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CLASS 9 MATHS NOTES

TRIANGLES

CHAPTER-7

TRIANGLES

KEY POINTS

- Two figures having the same shape and size are called congruent figures.
- Two plane figures are congruent, if each one when superimposed on the other, covers the other exactly.
- Two line segments are congruent, if they are of equal lengths.
- Two angles of equal measures are congruent.
- Two circles of the same radii are congruent.
- Two squares of the same sides are congruent.
- Two rectangles are congruent, if they have the same length and breadth.
- If two triangles ABC and DEF are congruent under the correspondence $A \longleftrightarrow D$, $B \longleftrightarrow E$ and $C \longleftrightarrow F$, then symbolically, it is expressed as $\Delta ABC \cong \Delta DEF$.
- There are four congruent conditions for triangles.

  (a) **Side-Angle-Side (SAS) congruent rule :** Two triangles are congruent, if two sides and the included angle of the one triangle respectively equal to the two sides and the included angle of the other triangle.

  (b) **Angle-Side-Angle (ASA) congruence rule :** Two triangles are congruent, if two angles and the included side of the one triangle are respectively equal to the two angles and the included side of the other triangle.

  (c) **Side-Side-Side (SSS) congruence rule :** Two triangles are congruent, if the three sides of one triangle are respectively equal to the three sides of the other triangle.

  (d) **Right angle-Hypotenuse-Side (RHS) congruence rule :** Two right triangles are congruent, if the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one

side of the other triangle.

- Angles opposite to equal sides of a triangle are equal.
- Sides opposite to equal angles of a triangle are equal.
- In a triangle, angle opposite to the longer side is larger (greater).
- In a triangle, side opposite to the larger (greater) angle is longer.
- Sum of any two sides of a triangle is greater than the third side.

Important Questions with Solutions

Part – A

1. Which of the following is not a congruence criterion for triangles?

   (a) SSS (b) RHS

   (c) AAA (d) SAS

2. If AB ≅ CD then

   (a) AB < CD (b) AB + CD = 0

   (c) AB = CD (d) AB > CD

3. If $\Delta ABC \cong \Delta DEF$ then

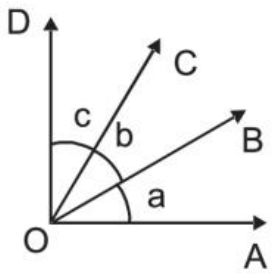
   (i) AB = _____ (ii) BC = _____

   (iii) CA = _____ (iv) $\angle E$ = _____

   (v) $\angle EDF$ = _____ (vi) $\angle BCA$ = _____

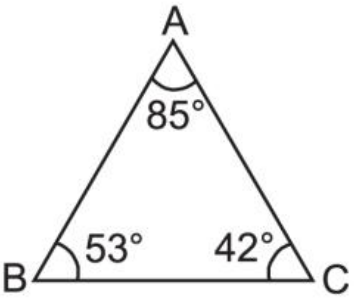
4. Circle O_1 ≅ Circle O_2. If radius of circle O_1 = 6 cm then diameter of circle O_2 is _____.

5. In the given figure, if a = b = c then $\angle AOC \cong$ _____

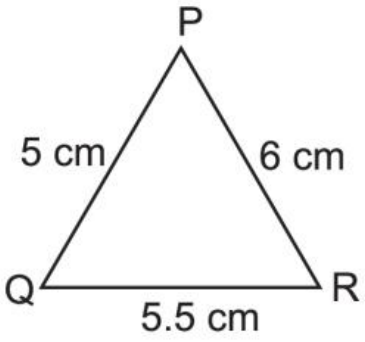


6. If $\Delta PQR \cong \Delta DEF$ then $Q \longleftrightarrow$ _____

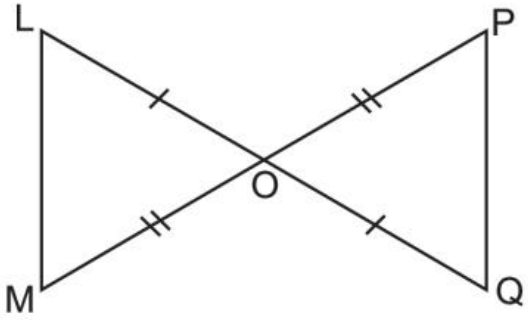
7. Which is the longest side of the triangles given in the figure?



8. Which is the largest angle in the ΔPQR?



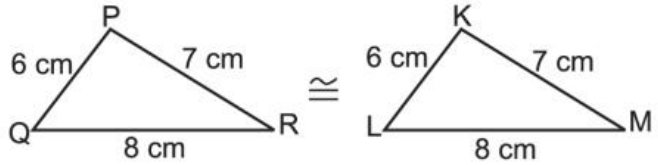
9. Which two triangles are congruent in the given figure. Write them in symbolic form.

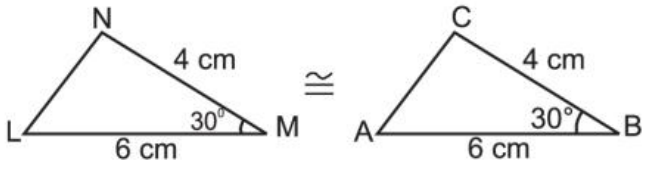


10. Two squares are congruent if they have _____.

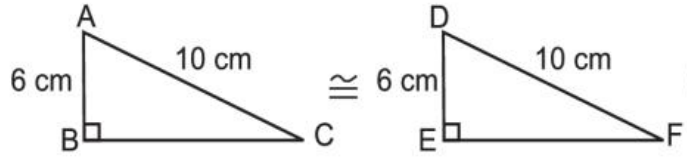
Part – B

11. Match the columns :

Column A		Column B
(i) 		(a) SAS congruence

(ii) 

(b) SSS congruence

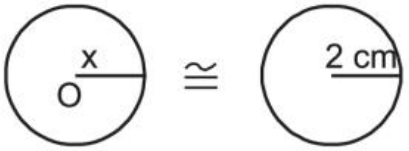
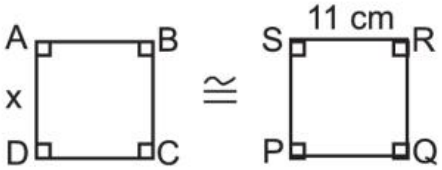
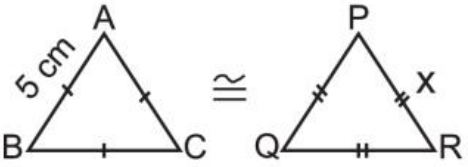
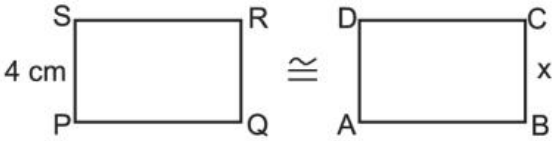
(iii) 

(c) ASA congruence

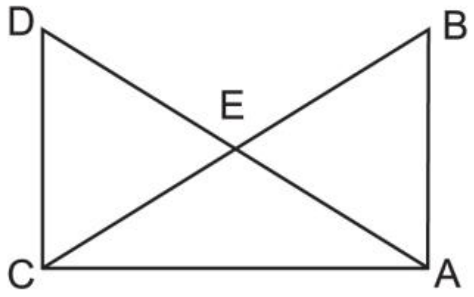
(iv) 

(d) RHS congruence

12. Match the columns :

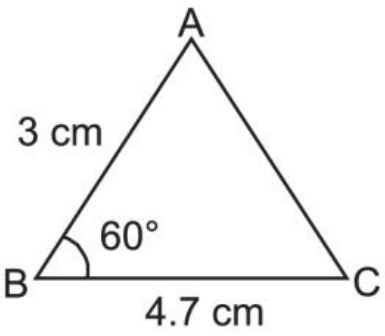
Column A			Column B
(i)		x = ?	(a) 2 cm
(ii)		x = ?	(b) 5 cm
(iii)		x = ?	(c) 10 cm
(iv)		x = ?	(d) 4 cm
(v)		x = ?	(e) 11 cm

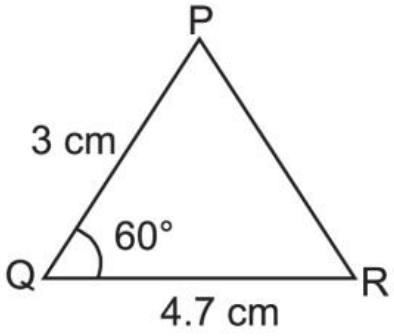
13. In the given figure. If AB = CD, AD = BC then prove that $\Delta ADC \cong \Delta CBA$



14. If ΔABC is an isosceles triangle such that AB = AC, then prove that altitude AD from A on BC bisects it.

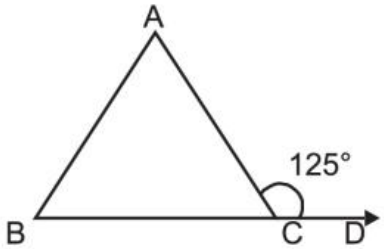
15. Which criteria of congruence of triangles is satisfied in the given figure.





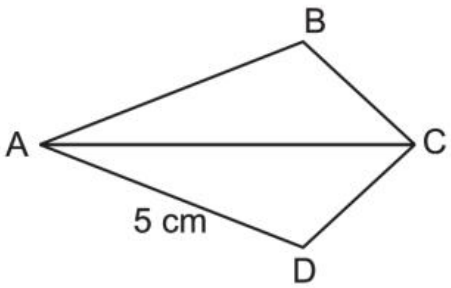
16. In a ΔPQR, $\angle P = 110°$, PQ = PR. Find $\angle Q$ and $\angle R$.

17. In the given figure AB = AC and $\angle ACD = 125°$. Find $\angle A$



18. In ΔABC, if $\angle A = 55°$, $\angle B = 75°$ then find out the smallest and longest side of the triangle.

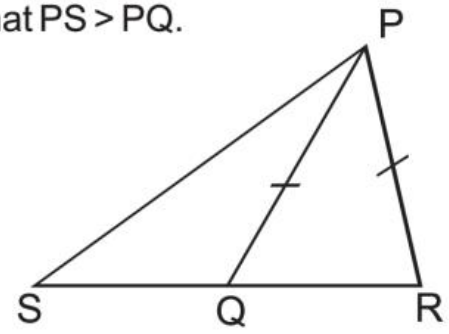
19. In the given figure, AC bisects $\angle A$ and $\angle C$. If AD = 5 cm find AB.



20. The vertex angle of an isosceles triangle is 80°. Find out the measure of base angles.

Part – C

21. In the given figure, Q is a point on the side SR of ΔPSR such that PR = PR. Prove that PS > PQ.

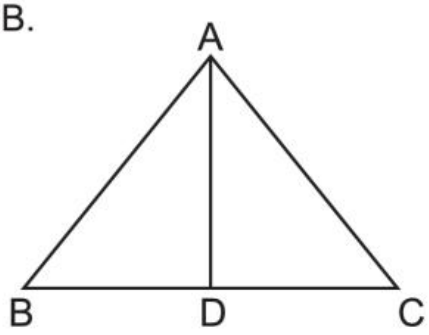


22. ABC is a triangle and D is the mid-point of BC. The perpendicular from D to AB and AC are equal. Prove that triangle is isosceles.

23. Prove that angles opposite to the equal sides of an isosceles triangle are equal.

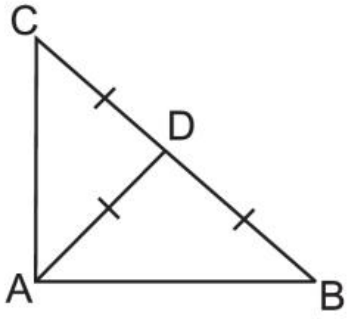
24. In the given figure, AC > AB and AD bisects $\angle BAC$.

Prove that $\angle ADC > \angle ADB$.

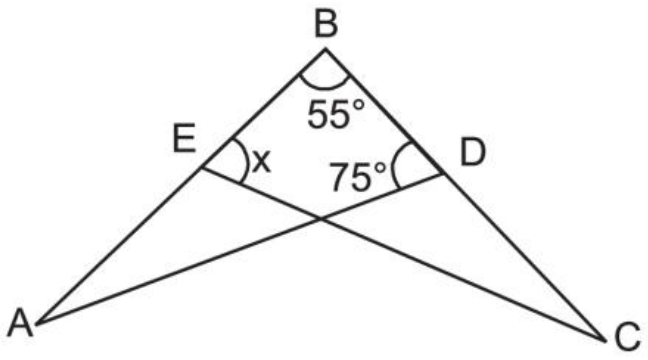


25. S is any point in the interior of a ΔPQR. Prove that SQ + SR < PQ + PR.

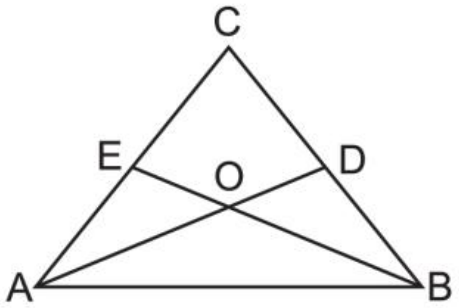
26. In the given figure, if AD = BD = CD. Find $\angle BAC$.



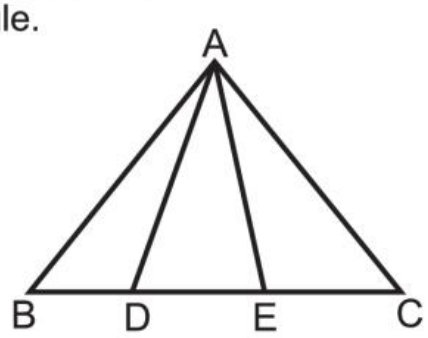
27. In the given figure, if AB = BC and $\angle A = \angle C$ then find the value of x.



28. In the given figure, $\angle ABC = \angle BAC$, D and E are points on BC and AC respectively such that DB = AE. If AD and BE intersect at O then prove that OA = OB.



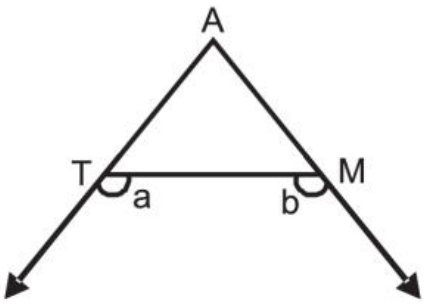
29. In the given figure, if AB = AC, $\angle BAD = \angle CAE$ then prove that ΔADE is an isosceles triangle.



30. In ΔDEF, $\angle E = 2\angle F$•DM is the angle bisector of $\angle EDF$ that intersects EF at M. If DM = MF, then prove that $\angle EDF = 72°$.

31. Prove that the angles of an equilateral triangle are 60° each.

32. In the given figure, $\angle a > \angle b$, show that $\angle ATM < \angle AMT$.



Part – D

33. AF, BD and CE altitudes of ΔABC are equal. Prove that ΔABC is an equilateral triangle.

34. Prove that two triangles are congruent if two angles and the included side of one triangle are equal to the two angles and the included side of the other triangle.

35. O is any point in the interior of a ΔABC. Prove that $OA + OB + OC > \frac{1}{2}$ (AB + BC + CA).

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

37. Two sides AB, BC and median AM of one ΔABC are respectively equal to sides PQ, QR and median PN of ΔPQR. Show that :

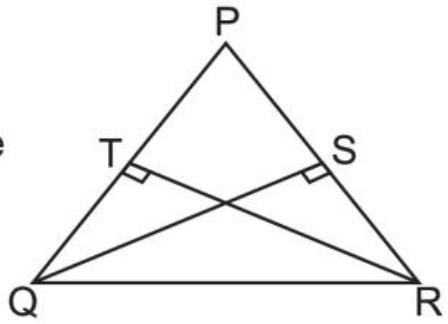
    (i) $\Delta ABM \cong \Delta PQN$

    (ii) $\Delta ABC \cong \Delta PQR$

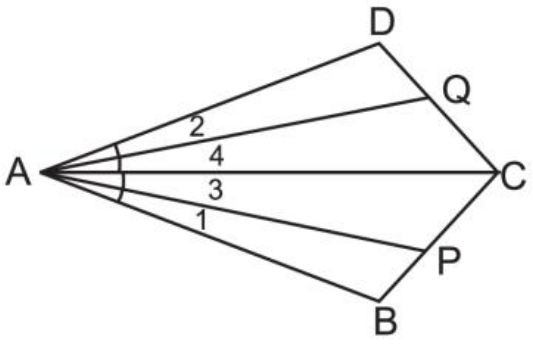
38. In the given figure, PQR is a triangle in which altitudes QS and RT to sides PR and PQ are equal. Show that

    (i) $\Delta PQS \cong \Delta PRT$

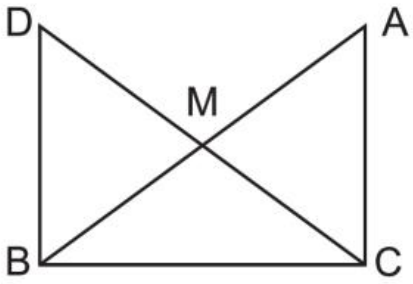
    (ii) PQR is an isosceles triangle



39. In the given figure, AB = AD, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$. Prove that AP = AQ.

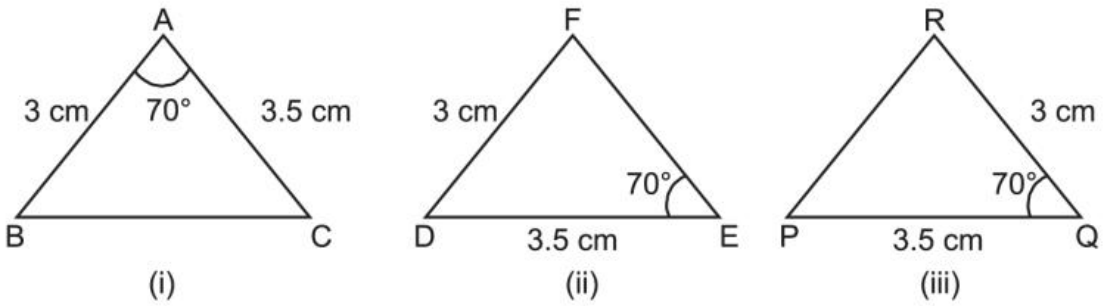


40. In the given figure, ABC is a right angled triangle, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. D is joined to B. Prove that $CM = \frac{1}{2} AB$



41. Prove that the sum of any two sides of a triangle is greater than its third side.

42. Vandana wishes to literate the poor children of the nearby slum area. She makes flash cards for them as shown in the given figure.



(a) Which two flash cards are congruent?

(b) Which criteria of congruency is satisfied here?

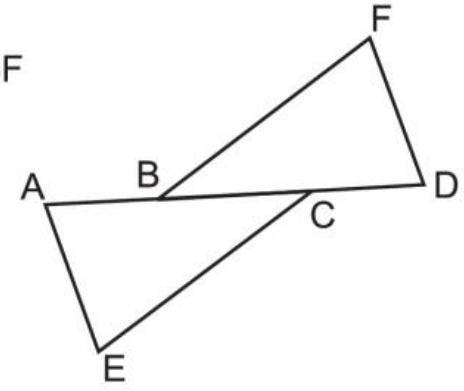
(c) Write the third side of both the triangles which are equal by CPCT.

43. Prove that the sum of any two sides of a triangle is greater than twice the median drawn to the third side.

44. In the given figure, AB = CD, CE = BF and $\angle ACE = \angle DBF$. Prove that

(i) $\Delta ABD = \Delta DBF$

(ii) AE = DF



CHAPTER-7

TRIANGLES

ANSWERS

1. (c) 2. (c)

3. (i) DE (ii) EF (iii) FD

   (iv) $\angle B$ (v) $\angle BAC$ (vi) $\angle EFD$

4. 12 cm 5. $\angle BOD$ 6. E

7. BC 8. $\angle Q$ 9. $\Delta LOM \cong \Delta QOP$

10. same sides length

11. (i) (b) (ii) (a) (iii) (d)

    (iv) (c)

12. (i) (c) (ii) (a) (iii) (e)

    (iv) (b) (v) (d)

15. SAS 16. $\angle Q = \angle R = 35^0$ 17. $\angle A = 70^0$

18. Smallest side = AB

    Longest side = AC

19. AB = 5 cm 20. $50^0, 50^0$ 26. $\angle BAC = 90^0$

27. 75^0

42. (a) (i) and (iii)

    (b) $\Delta ABC \cong \Delta QRP$ (SAS Congruency)

    (c) BC = PR

43. (a) BD

PRACTICE TEST

Time : 50 Min. **Triangles** M.M. 20

1. Find the measure of each exterior angle of an equilateral triangle. (1)

2. Which of the following is not a criterion for congruence of triangles? (1)

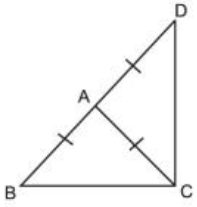
   (a) SSA (b) SAS

   (c) ASA (d) SSS

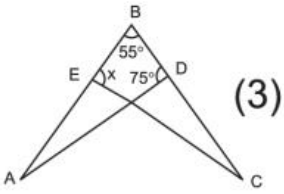
3. In a ΔABC, If AB = AC and $\angle A = 70$. Find $\angle B$ and $\angle C$. (2)

4. The vertical angle of an isosceles triangle is 100°. Find its base angle. (2)

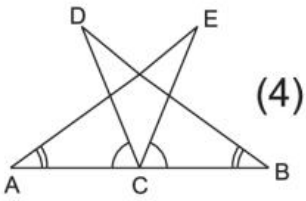
5. In the given figure, ABC is a triangle in which AB = AC, side BA is produced to D such that AB = AD. Prove that $\angle BCD = 90°$. (3)



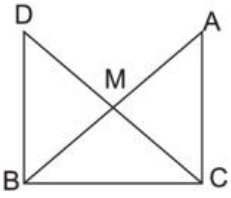
6. In the given figure, if AB =BC and $\angle A = \angle C$. Then find the value of x. (3)



7. In the given figure, C is the midpoint of AB, if $\angle DCA = \angle ECB$ and $\angle DBC = \angle EAC$, Prove that DC = EC and BD = AE. (4)



8. In the given figure ABC is a right angled triangle, right angled at C. M is the mid-point of hypotenuse is joined to M and produced to a point D such that DM = CM. D is joined to B. (4)



Show that $CM = \frac{1}{2}AB$.