is a Median of triangle ABC

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4. In the figure, given below, triangle ABC is right-angled at B. ABPQ and ACRS are squares.

Prove that :

$\triangle ACQ$ and $\triangle ASB$ are congruent

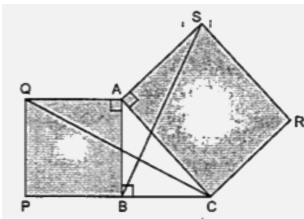


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5. In the figure, given below, triangle ABC is right-angled at B. ABPQ and ACRS are squares.

Prove that :

$$CQ = BS$$



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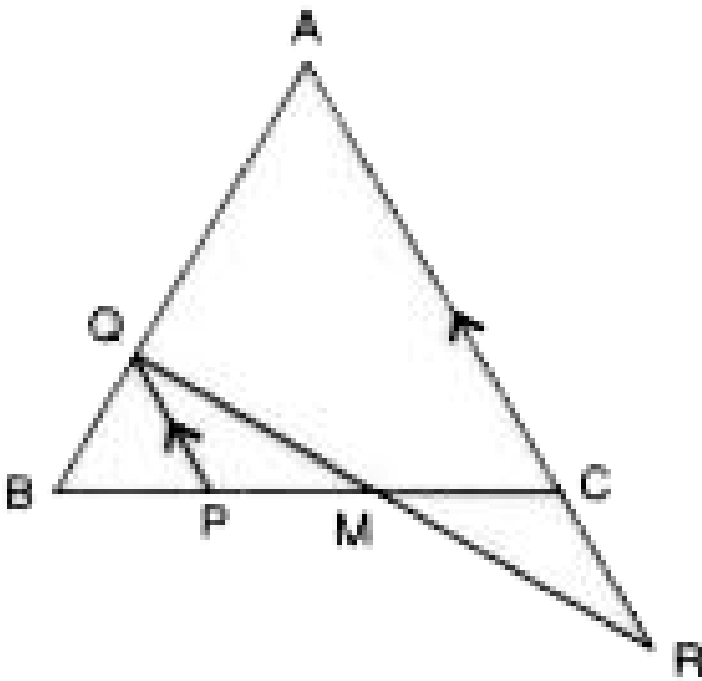
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Prove that QR bisects PC.

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9. In $\triangle ABC$, $AB = AC$ and the bisectors of angles B and C intersect at point O. Prove that

$$BO = OC$$

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10. In $\triangle ABC$, $AB = AC$ and the bisectors of angles B and C intersect at point O. Prove that :

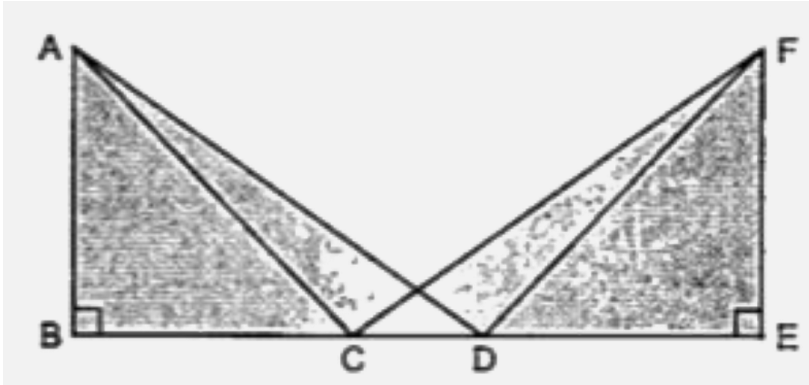
(i) $BO = CO$

(ii) AO bisects angle BAC.



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11. In the following, $AB=EF$, $BC=DE$ and $\angle E = 90^\circ$



Prove that $AD=FC$



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1. In a triangle ABC, D is mid-point of BC, AD is produced upto E so that DE = AD. Prove that :

(i) $\triangle ABD$ and $\triangle ECD$ are congruent.

(ii) $AB = EC$

(iii) AB is parallel to EC.



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2. In a triangle ABC, D is the mid - point of BC, AD is produced upto E so that DE = AD.

Prove that :

$$AB = EC$$



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3. In a triangle ABC, D is mid-point of BC, AD is produced upto E so that DE = AD. Prove that :

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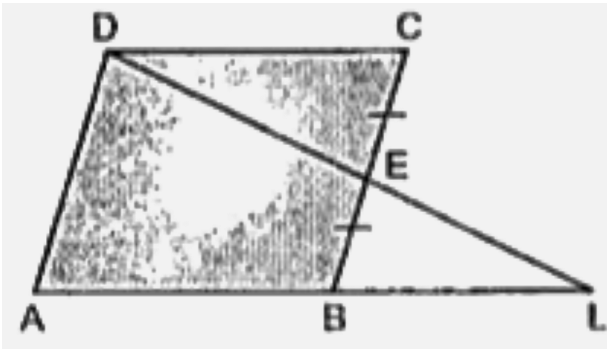
(iii) AB is parallel to EC .

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4. From the given diagram, in which $ABCD$ is a Parallelogram, ABL is a line segment and E is a mid - point of BC .

Prove that :

$$\triangle DCE \cong \triangle LBE$$

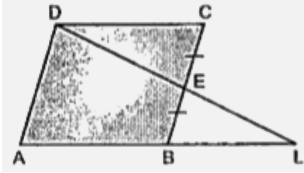


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Prove that :

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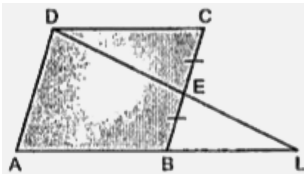


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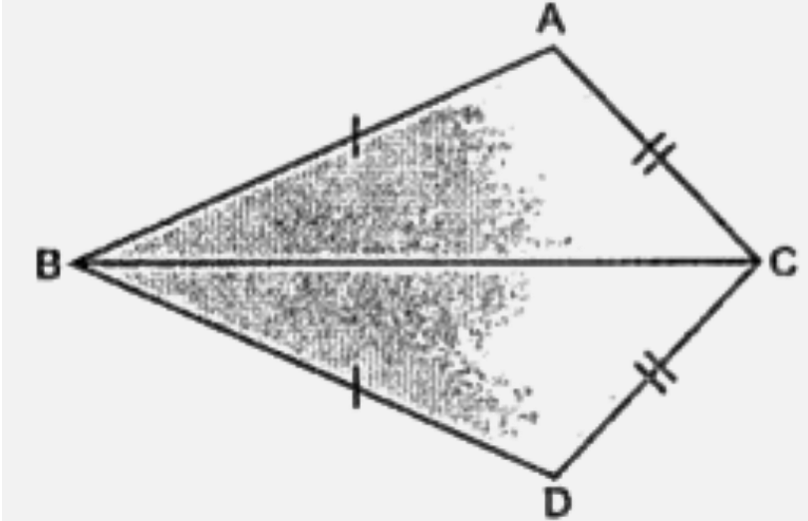
Prove that :

$$AL = 2DC$$



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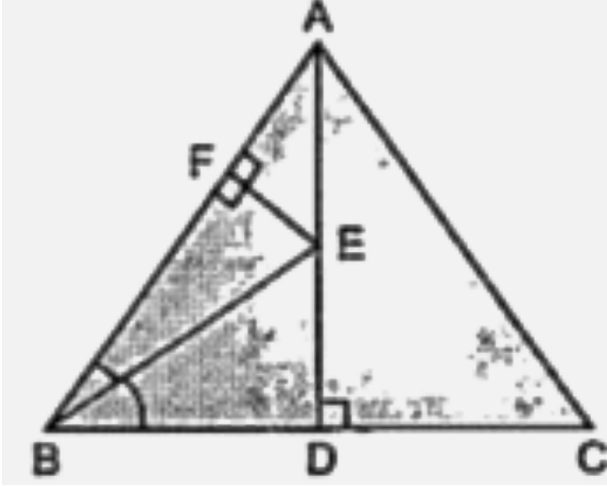
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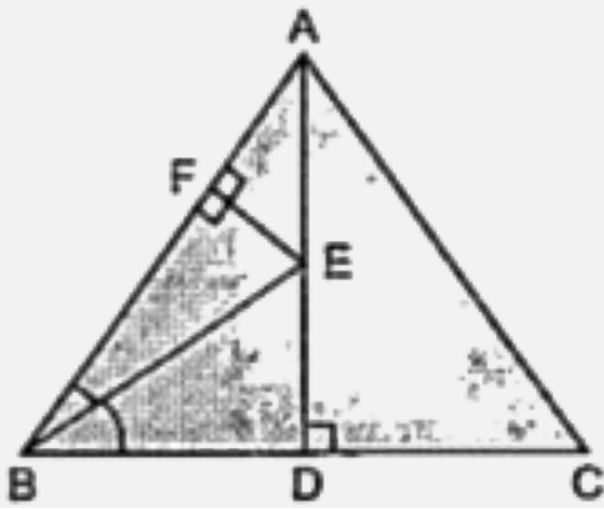
Prove that : $ED=EF$



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9. In the following figure, $AB = AC$ and AD is perpendicular to BC . BE bisects angle B and EF is perpendicular to AB .

Prove that :



$$ED=EF$$

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10. On the sides AB and AC of triangle ABC, equilateral triangles ABD and ACE are drawn. Prove that :

$$\angle CAD = \angle BAE$$

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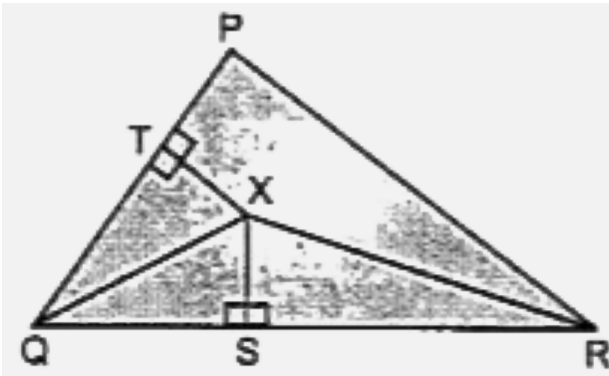
11. On the sides AB and AC of triangle ABC, equilateral triangles ABD and ACE are drawn. Prove that :

(i) $\angle CAD = \angle BAE$

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12. In the adjoining figure, OX and RX are the bisectors of the angle Q and R respectively of the triangle PQR . If $XS \perp QR$ and $XT \perp PQ$.

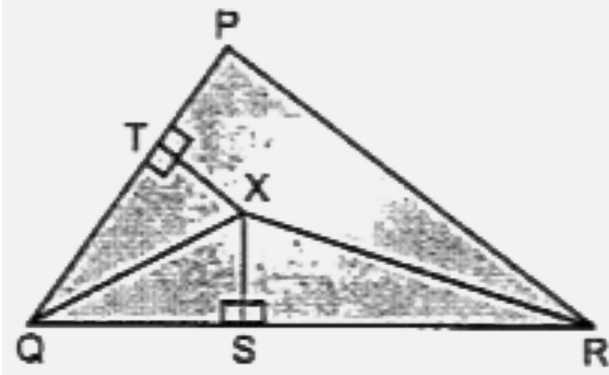


Prove that :

$$\Delta XTQ \cong \Delta XSQ$$

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13. In the adjoining figure, OX and RX are the bisectors of the angle Q and R respectively of the triangle PQR . If $XS \perp QR$ and $XT \perp PQ$.

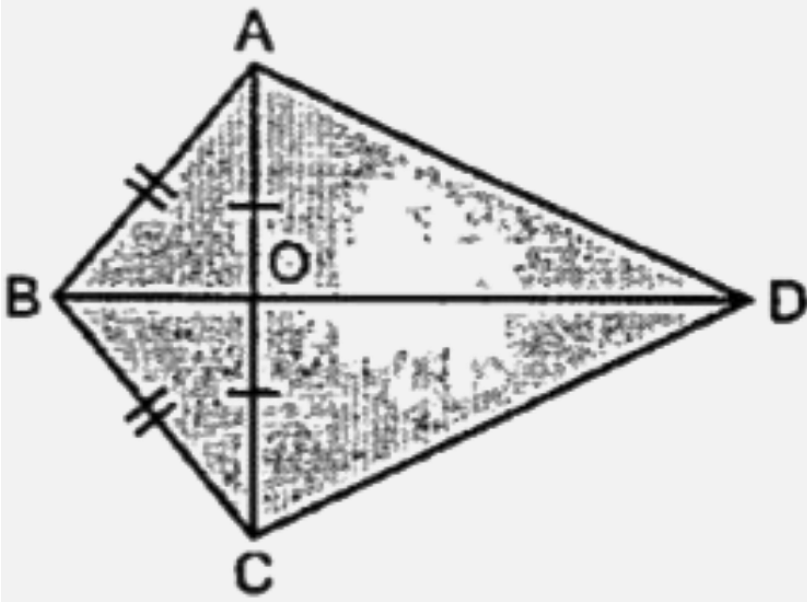


Prove that :

PX bisects angle P.

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14. In the following figure, $OA = OC$ and $AB = BC$.



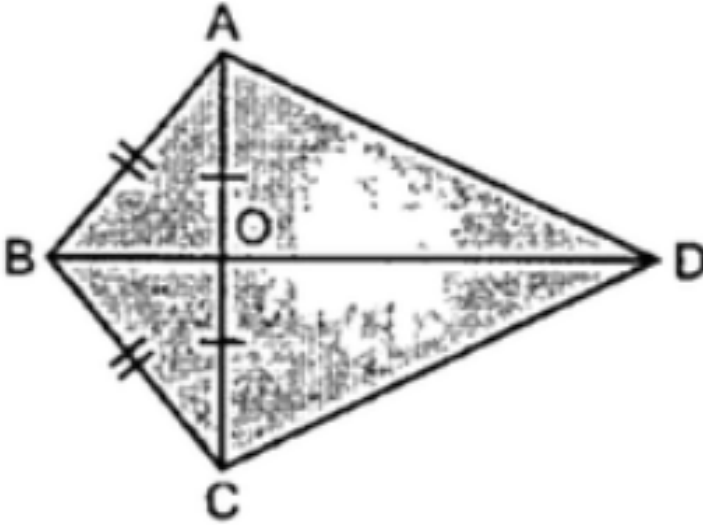
Prove that :

$$\angle AOB = 90^\circ$$



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15. In the following figure, $OA = OC$ and $AB = BC$.



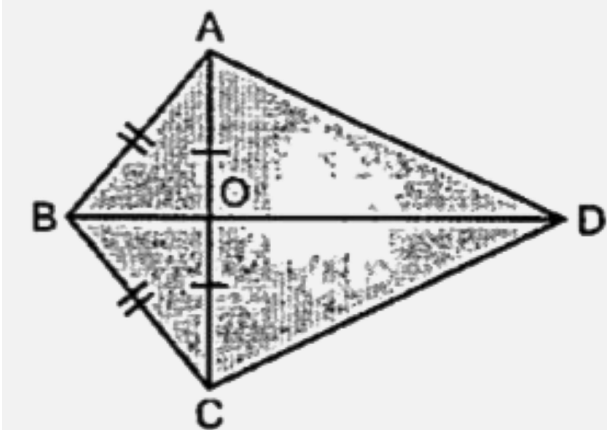
Prove that :

$$\triangle AOD \cong \triangle COD$$



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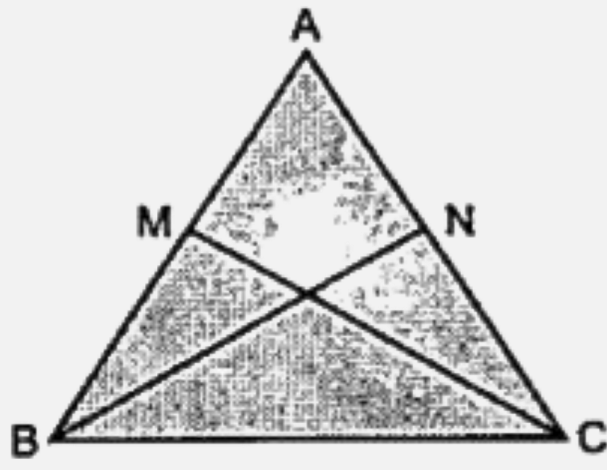
Prove that :

$$AD=CD$$



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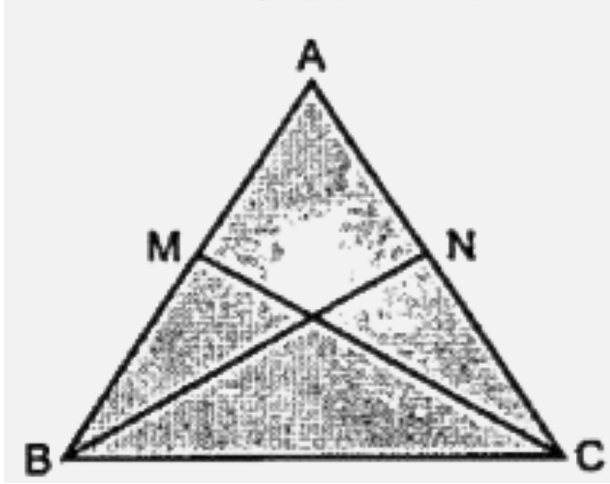
17. The following figure shows a triangle ABC in which $AB=AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that



$$AM = AN$$

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18. The following figure shows a triangle ABC in which $AB=AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that

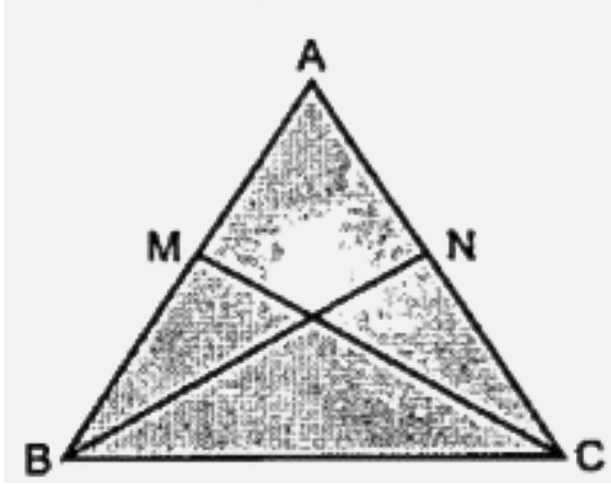


$$\triangle AMC \cong \triangle ANB$$



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19. The following figure shows a triangle ABC in which $AB=AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that

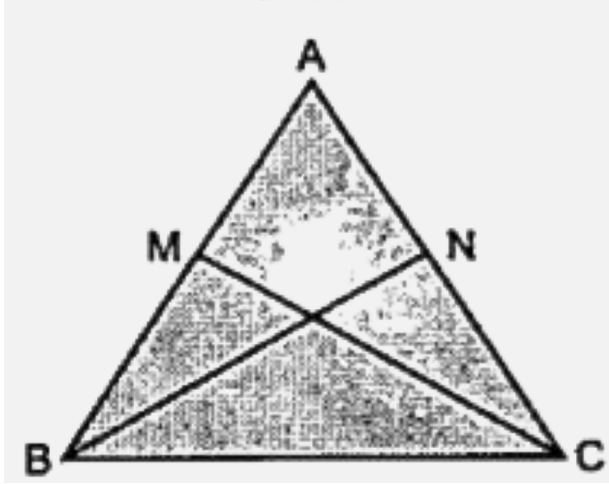


$$BN = CM$$



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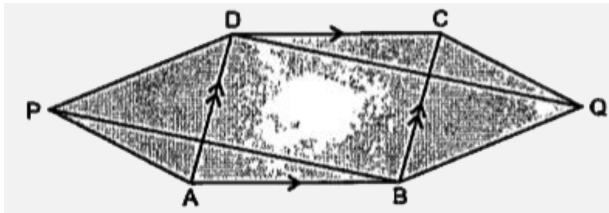
20. The following figure shows a triangle ABC in which $AB=AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that



$$\triangle BMC \cong \triangle CNB$$

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21. In the given diagram ABCD is a parallelogram. $\triangle APD$ and $\triangle BQC$ are equilateral triangles.

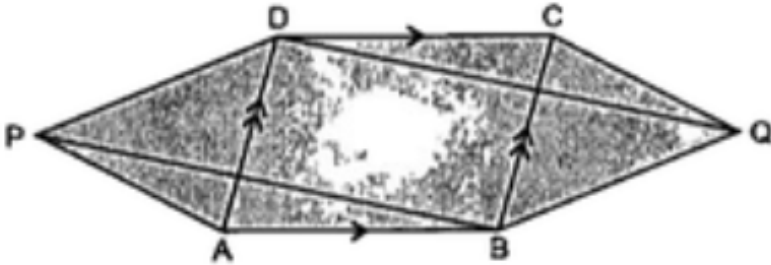


Prove that :

$$\angle PAB = \angle QCD$$

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22. In the given diagram ABCD is a parallelogram. $\triangle APD$ and $\triangle BQC$ are equilateral triangles.



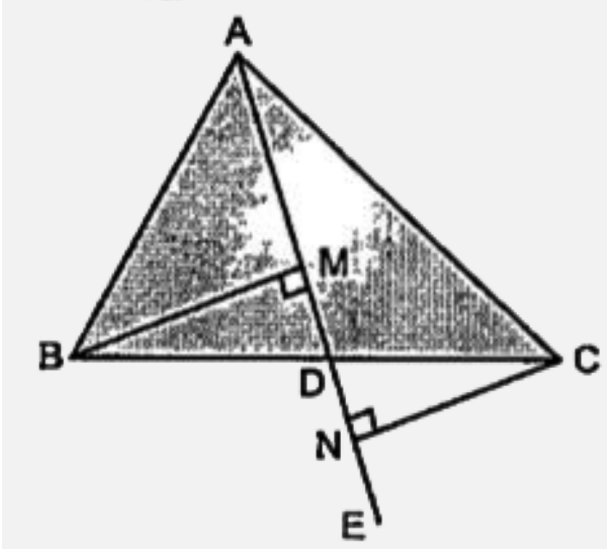
Prove that :

$$PB = QD$$



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23. In the given figure ABC is a triangle and D is the mid-point of BC. AD is produced to E. BM and CN are two perpendiculars dropped from B and C respectively on AE.

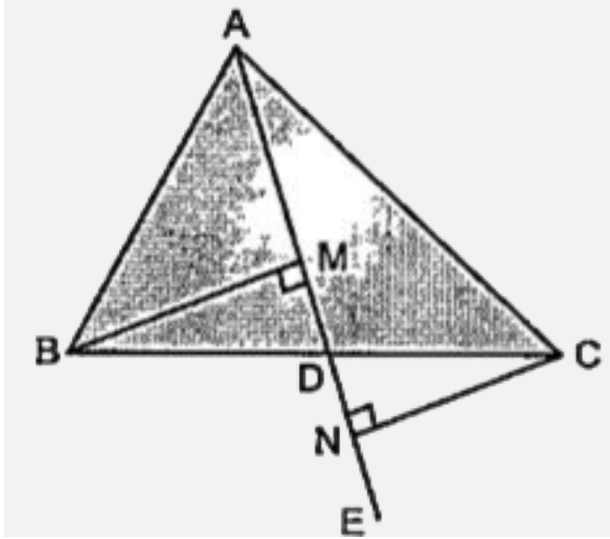


Prove that :

$$\triangle BMD \cong \triangle CND$$

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24. In the given figure ABC is a triangle and D is the mid-point of BC. AD is produced to E. BM and CN are two perpendiculars dropped from B and C respectively on AE.



Prove that :

$$BM = CN$$



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