



MATHS

BOOKS - NAGEEN PRAKASHAN ENGLISH

TRIANGLES

Solved Examples

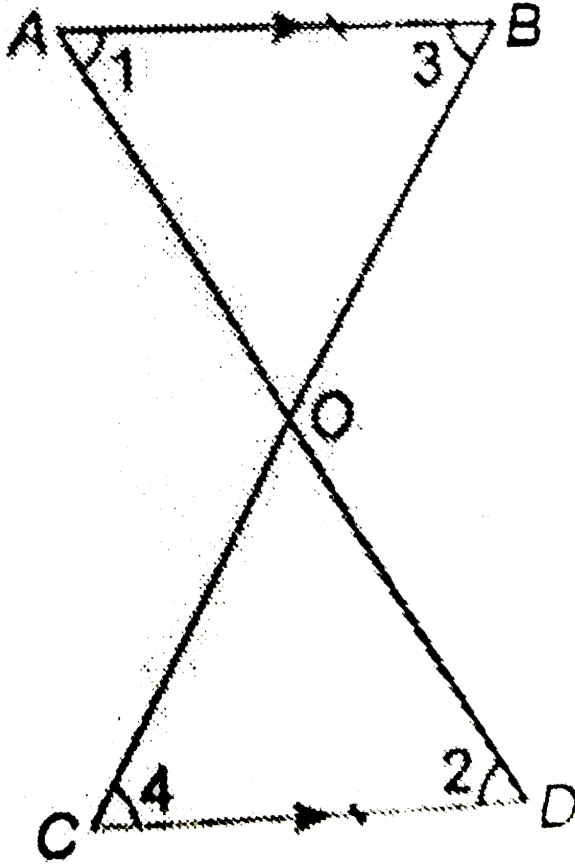
1. In the given figure, prove that $AC = BD$.

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2. In the adjoining figure, $AB = CD$ and $AB \parallel CD$ prove that

(i) $\triangle AOB \cong \triangle DOC$

(ii) AD and BC bisect each other at the point O.



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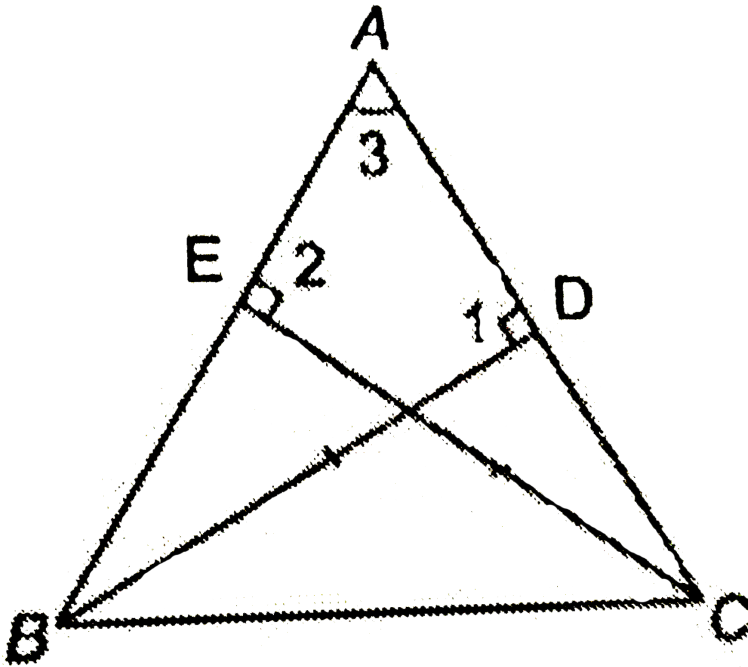
3. The sides AB and BC and the median AD of triangle ABC are equal to the sides PQ and QR and the median PM of triangle PQR respectively.

Prove that the triangles ABC and PQR are congruent.

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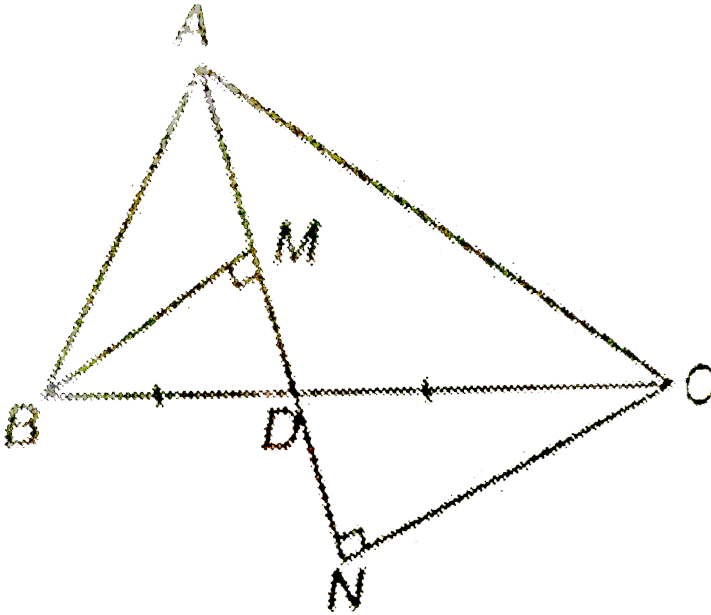
4. In the adjoining figure, $BD = CE$ and $\angle ADB = \angle AEC = 90^\circ$, prove that

(i) $\triangle ABD \cong \triangle ACE$ (ii) ABC is an isosceles triangle.



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5. In the adjoining figure, D is the mid-point of BC. If BM and CN are perpendiculars from B and C respectively on AD and AD produced, then prove that $BM = CN$.



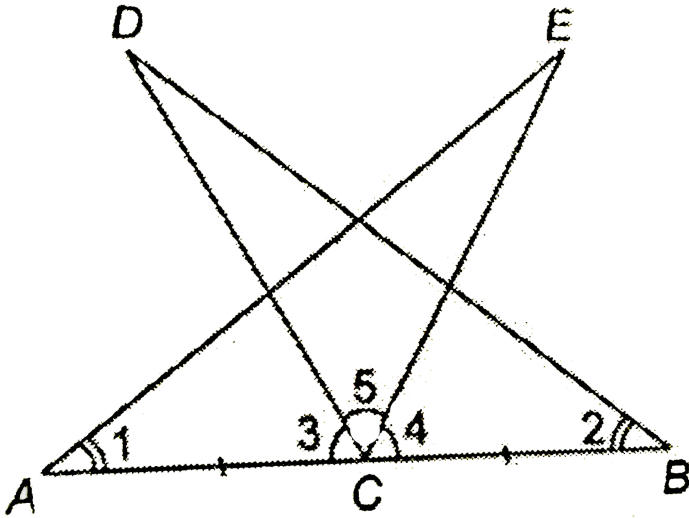
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6. Use the information marked to prove :

(i) $\triangle EAC \cong \triangle DBC$ (ii) $EC = DC$

Also state the Euclid's axiom used in proving the congruency of two

triangles.

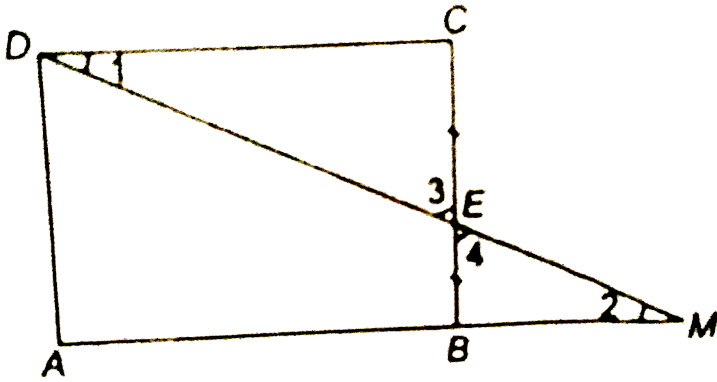


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7. In the adjoining figure $ABCD$ is a parallelogram, ABM is a line segment and E is the mid-point of BC . Prove that :

(i) $\triangle DCE \cong \triangle MBE$ (ii) $AB = BM$

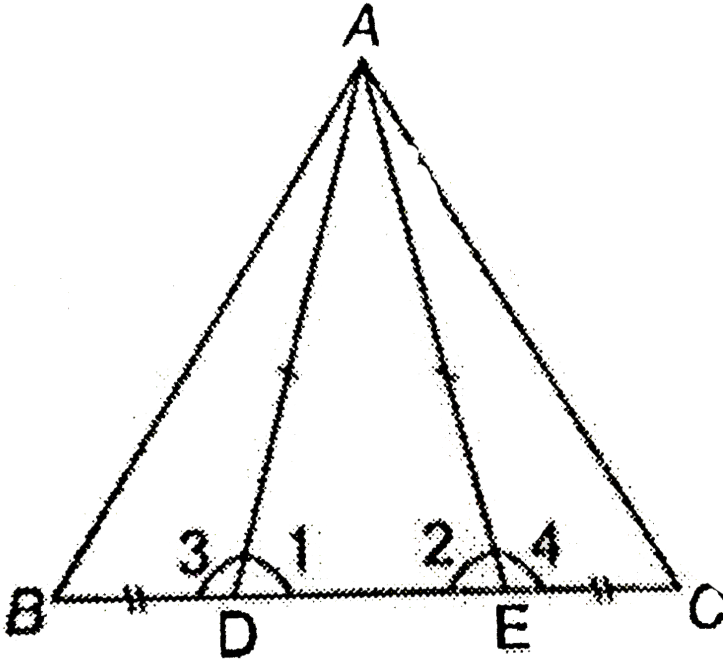
(iii) $AM = 2DC$



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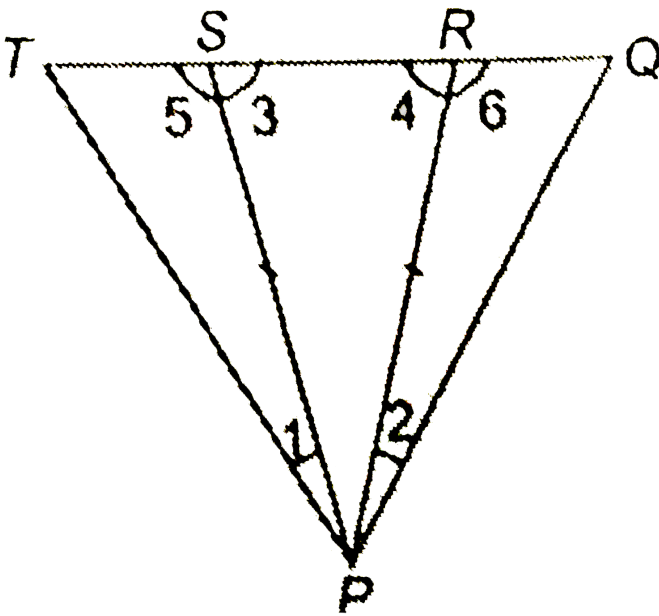
8. In the given figure, D and E are the points on the base BC of $\triangle ABC$ such that $BD = CE$, $AD = AE$ and $\angle ADE = \angle AED$, prove that

$$\triangle ADB \cong \triangle AEC.$$



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9. In the given figure, $PS = PR$, $\angle TPS = \angle QPR$. Prove that $PT = PQ$.

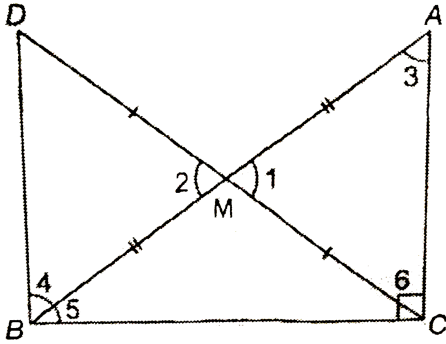


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10. In right triangle ABC, right angle at C, M is the mid-point of the hypotenuse AB. C is joined to M and produced to a point D such that $DM = CM$. Point D is joined to point B. Show that

(i) $\triangle AMC \cong \triangle BMD$ (ii) $\angle DBC = \angle ACB$

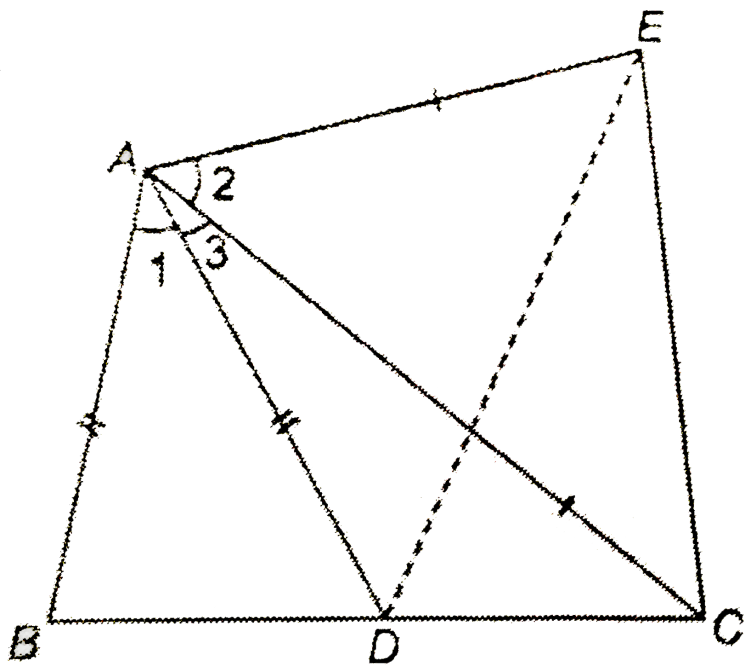
(iii) $\triangle DBC \cong \triangle ACB$ (iv) $CM = \frac{1}{2}AB$



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11. In the given figure, $AC = AE$, $AB = AD$ and $\angle BAD = \angle EAC$.

Prove that $BC = DE$.



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12. If the bisector of the vertical angle of a triangle bisects the base of the triangle, then the triangle is isosceles. GIVEN : triangle ABC in which AD is the bisector of angle A meeting BC in D such that $BD = DC$ TO PROVE: triangle ABC is an isosceles triangle.

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13. ABC is an isosceles triangle with $AB = AC$. Side BA is produced to D such that $AB = AD$. Prove that $\angle BCD$ is a right angle.



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14. If $\triangle ABC$ is an isosceles triangle with $AB = AC$. Prove that the perpendiculars from the vertices B and C to their opposite sides are equal.



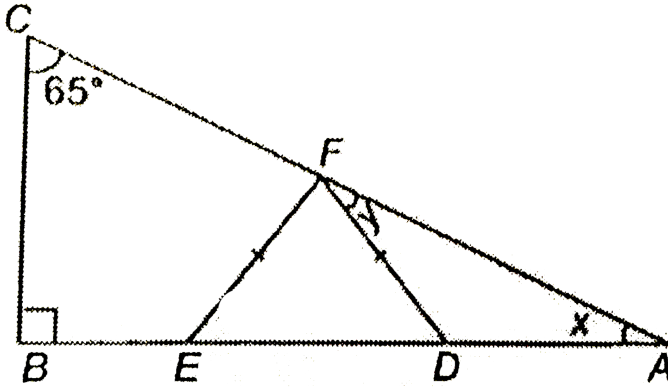
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15. BE and CF are two equal altitudes of a triangle ABC . Using RHS congruence rule, prove that the triangle ABC is isosceles



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16. In the adjoining figure, find the measure of angle FEB, if the lengths of sides AD, DF and FE are equal and $\angle ACB = 65^\circ$.



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17. ABC is a triangle in which $\angle B = 2 \angle C$. D is a point on BC such that AD bisects $\angle BAC$ and $AB = CD$. Prove that $\angle BAC = 72^\circ$.

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18. In $\triangle ABC$, $\angle A = 100^\circ$, $\angle C = 30^\circ$. Find (i) largest side, (ii) smallest side of $\triangle ABC$.



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19. In $\triangle ABC$, D is any point on side BC . Prove that

$$AB + BC + CA > 2AD$$

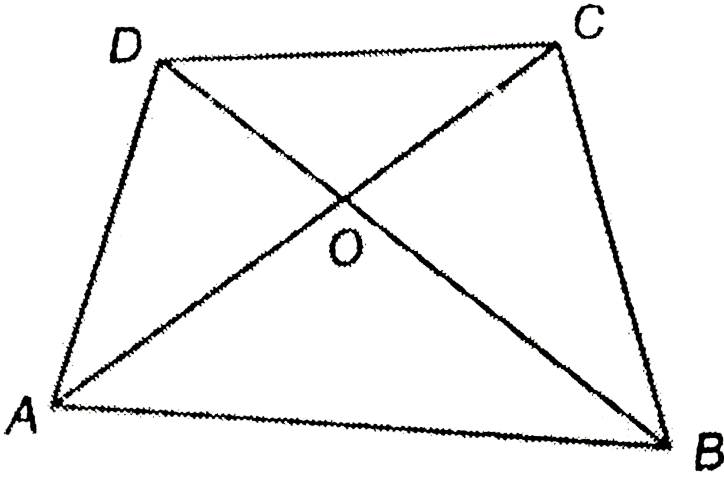


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20. In the adjoining figure, $ABCD$ is a quadrilateral. Its diagonals AC and BD intersect at point 'O'. Prove that :

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

(b) $AB + BC + CD + DA > (AC + BD)$



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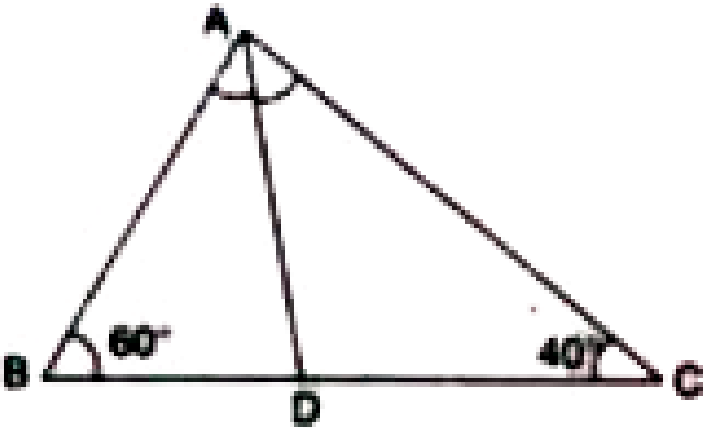
21. Show that the difference of any two sides of a triangle is less than the third side.

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22. In $\triangle ABC$, $BC = CA$ and $\angle A = 40^\circ$. Find the largest side of $\triangle ABD$.



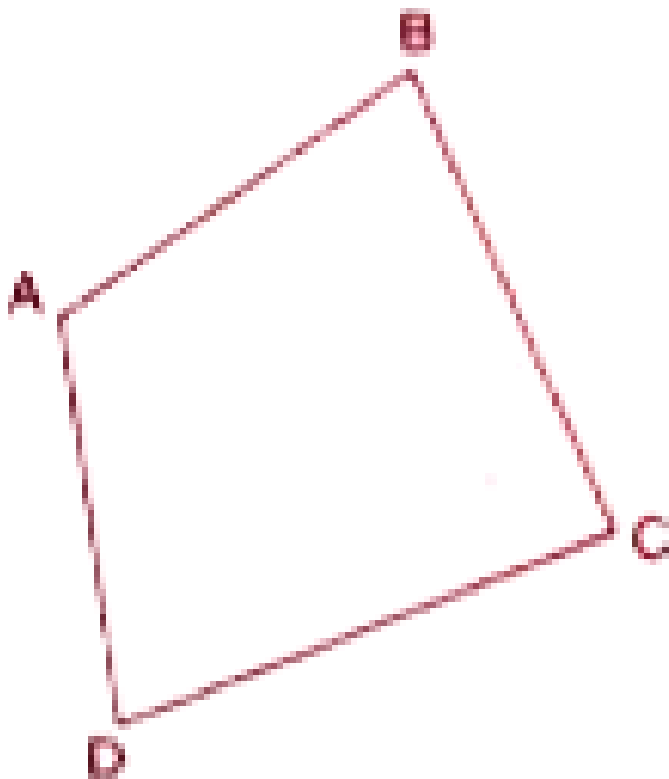
23. In the adjoining figure, AD bisects $\angle A$. Arrange AB, BD and DC in the descending order of their lengths.



24. In quadrilateral ABCD, AB is the shortest side and DC is the longest side. Prove that :

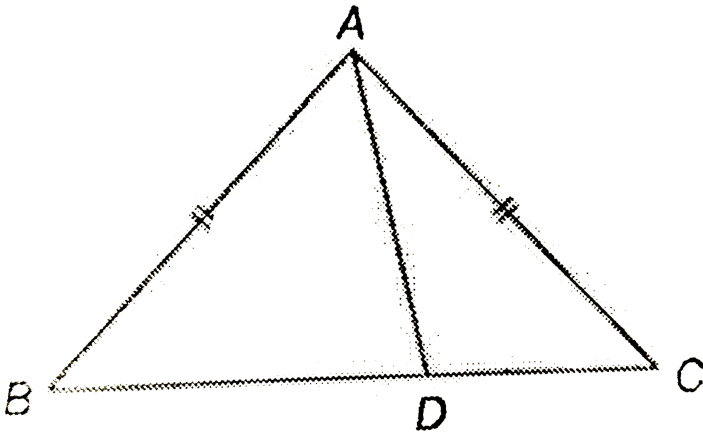
(i) $\angle B > \angle D$

(ii) $\angle A > \angle C$



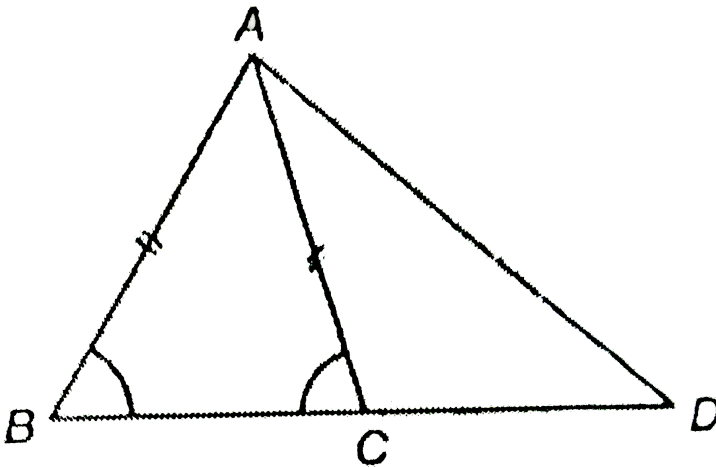
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25. If D any point on the BC of an isosceles triangle ABC then prove that $AB > AD$ and $AC > AD$.



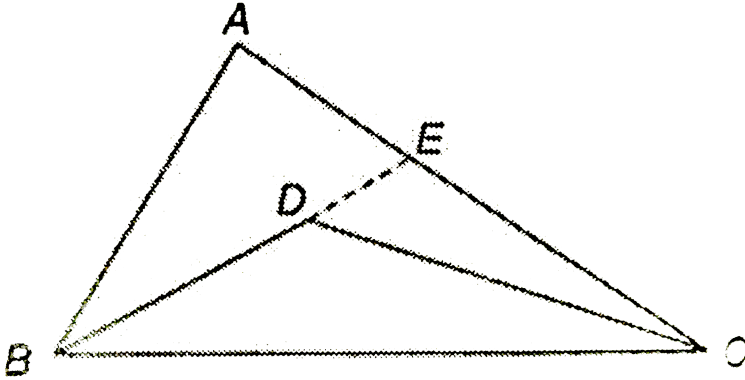
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26. In isosceles triangle ABC , D is a point on the base BC produced. Prove that $AD > AB$.



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27. In the adjoining figure, ABC is a triangle and D is any point in its interior. Show that $BD + DC < AB + AC$.



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28. Prove that the perimeter of a triangle is greater than the sum of its altitudes.

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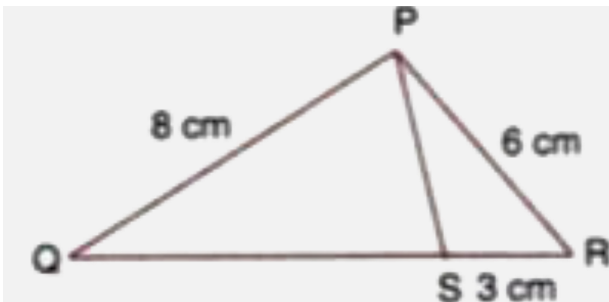
29. $\triangle ABC$ and $\triangle DBC$ are two isosceles triangles on the same base BC and vertices A and D are on the same side of BC (see Fig. 7.39). If AD is extended to intersect BC at P, show that (i) $\triangle ABD \cong \triangle ACD$ (ii) $\angle B = \angle C$

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30. In figure, $\angle B < \angle A$ and $\angle C < \angle D$. Show that $AD < BC$.

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31. PQR is a triangle. S is a point on the side QR of $\triangle PQR$ such that $\angle PSR = \angle QPR$. Given $QP = 8$ cm, $PR = 6$ cm and $SR = 3$ cm.



Find the lengths of QR and PS.



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32. Bisectors of the angles B and C of an isosceles $\triangle ABC$ with $AB = AC$ intersect each other at O . Show that external angle adjacent to $\angle ABC$ is equal to $\angle BOC$.



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33. Prove that sum of any two sides of a triangle is greater than twice the median with respect to the third side.



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34. Show that in a quadrilateral $ABCD$
 $AB + BC + CD + DA < 2(BD + AC)$



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1. If 3 sides of a triangle are 35 cm, 16 cm and 12 cm, then which type of triangle is this ?

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2. If 3 sides of a triangle are of lengths 12 cm, 8 cm and 17 cm. then which type of triangle is this ?

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3. If 3 sides of a triangle are of length 16 cm, 12 cm and 13 cm, then which type of triangle is this ?

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4. If 3 sides of a triangle are 63 cm, 16 cm, and 65 cm, then which type of triangle is this ?

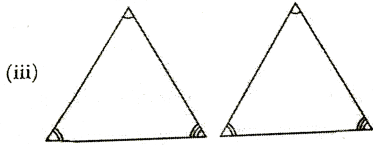
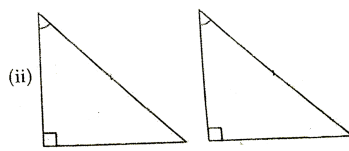
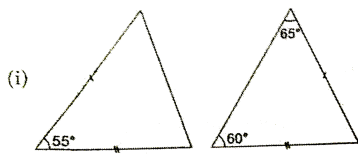
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5. If 3 sides are of lengths 24 cm, 10 cm and 12 cm, then which type of triangle is this ?

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Exercise 7 A

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



(iv) In $\triangle ABC$ and $\triangle DEF$, $AB = EF$, $BC = DF$ and $\angle B = \angle F$

(v) In $\triangle ABC$ and $\triangle PQR$, $AB = QR$, $AC = PR$ and $\angle B = \angle R$

(vi) In $\triangle ABC$ and $\triangle PQR$, $\angle A = \angle P$, $AC = PR$ and $AB = PQ$

(vi) In $\triangle ABC$ and $\triangle PQR$, $AB = QR$, $\angle A = \angle Q$ and $AC = QP$.

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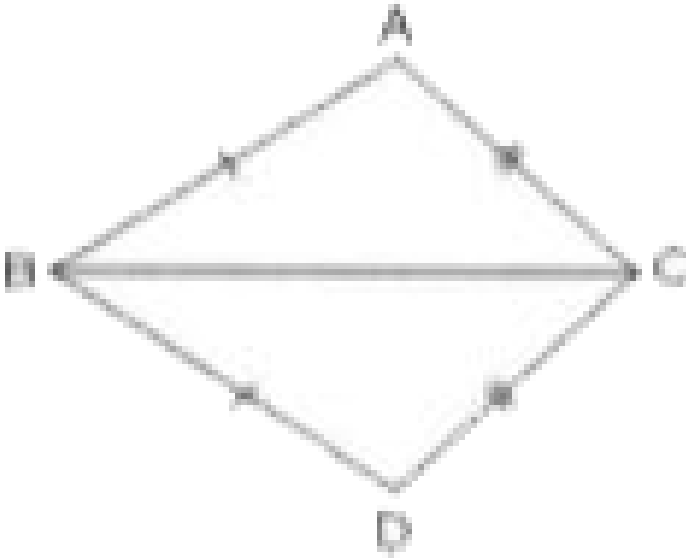
2. In a $\triangle ABC$, D is mid-point of BC , AD is produced upto E so that $DE = AD$, prove that :

(i) $\triangle ABD$ and $\triangle ECD$ are congruent (ii) $AB = EC$

(iii) AB is parallel to EC .

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3. 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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4. BD is the bisector of angle ABC . From a point P in BD , perpendiculars PE and PF are drawn to AB and BC respectively, prove that :
- (i) Triangle BEP is congruent to triangle BFP (ii) $PE=PF$.

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5. Given a $\triangle ABD$ in which $AB = AD$ and AC bisects BD . Prove that :
 $\triangle ABC \cong \triangle ADC$.



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6. In a triangle ABC , $AB = AC$ and bisector of angle A meets BC at D . Prove that :

(i) $\triangle ABD \cong \triangle ACD$ (ii) AD is perpendicular to BC .



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7. In quadrilateral $ABCD$, $AB=DC$ and $AD=BC$. Prove that the sides AB and DC are parallel to each other.



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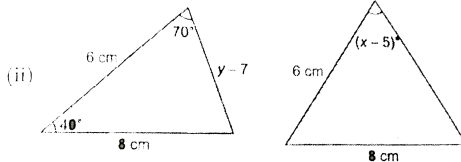
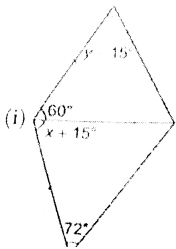
8. In $\triangle ABC$, $AB = AC$ and the bisectors of $\angle B$ and $\angle C$ meet AC and AB at point D and E respectively. Prove that $BD = CE$.

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9. In $\triangle ABC$, $\angle B = \angle C$. Prove the perpendiculars from the mid-point of BC to AB and AC are equal.

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10. Find the value of x and y in each of the following figures containing two congruent triangles :



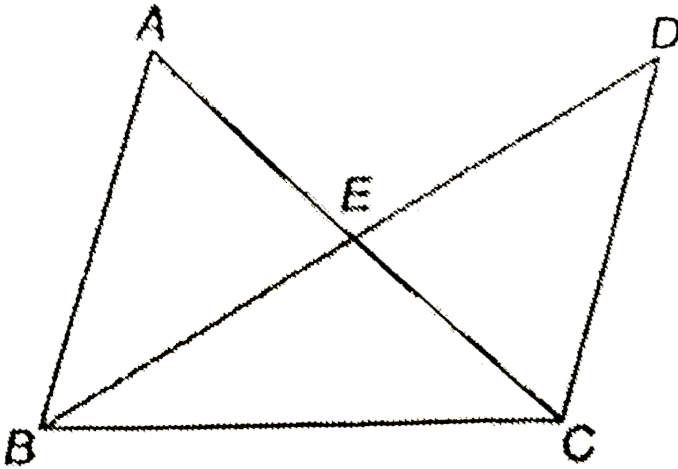
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11. In the adjoining figure, $\angle BAC = \angle BDC$ and $\angle ABC = \angle BCD$.

Prove that :

(i) $\triangle ABC \cong \triangle DCB$

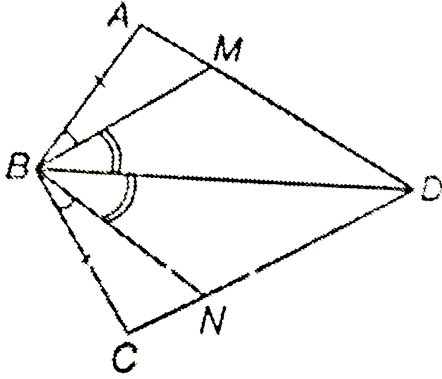
(ii) $\triangle ABE \cong \triangle DCF$.



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12. In the adjoining figure, ABCD is a quadrilateral. M and N are the points on AD and CD respectively such that $AB = BC$, $\angle ABM = \angle CBN$ and

$\angle MBD = \angle NBD$. Prove that $BM = BN$.

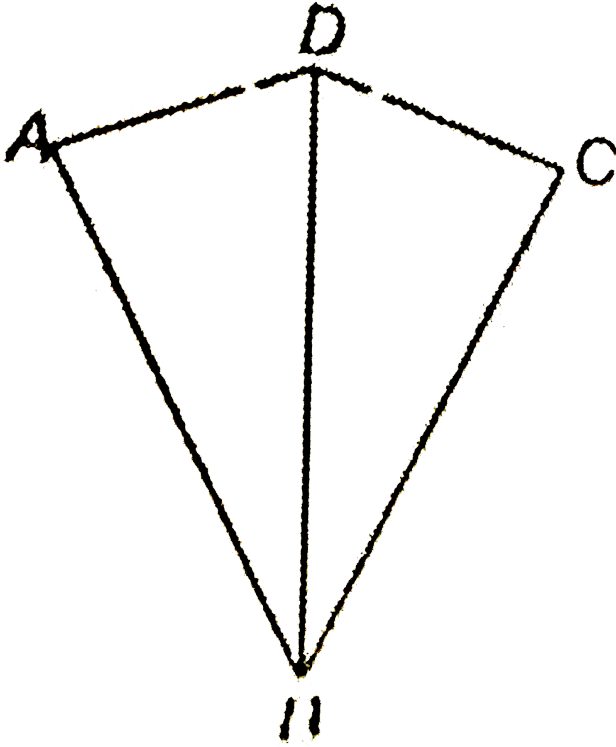


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13. Given $AD = DC$ and DB bisects $\angle ADC$.

(i) Prove that, $\triangle ADB \cong \triangle CDB$

(ii) If $\angle ABD = 48^\circ$, find $\angle CBD$.

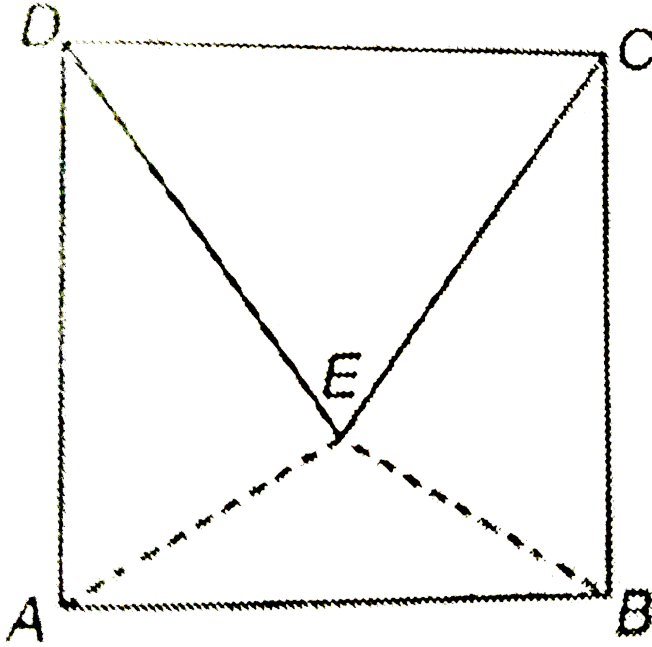


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14. The adjoining figure shows a square ABCD and an equilateral triangle DEC. Prove that :

(i) $\angle ADE = \angle BCE = 30^\circ$

(ii) $\triangle ADE \cong \triangle BCE$



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15. Equilateral triangles ABD and ACE are drawn on sides AB and AC respectively of a $\triangle ABC$ outside it. Prove that :

(i) $\angle DAC = \angle EAB$ (ii) $DC = BE$

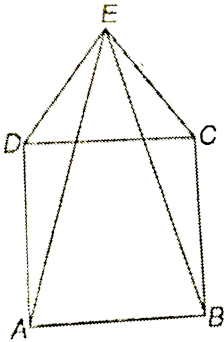
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16. The following figure shows a square ABCD and an equilateral triangle DCE. Prove that :

(i) $\angle ADE = \angle BCE = 150^\circ$

(ii) $\triangle ADE \cong \triangle BCE$

(iii) $AE = BE$

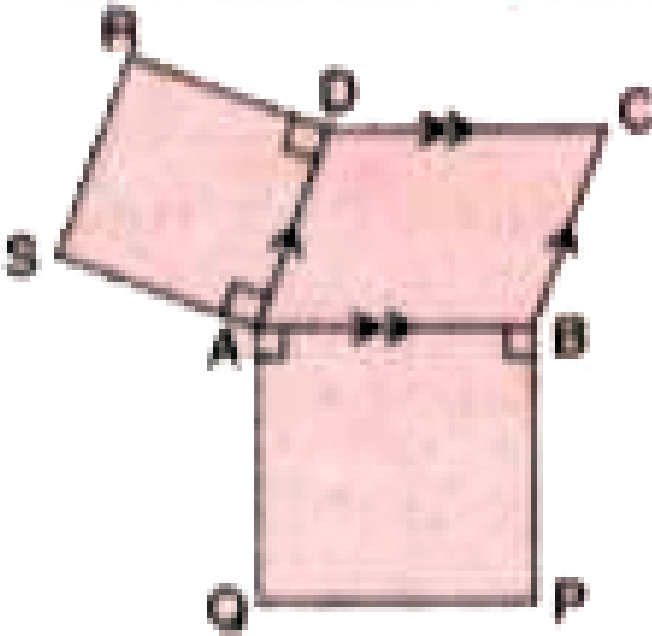


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17. The given figure shows a parallelogram ABCD. Squares ABPQ and ADRS are drawn on sides AB and AD of the parallelogram ABCD. Prove that :

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

(ii) $SQ = AC$

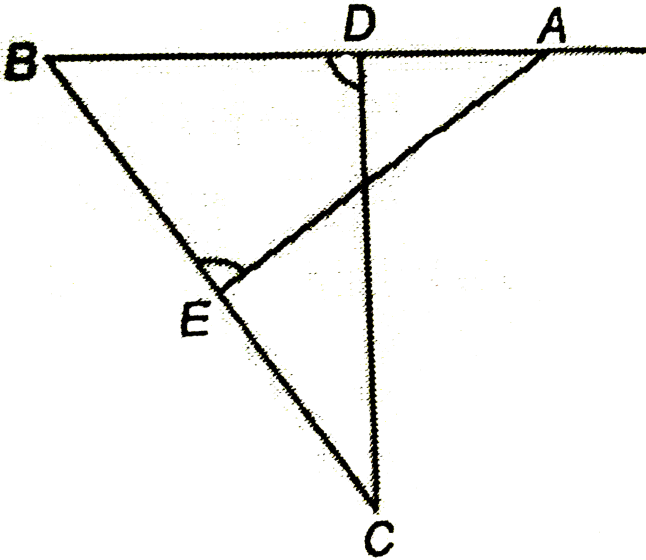


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18. In a $\triangle ABC$, BD is the median to the side AC , BD is produced to E such that $BD = DE$. Prove that : AE is parallel to BC .

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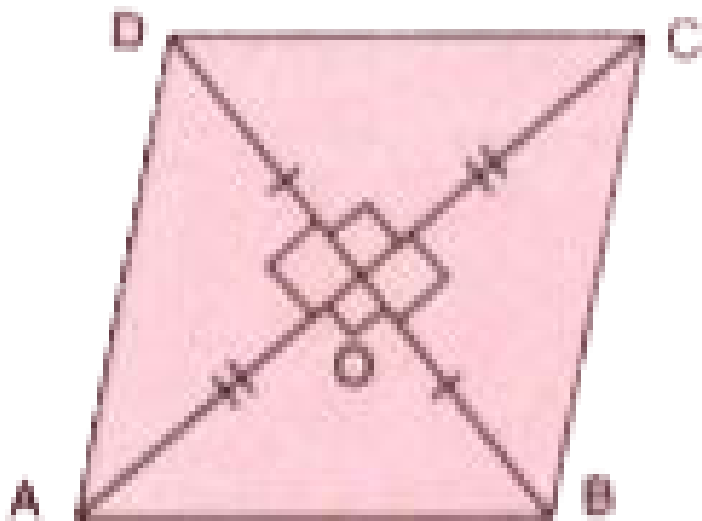
19. In the given figure, $\angle BDC = \angle BEA$ and $AB = BC$. Show that $AE = CD$.



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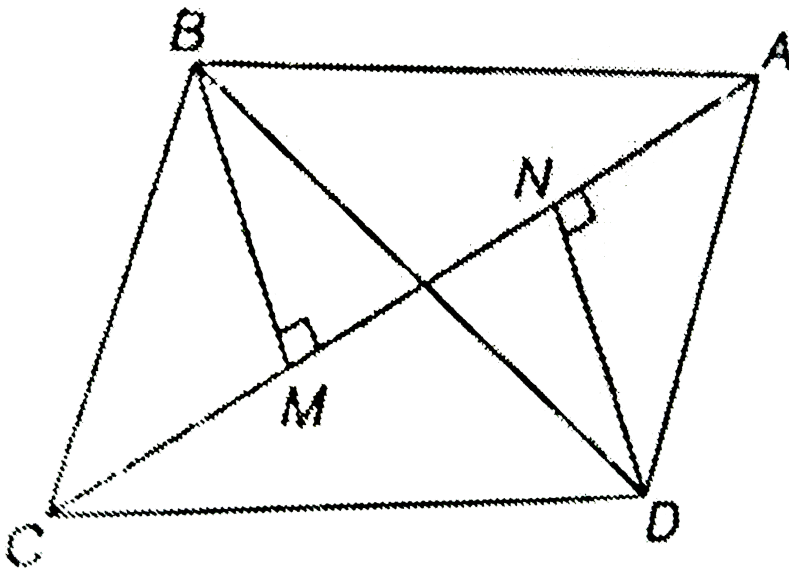
20. If the diagonals of a quadrilateral bisect each other at right angle, prove that the quadrilateral is a rhombus.

A rhombus has all its four sides equal.



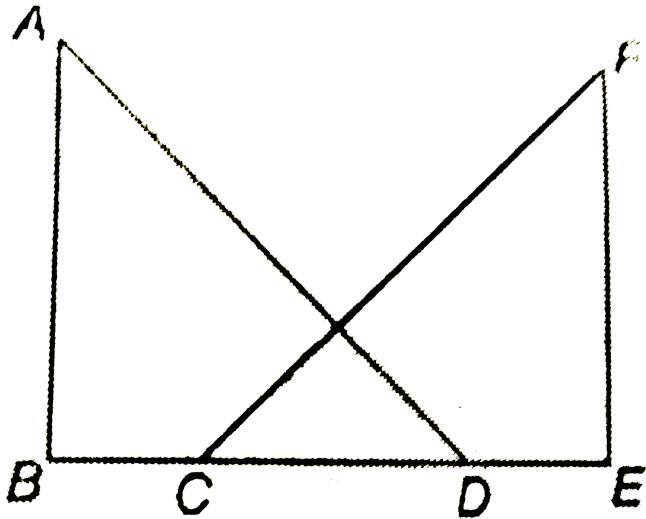
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21. In the adjoining figure, BM and DN are the perpendiculars from B and D respectively to AC such that $BM = DN$. Prove that $BO = OD$.



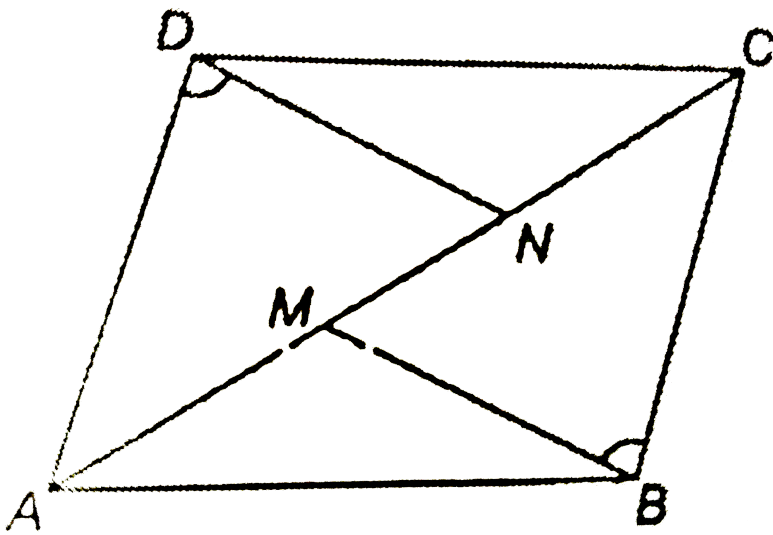
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22. In the adjoining figure, $AB = EF$, $BC = DE$, $\angle ABC = \angle FED = 90^\circ$, prove that $AD = CF$



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23. In the adjoining figure, ABCD is a parallelogram. If $\angle MBC = \angle NDA$, prove that $AM = NC$.



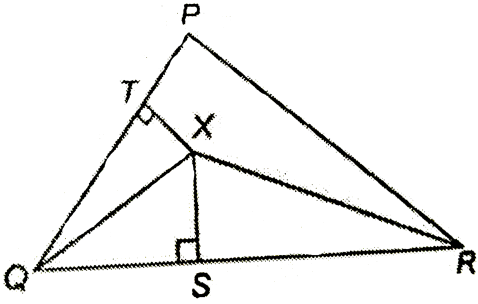
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24. In the adjoining figure, QX and RX are the bisectors of the angles Q and R respectively of the angles Q and R respectively of the triangle PQR.

If $XS \perp PQ$. Prove that :

(i) $\Delta XTQ \cong \Delta XSQ$

(ii) PX bisects angle P.



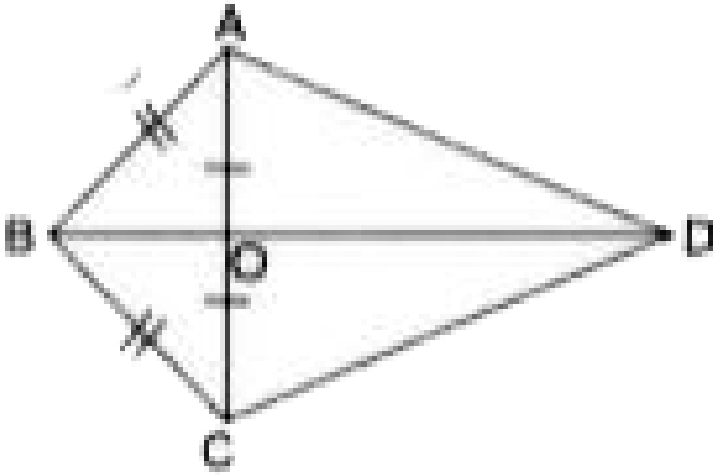
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25. In the following figure, $OA = OC$ and $AB = BC$. Prove that :

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

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

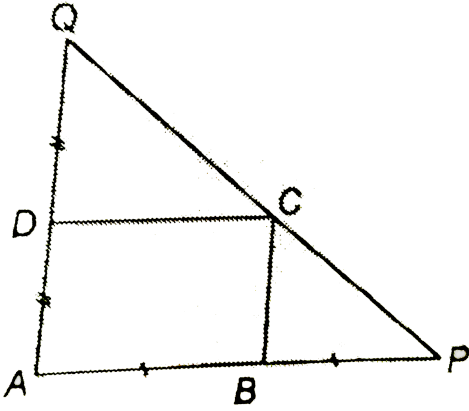
(iii) $AD = CD$



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26. In the adjoining figure, ABCD is a parallelogram. The side AB is produced to P such that $AB = BP$ and the side AD is produced to Q such that $AD = DQ$.

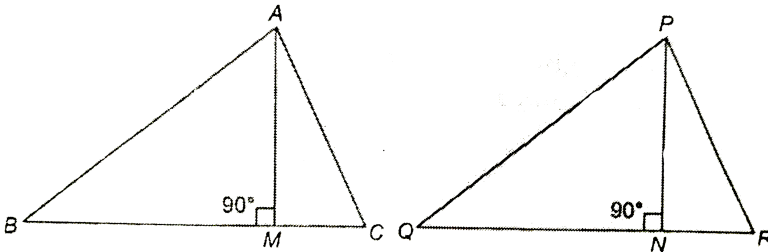
Prove that $CP = CQ$.



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27. In the following figures, $AB = PQ$, $AC = PR$ and $AM = PN$.

Prove that $\triangle ABC \cong \triangle PQR$.



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28. Prove that the medians of an equilateral triangle are equal.



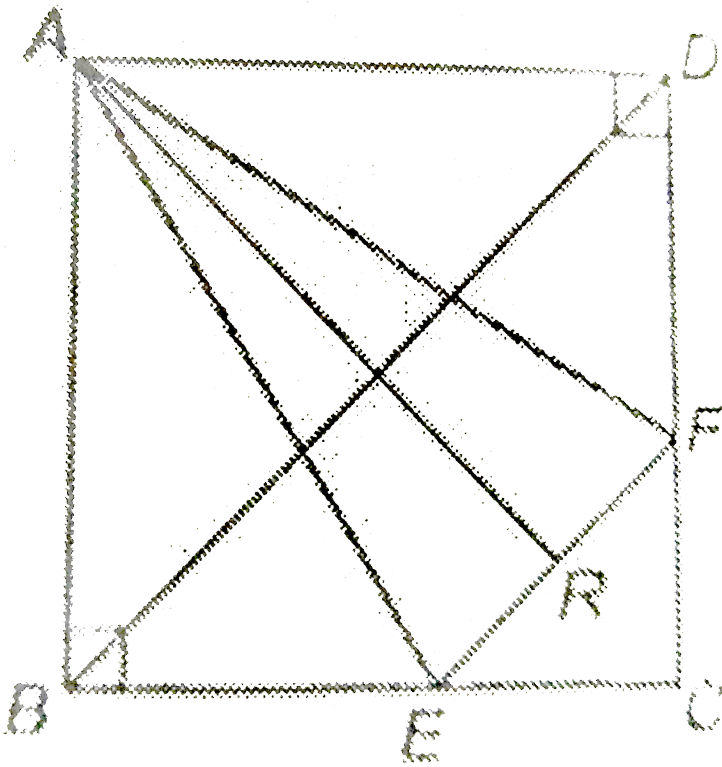
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29. ABCD is a square EF is parallel to BD. R is the mid-point of EF. Prove that :

(i) $BE = DF$

(ii) AR bisects angle BAD

(iii) If AR produced it will pass through C.



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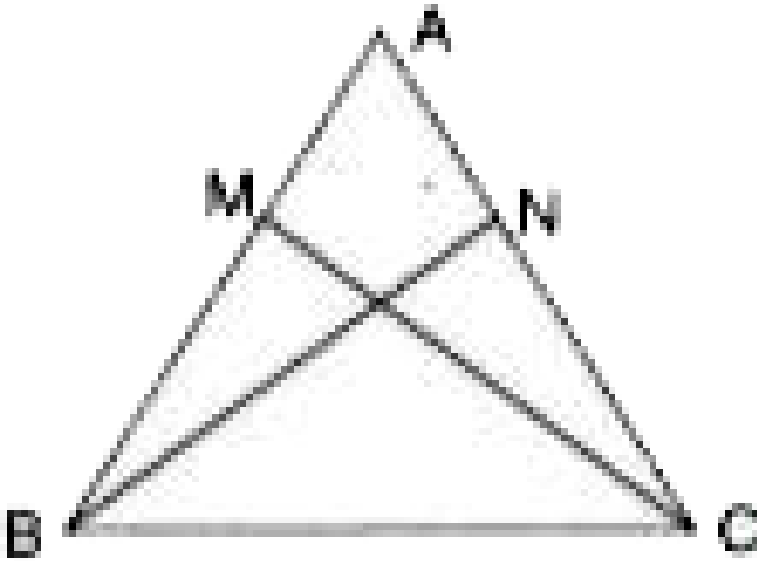
30. The following figure shows a triangle ABC in which $AB = AC$. M is a point on AB and N is a point on AC such that $BM = CN$. Prove that :

(i) $AM = AN$

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

(iii) $BN = CM$

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

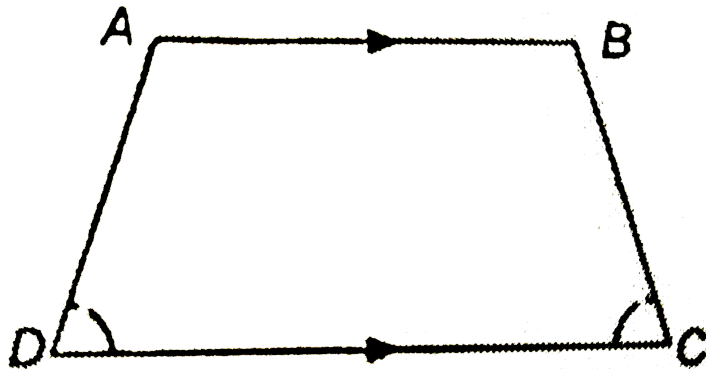


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31. In the given figure, $AB \parallel DC$ and $\angle D = \angle C$. Prove that :

(i) $AD = BC$

(ii) $AC = BD$

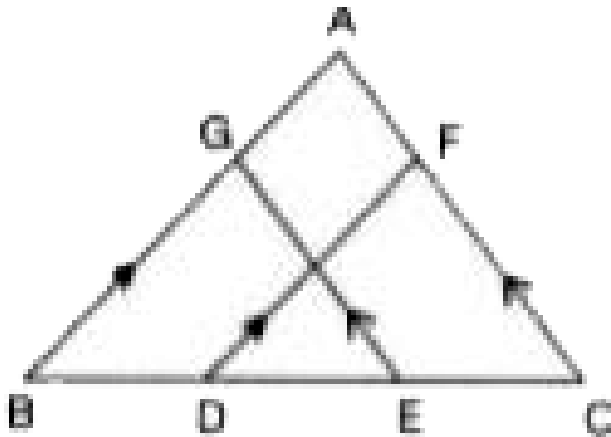


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32. In the given figure : $AB \parallel FD$, $AC \parallel GE$ and $BD = CE$, prove that :

(i) $BG = DF$

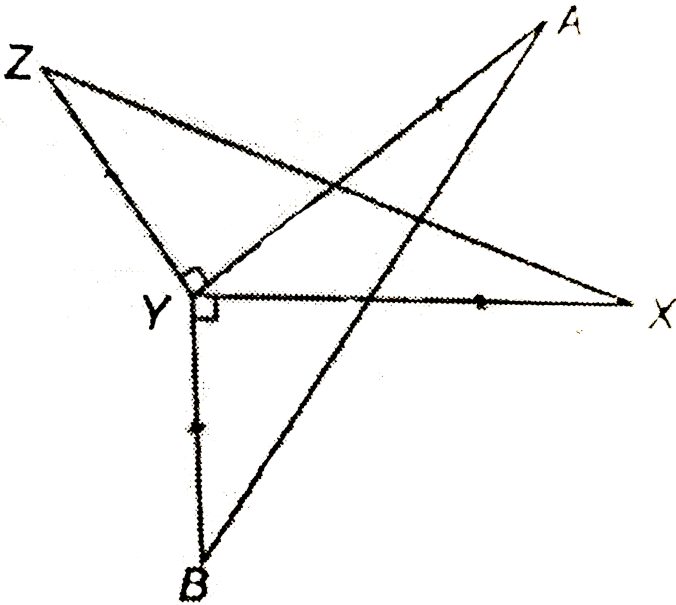
(ii) $CF = EG$





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33. In the adjoining figure, $\angle AYZ = \angle BYX = 90^\circ$, $AY = YZ$ and $XY = BY$. Prove that $AB = ZX$.



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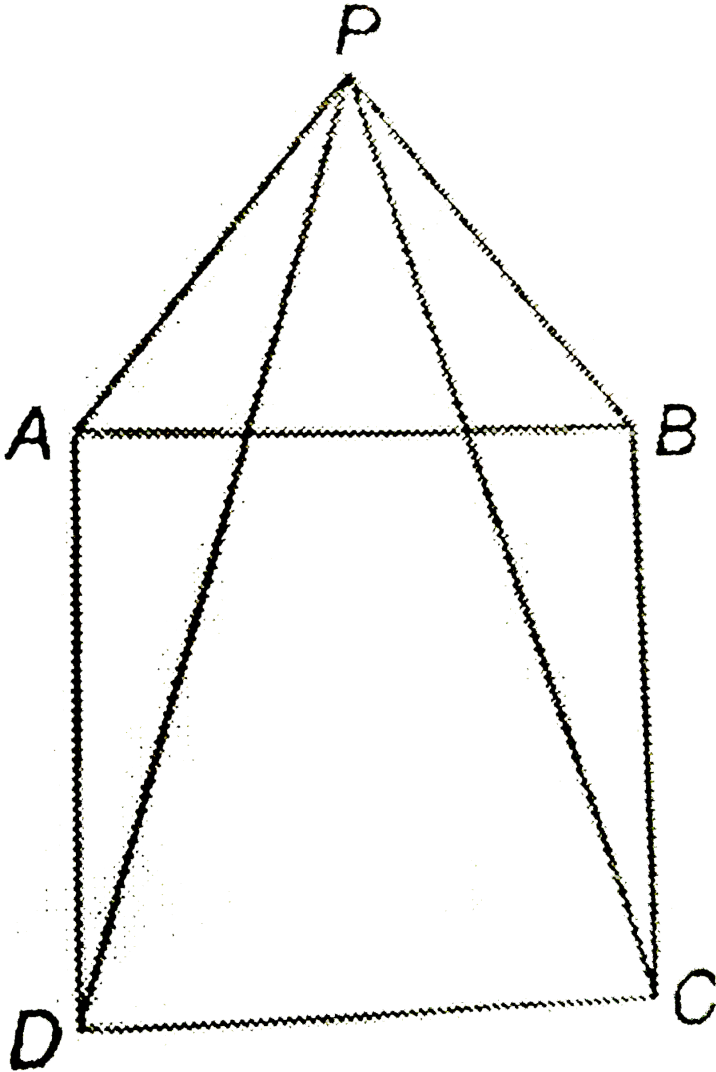
34. In the adjoining figure, ABCD is a square and PAB is an equilateral triangle. Find :

(i) $\angle APD$

(ii) $\angle PDC$

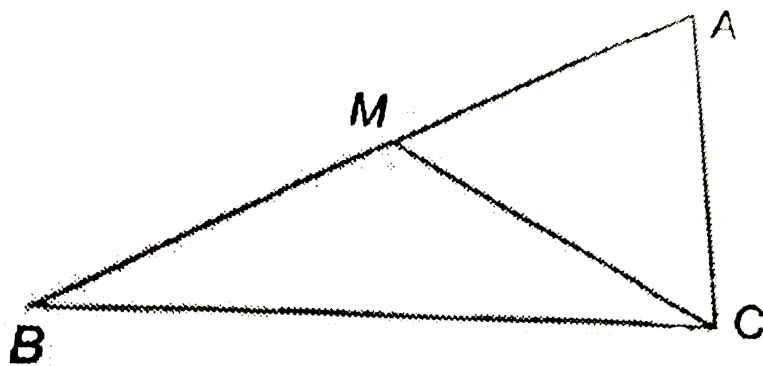
(iii) $\angle DPC$

(iv) Prove that $DP = CP$



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35. In the adjoining figure, $\triangle ABC$ is right angled at C and M is the mid-point of hypotenuse AB, If $AC = 32$ cm and $BC = 60$ cm, then find the length of CM.



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Exercise 7 B

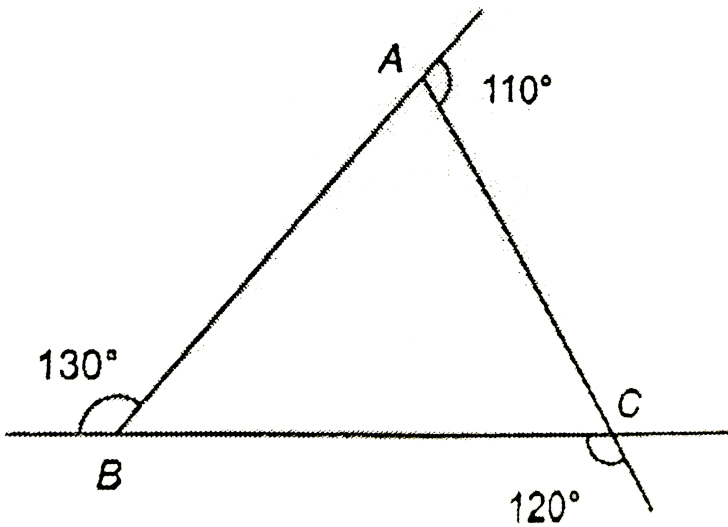
1. In $\triangle ABC$, $AB = 8$ cm, $BC = 15$ cm and $AC = 17$ cm. find the largest angle.

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2. In $\triangle ABC$, $\angle A = 50^\circ$, $\angle B = 60^\circ$. Find the largest side.

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3. In the adjoining figure, write the sides of $\triangle ABC$ in descending order of their length.



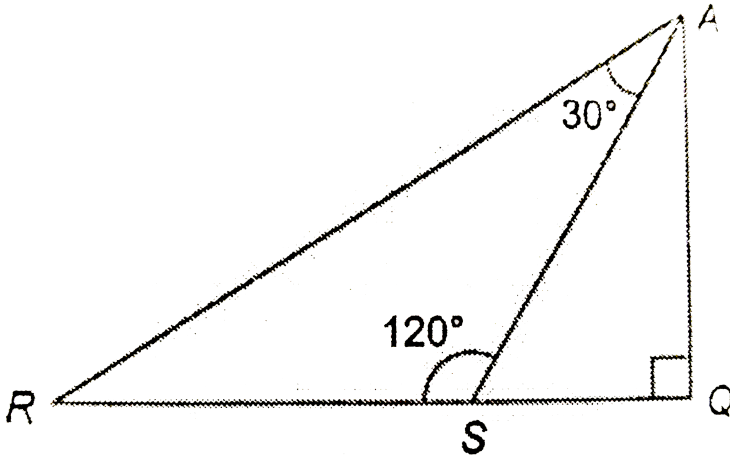
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4. In the adjoining figure, explain :

(i) which side is the greatest side ?

(ii) which of two sides are equal ?

(iii) which is the smallest side of $\triangle AQS$?

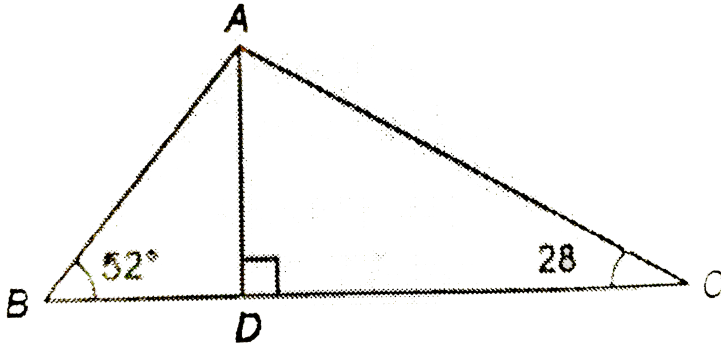


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5. In the adjoining figure,

(i) Which side is smallest ?

(ii) In $\triangle ABC$, what is the nature of $\angle BAC$?



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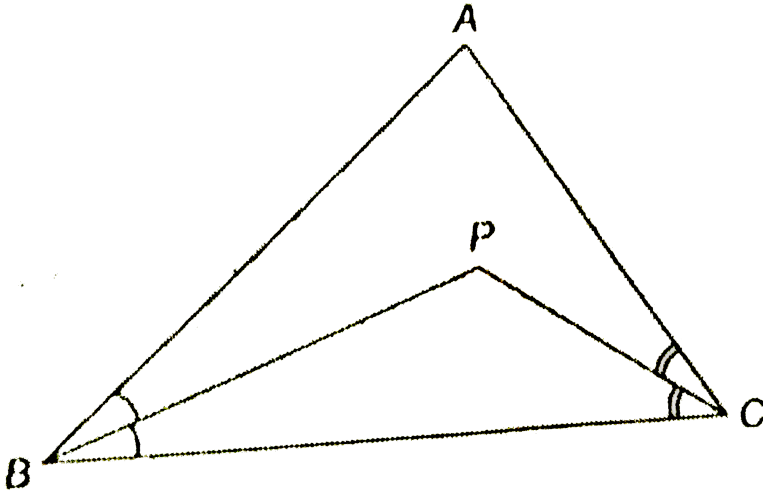
6. In the adjoining figure, $x > y$, Prove that $AB > AC$



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7. In the adjoining figure, $AB > AC$ and the angle bisectors of $\angle B$ and $\angle C$ meet at point P . Prove that

$PB > PC$.

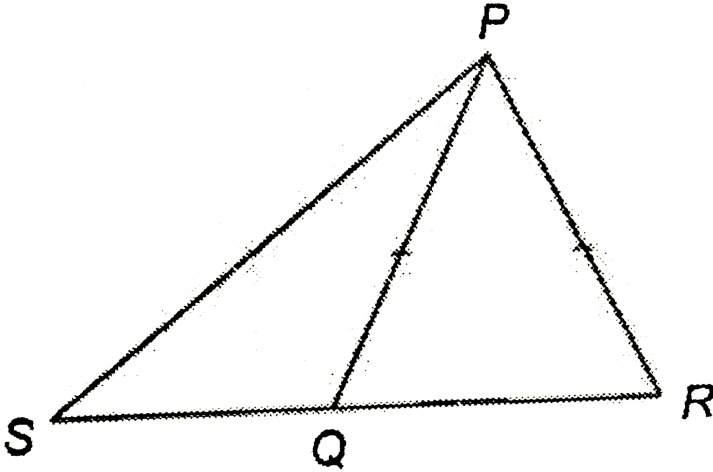


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8. Prove that sum of any two sides of a triangle is greater than twice the median with respect to the third side.

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9. In the adjoining figure, $PQ=PR$. Show that $PS > PQ$.



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10. Prove that the perimeter of a triangle is greater than the sum of its altitudes.

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11. Prove that the sum of the sides of a quadrilateral is greater than twice of one of its diagonal.

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12. Prove that in a quadrilateral the sum of all the sides is greater than the sum of its diagonals.

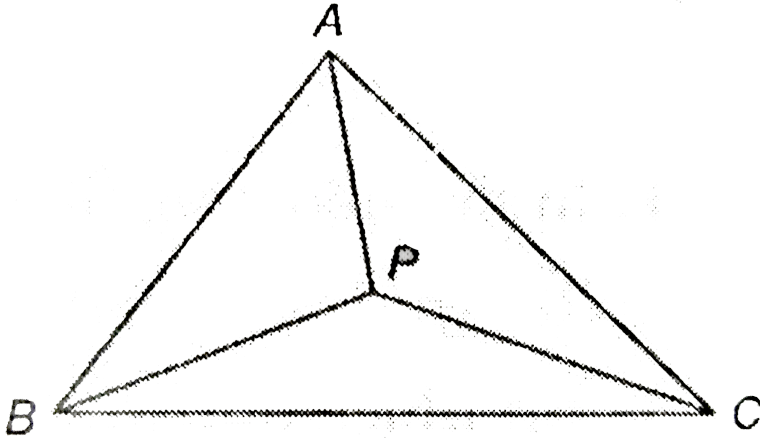
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13. Prove that the perimeter of a triangle is greater than the sum of its three medians.

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14. In the adjoining figure, P is an interior point of $\triangle ABC$. Then prove that :

$$AB + BC + CA < 2(PA + PB + PC)$$



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15. In $\triangle ABC$, if $BC > AC > AB$ then :

- (i) What is the relation $\angle A$ and $\angle C$?
- (ii) What is the relation between the values of $(AB + AC)$ and BC ?
- (iii) What is the relation between the values of $(AC - BC)$ and AB ?
- (iv) What is the smallest angle in $\triangle ABC$?

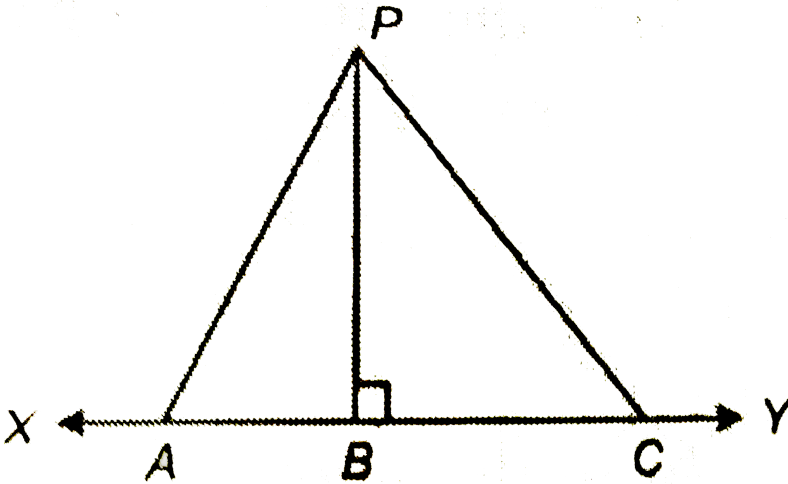


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16. In the adjoining figure, line segment PA , PB and PC are drawn from point P to line XY . Here PB is perpendicular to XY .

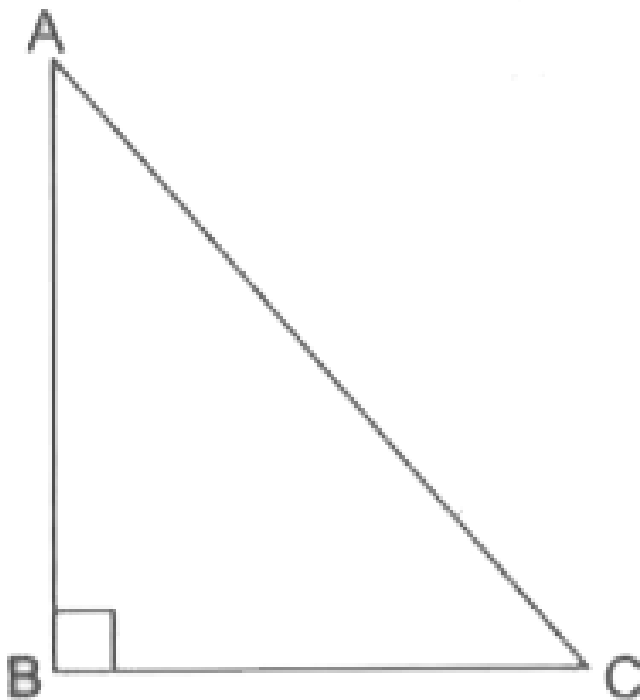
(i) What is the nature of the angles formed by line segment PA and PC from XY ?

(ii) Which line segment is the smallest in the segment PA , PB and PC ?



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17. Show that in a right angled triangle, the hypotenuse is the longest side.



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Revision Exercise Very Short Answer Questions

1. In an isosceles $\triangle ABC$ if $\angle A = 90^\circ$ and $AB = AC$, find $\angle B$ and $\angle C$.

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2. In a right triangle ABC, $\angle B = 90^\circ$ find the longest side.

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3. Can we construct a triangle ABC in which $AB = 3$ cm, $BC = 4$ cm and $AC = 8$ cm ?

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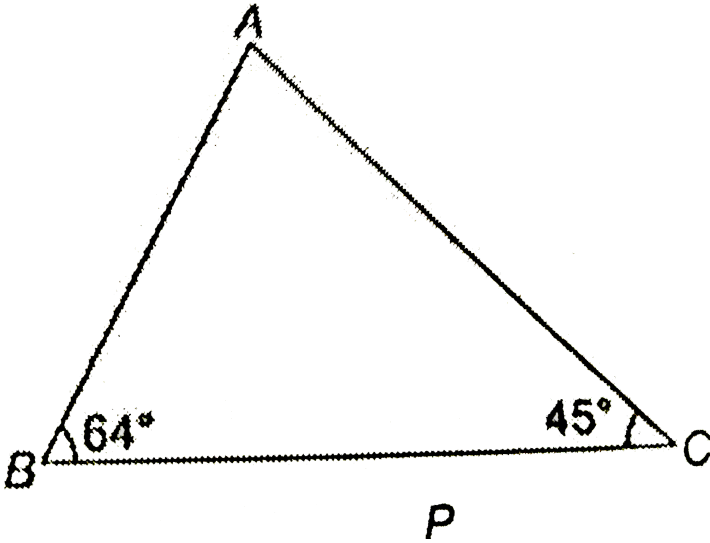
4. Is it possible that a triangle has one obtuse and one right angle ?

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5. In $\triangle XYZ$, $\angle X = 45^\circ$, $\angle Y = 75^\circ$ in another triangle ABC, $\angle A = 45^\circ$, $\angle C = 60^\circ$ and $AC = 6$ cm. find XZ, given that $\triangle XYZ \cong \triangle ABC$.

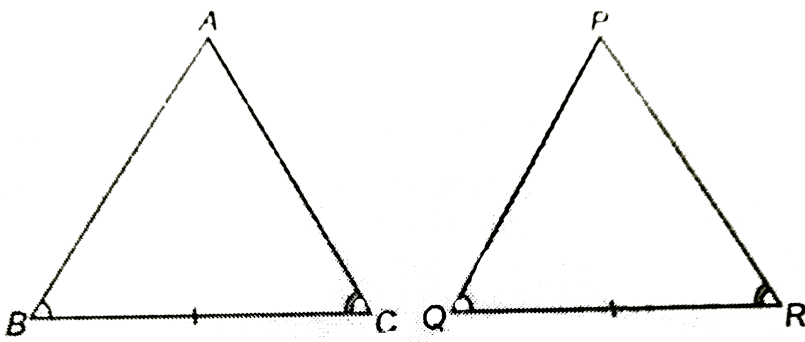
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6. Find the greatest and the smallest side of $\triangle ABC$ in the adjoining figure.



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7. In the given figure whether $\triangle ABC$ is congruent to $\triangle PQR$. Mention the condition for congruence.



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8. In $\triangle ABC$, $\angle A = \angle B = 30^\circ$ name the longest side.

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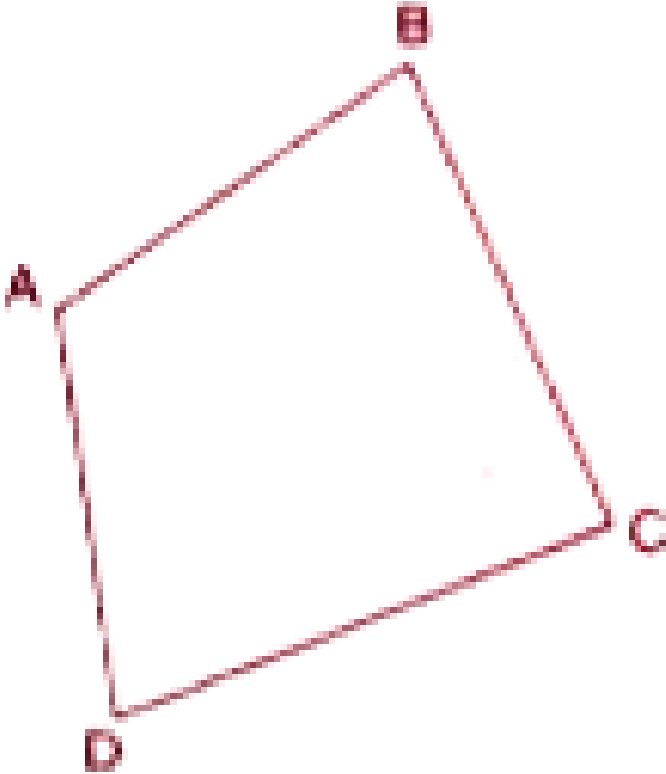
9. In $\triangle ABC$, $AB = 2.5$ cm and $BC = 6$ cm. what is the possible length of AC ?

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10. In quadrilateral ABCD, AB is the shortest side and DC is the longest side. Prove that :

(i) $\angle B > \angle D$

(ii) $\angle A > \angle C$

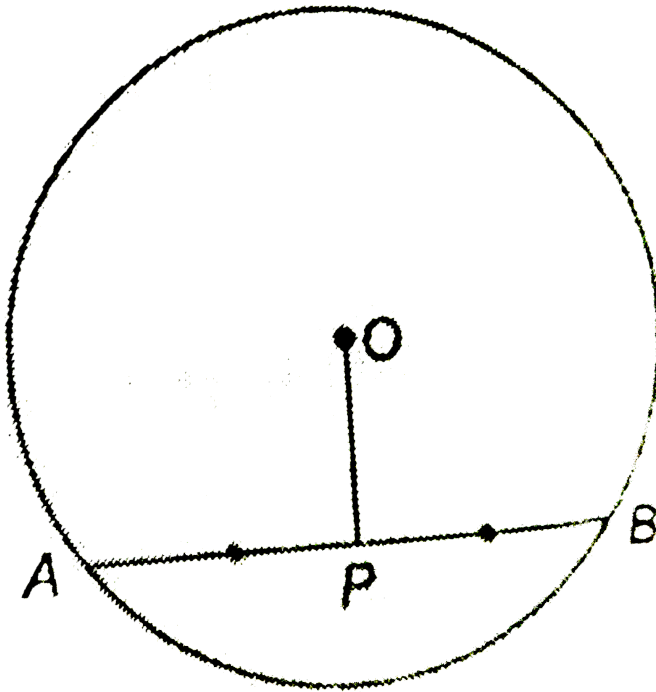


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1. P is any point in the angle ABC such that the perpendicular drawn from P on AB and BC are equal. Prove that BP bisects angle ABC.

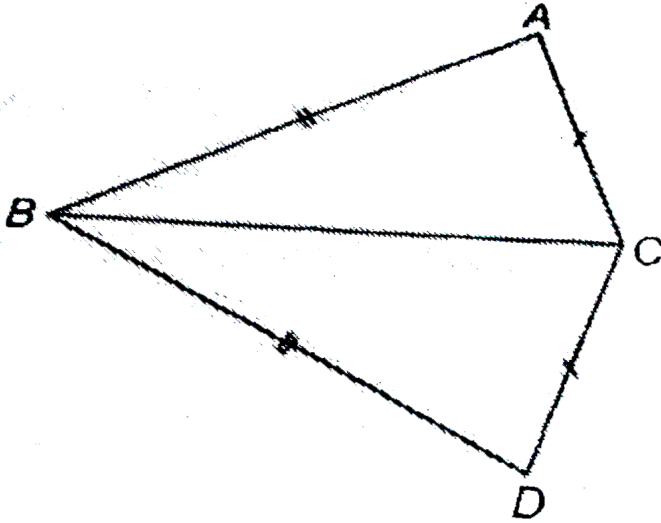
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2. The given figure shows a circle with centre O. P is mid-point of chord AB. Show that OP is perpendicular to AB.



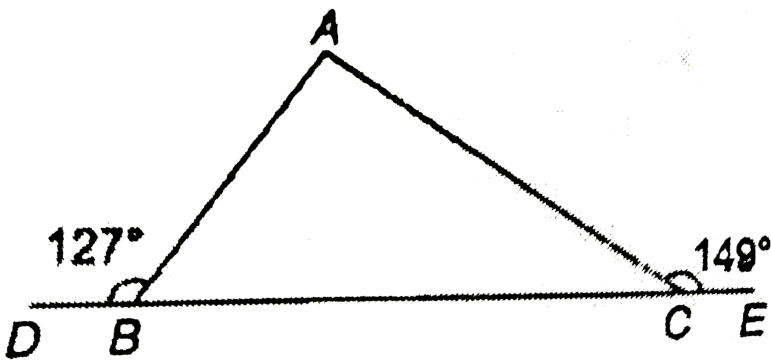
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3. In the given figure $AB = DB$, $AC = DC$ if $\angle ABD = 58^\circ$, $\angle DBC = 2x - 4^\circ$, $\angle ACB = y + 15^\circ$ and $\angle DCB = 63^\circ$, find the values of x and y .



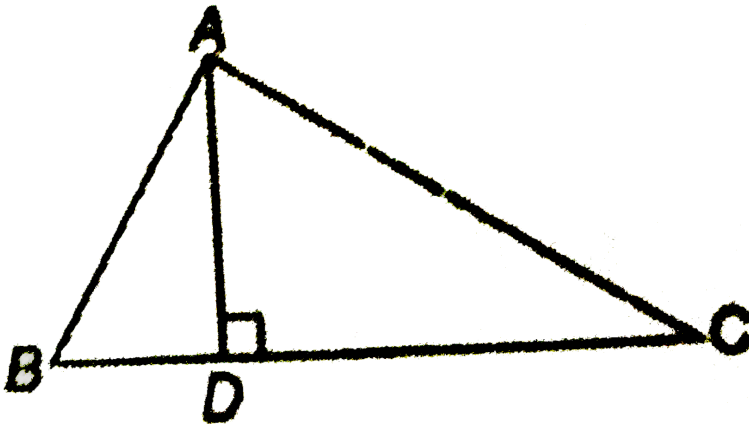
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4. In the adjoining figure, $\angle ABD = 127^\circ$ and $\angle ACE = 149^\circ$. Prove that $AC > AB$.



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5. In the figure, AD is perpendicular to BC , prove that $AB + AC > 2AD$.

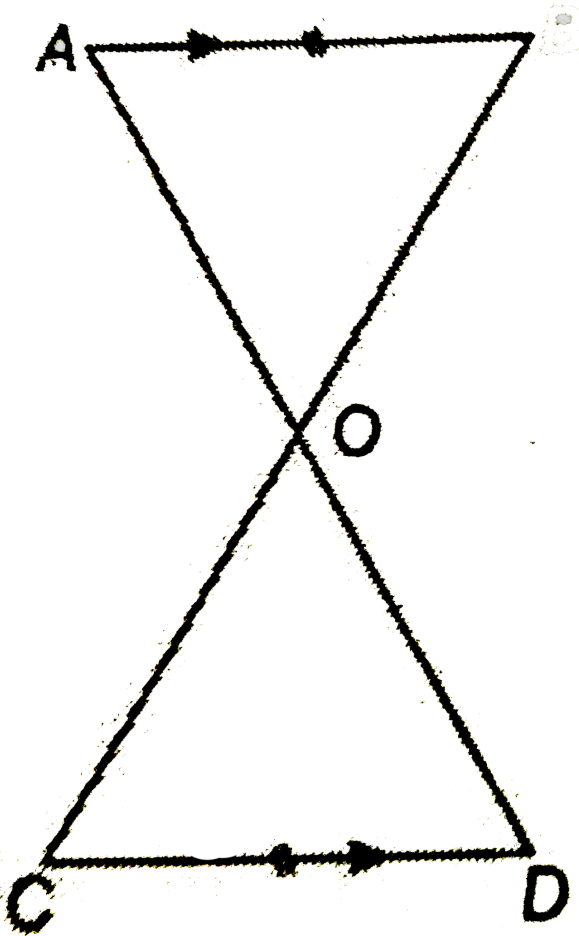


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6. In the adjoining figure $AB = CD$ and $AB \parallel CD$ prove that :

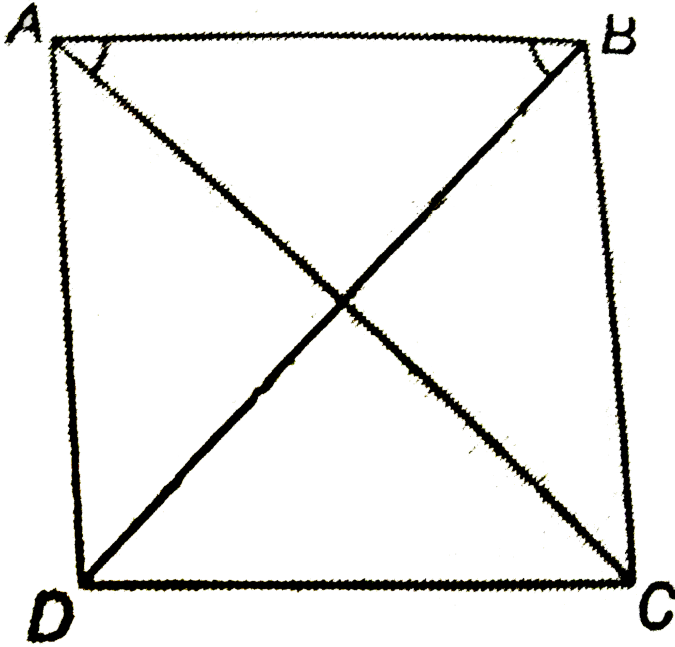
(i) $\triangle AOB \cong \triangle DOG$

(ii) AD and BC bisect each other at point O.



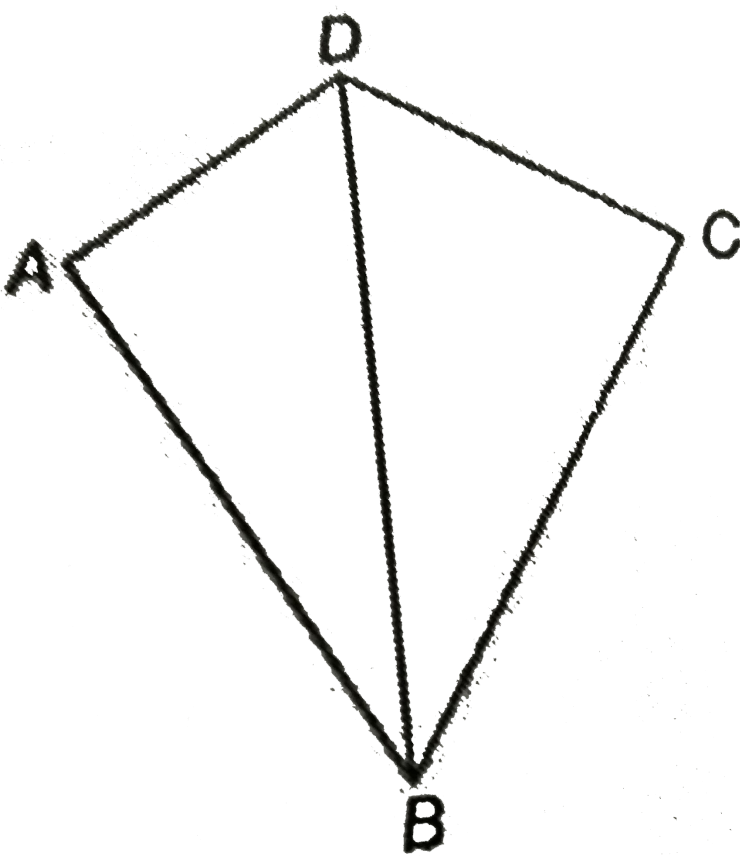
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7. In the adjoining figure, $\angle DAB = \angle ABC$ and $AD = BC$ prove that $BD = AC$.



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8. In the adjoining figure, $AD = DC$ and DB bisects $\angle ADC$. Prove that $\triangle ADB \cong \triangle CDB$.



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9. In $\triangle ABC$, $AB = AC$ and D is a point in BC so that $BD = CD$. Prove that AD bisects $\angle BAC$.

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10. In PQR , S is any point on the side QR . Show that $PQ + QR + RP > 2PS$

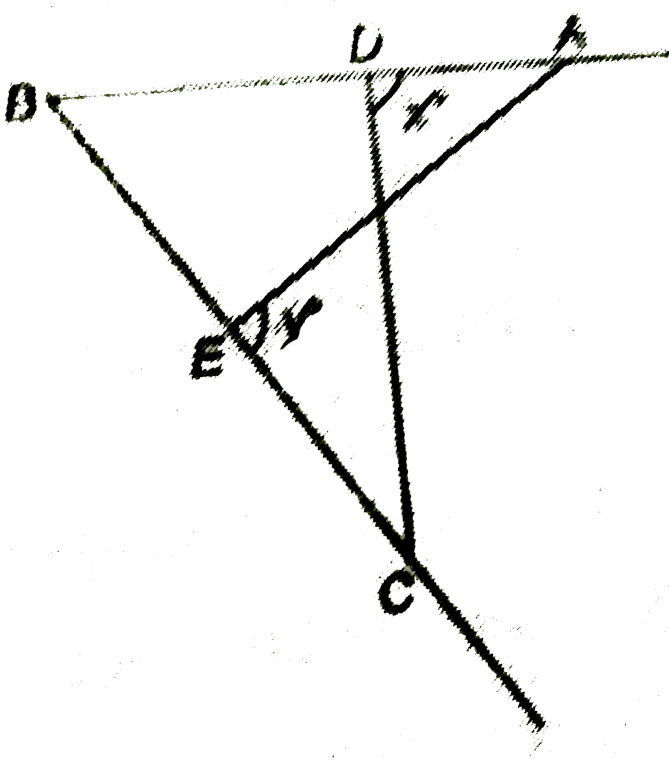


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Revision Exercise Long Answer Type Question

1. In the given figure, if $x = y$ and $AB = CB$, then prove that $AE = CD$

.

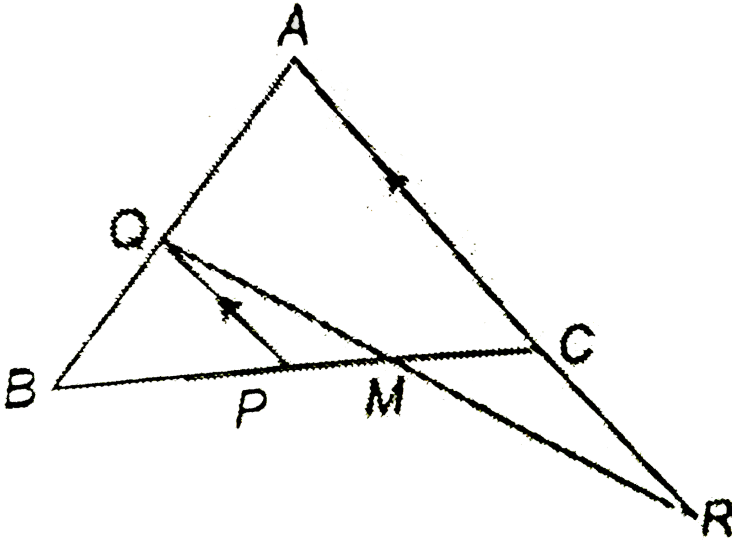


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2. ABC is a triangle, right angled at B . If $BCDE$ is a square on side BC and $ACFG$ is a square on AC , prove that $AD = BF$.

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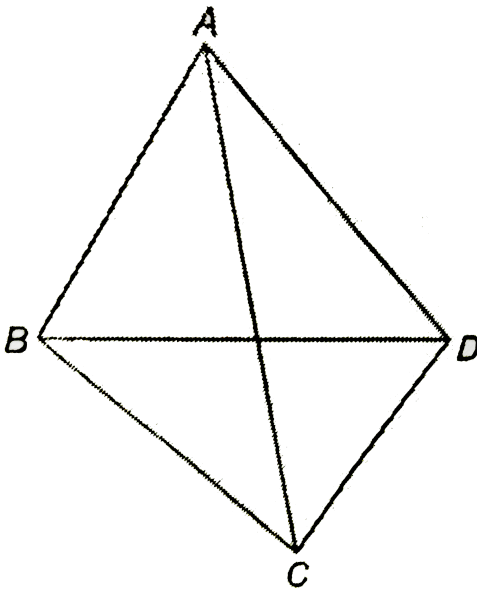
3. In the given figure, ABC is an equilateral triangle, $PQ \parallel AC$ and AC is produced to R such that $CR = BP$. Prove that QR bisects PC .



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4. The given figure shows a quadrilateral $ABCD$. Prove that :

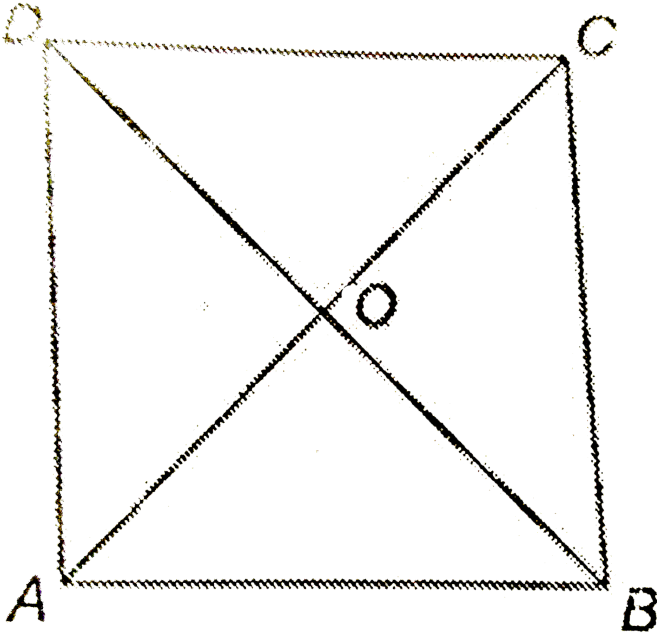
$$AB + BC + CD + DA > AC + BD$$



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5. In the adjoining figure, the diagonals AC and BD of a quadrilateral ABCD intersect point O. Prove that :

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



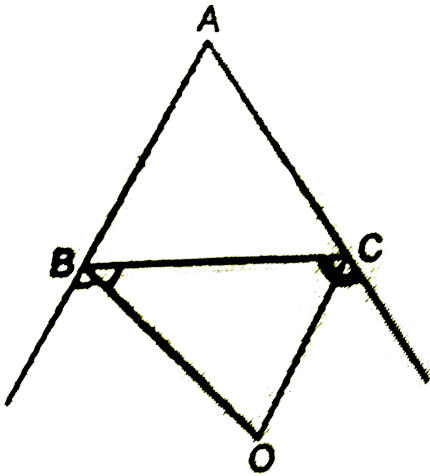
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6. Let O be any point in the interior of $\triangle ABC$, prove that :

$$AB + BC + CA < 2(OA + OB + OC)$$

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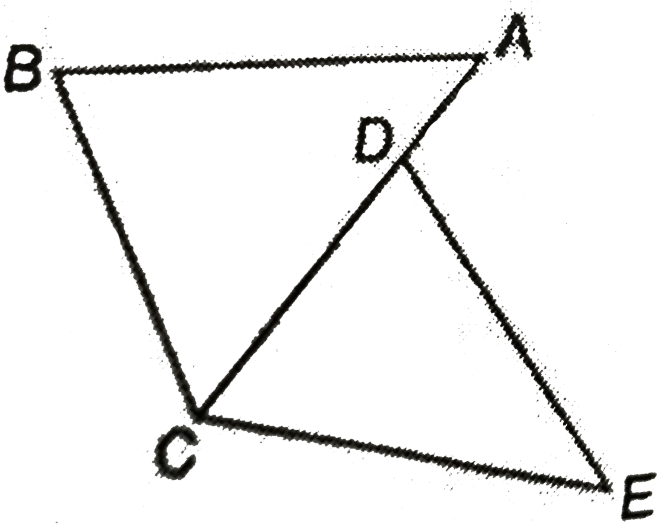
7. In the adjoining figure BO and CO are the bisectors of $\angle CBD$ and $\angle BCE$ respectively. If $AC > AB$, prove that $OB > OC$.



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8. In the following figure, if $AD = DE$. Prove that :

$$AB + BC > CE$$



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