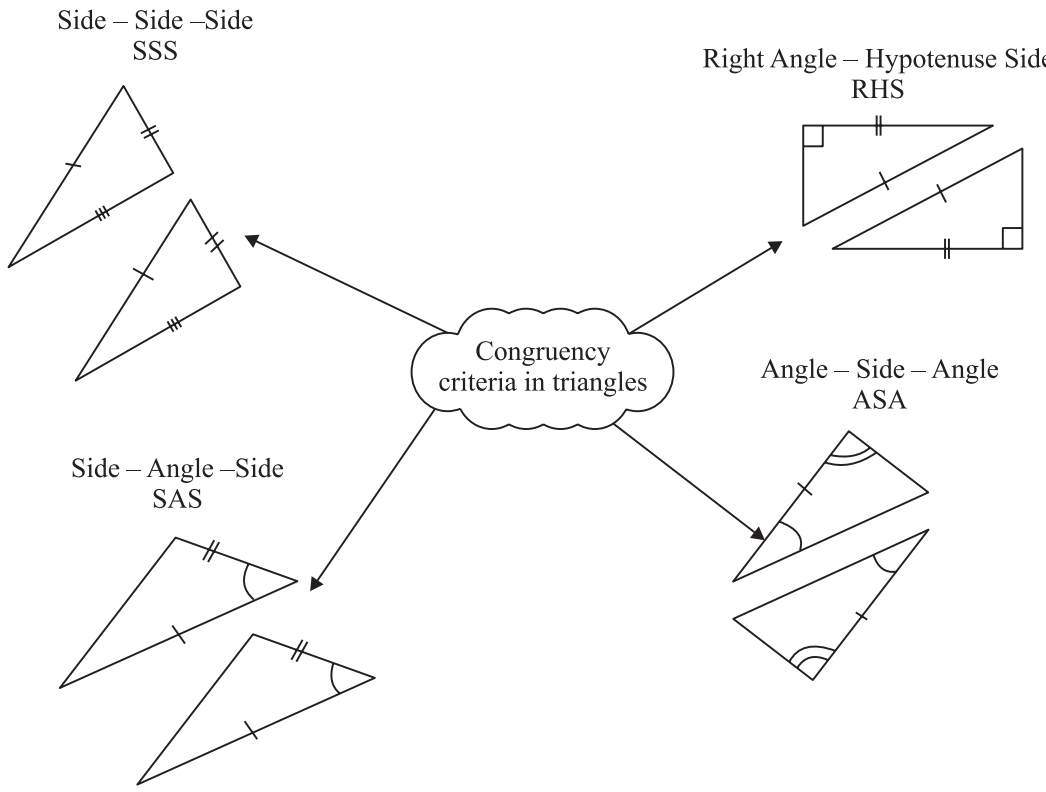
Chapter-7
TRIANGLES

MIND MAP



Key points

Congruence in different shapes

- 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 have 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.

Congruency Criteria:

- If two triangles ABC and DEF are congruent under the correspondence $A \leftrightarrow D$, $B \leftrightarrow E$ and $C \leftrightarrow F$, then symbolically, it is expressed as $\Delta ABC \cong \Delta DEF$.
- There are four congruent criteria for triangles:

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

Very Short Answer Question (1 Mark)

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

(a) SSS (b) RHS

(c) AAA (d) SAS

2. If $AB \cong CD$ then

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

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

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

(a) $AC = DE$ (b) $BC = DF$

(c) $FE = CB$ (d) $AB = DF$

4. If one angle of a triangle is equal to the sum of the other two angles, then the triangle is

(a) an equilateral triangle (b) an isosceles triangles

(c) an obtuse triangle (d) a right triangle

5. **If *AB* = *QR*, *BC* = *PR* and *CA* = *PQ*, then**

(a) $\Delta ABC \cong \Delta PQR$ (b) $\Delta CBA \cong \Delta PRQ$

(c) $\Delta BAC \cong \Delta RPQ$ (d) $\Delta PQR \cong \Delta$BCA

6. Two figures are congruent if they have the _____ shape and same _____.

7. Two circles are congruent if they have _____ radii.

8. Two equilateral triangles are congruent, if they have _____ sides.

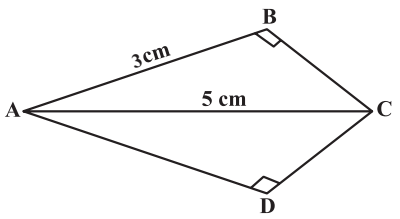
9. Two square are congruent if they have _____ sides.

10. If $\Delta PQR \cong \Delta LMN$ then QR = _____

11. In ΔABC, $AB = AC$ and $\angle B = 40°$, then find $\angle$C.

12. Write correct symbolic form of congruency if $AB = QR$, $BC = PR$ and $CA = PQ$.

13. In the given figure, AC is bisector of $\angle BAD$. AB = 4 cm and AC = 5 cm, then find AD.

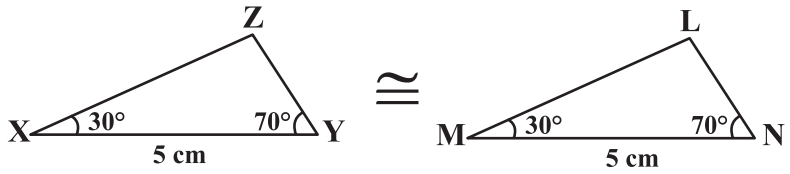


14. Find the diameter of circle O_2, if circle $O_2 \cong$ Circle O_1 and radius of circle O_1 is 6 cm

15. Write the congruence criteria for triangles ΔABC and ΔQPR where $AB = QP$, $\angle B = \angle P$ and $BC = PR$.

16. For right angled triangle ΔABC, $AB = BC$, find $\angle A$.

17. Write the congruence criteria for the following triangles.



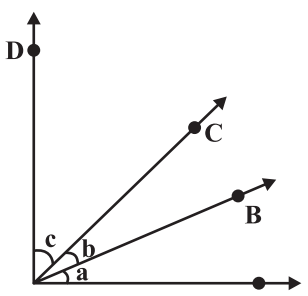
18. Name the side equal to side NL if $\Delta PQR \cong \Delta LMN$.

19. Line segment MN = 4 cm and TP = 4.2 cm. Are they congruent?

20. What does it mean if two triangles are congruent by SSS criteria?

21. In ΔPQR, $\angle R = \angle P$, $QR = 4$ cm and $PR = 5$ cm. Find PQ.

22. In the given figure if $a = b = c$, then name the angle congruent to $\angle AOC$.



23. What does 'R' stands for in RHS congruence?

24. In ΔBCD and ΔWXY, $BD = WX$ and $\angle B = \angle X$. What should be the third possibility to satisfy ASA congruency criterion?

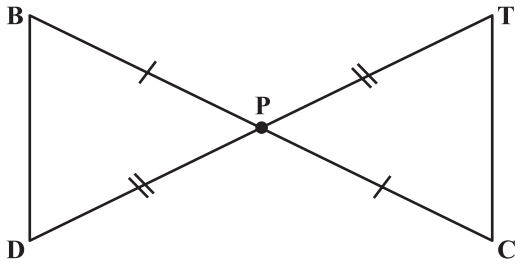
25. If $\Delta ABC \cong \Delta MNO$ then $\angle ABC = ?$

Short Answer type-I questions (2 marks)

26. If $\Delta ABP \cong \Delta KST$ then

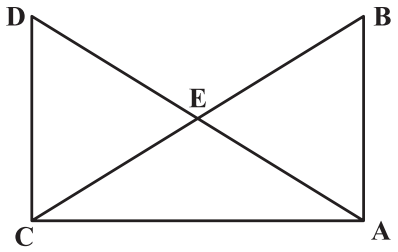
(a) $\angle P =$ _____ (b) $KT =$ _____

27. In the following figure, which of the two triangles are congruent? Name them in symbolic form.



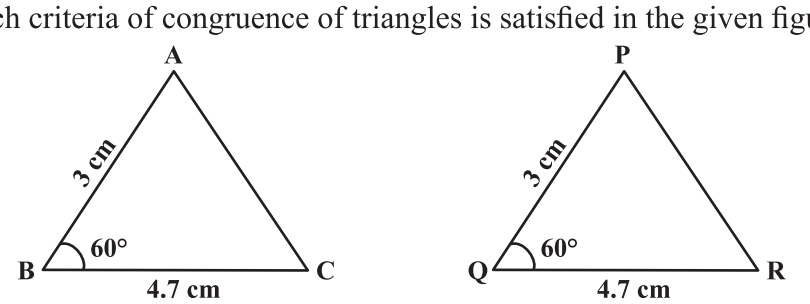
28. Explain why AAA is not a criteria for congruency of two triangles.

29. In the given, if $AB = CD$, $AD = BC$ then prove that $\Delta ADC \cong \Delta CBA$



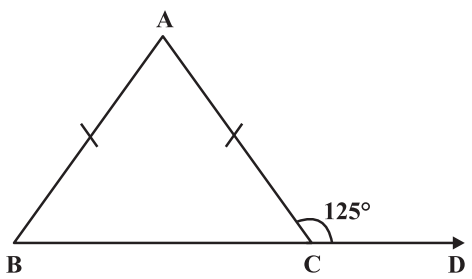
30. If ΔABC is an isosceles triangle such that $AB = AC$, then prove that altitude AD from A on BC bisects it.

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

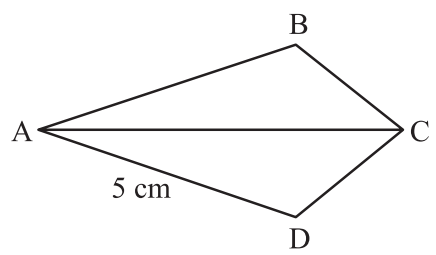


32. In a ΔPQR, $\angle P = 110°$, $PQ = PR$. Find $\angle Q$ and $\angle R$.

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



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



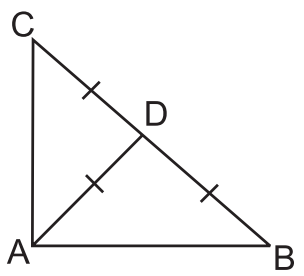
35. The vertex angle of an isosceles triangle is 80°. Find out the measure of base angles.

Short Answer type-II Questions (3 Marks)

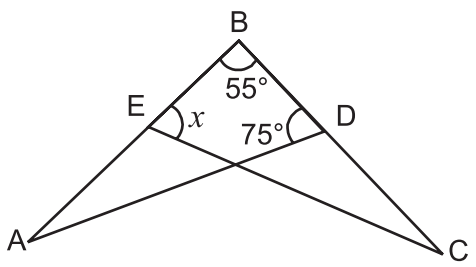
36. ABC is a triangle and D is the mid-point of BC. The perpendicular from D to AB and AC are equal. Prove that triangle is isosceles.

37. Prove that angles opposite to equal sides of an isosceles triangles are equal.

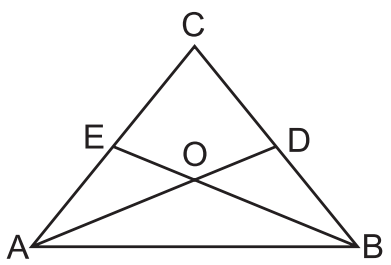
38. In the given figure, If $AD = BD = CD$, find $\angle BAC$



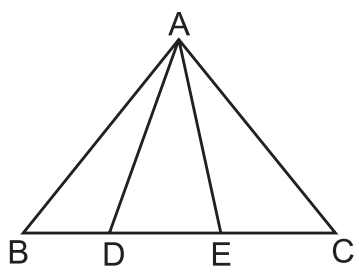
39. In the given figure, if $AB = BC$ and $\angle A = \angle C$ then find the value of x.



40. 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 $OA = OB$.



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



42. In ΔDEF, DM is the angle bisector of$\angle EDF$ that intersectsEF at$M$. If $DM = MF$, and $\angle E = 2\angle F$ then prove that $\angle EDF = 72°$

43. Prove that each angle of an equilateral triangle is 60^0.

Long Answer Questions (5 Marks)

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

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

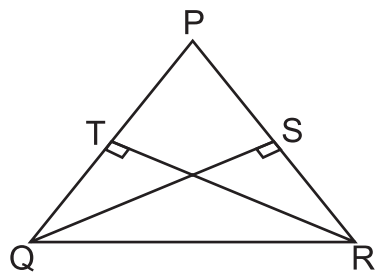
(i) $\Delta ABM \cong \Delta PQN$

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

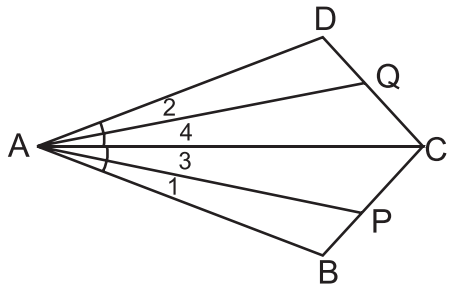
46. In the given figure, PQR is a triangle in which altitudes QS and RT to sides PR and PQ are equal. Show that.

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

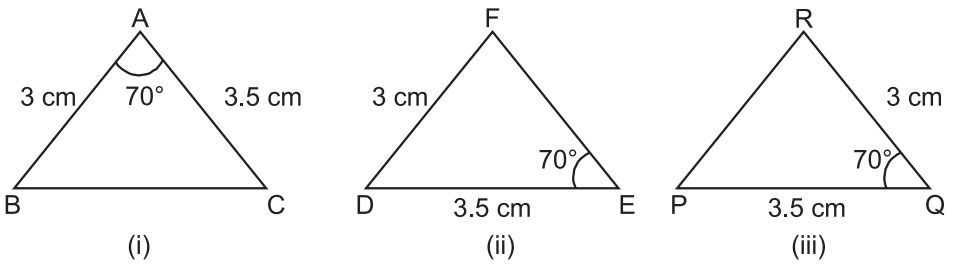
(ii) PQR is an isosceles triangle



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



48. 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.

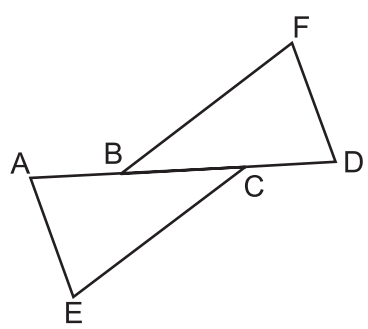
(b) Which criteria of congruency is satisfied here?

(c) Write the third side of both the triangles using *CPCT*.

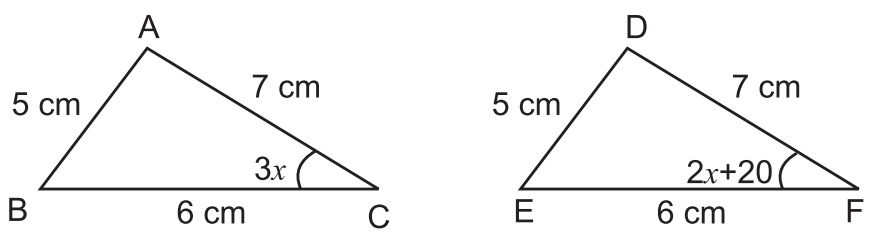
49. In the given figure $AB = CD$, $CE = BF$ and $\angle ACE = \angle DBF$. Prove that

(i) $\Delta ACE \cong \Delta DBF$

(ii) $AE = DF$



50. Show that the triangles ΔABC and ΔDEF in the given figure are congruent. Hence find the value of x.



Chapter - 7
TRIANGLES
Answers

1. (c) AAA

2. (c) $AB = CD$

3. (c) $FE = CB$

4. (d) a right triangle

5. (b) $\Delta CBA \cong \Delta PRQ$

6. same, size

7. equal

8. equal

9. equal

10. QR = MN

11. 40°

12. $\Delta ABC \cong \Delta QRP$

13. AD = 3cm

14. 12 cm

15. SAS

16. $\angle A = 45°$

17. ASA

18. $NL = RP$

19. No

20. It means all three sides of one triangle are respectively equal to three sides of other triangle.

21. PQ = 4 cm

22. $\angle BOD$

23. Right angle

24. $\angle D = \angle W$

25. Sides of squares must be equal

26. (a) $\angle T$ (b) AP

27. $\Delta PBD \cong \Delta PCT$ or any correct form

28. Becuase many triangles are possible with given three angles.

29. In ΔADC and ΔCBA

$AB = CD$ (given)

$AD = BC$ (given)

$AC = AC$ (common)

$\therefore\ \Delta ADC \cong \Delta CBA$ (by SSS congruence rule)

30. In ΔABD and ΔACD

$AB = AC$ (given)

$AD = AD$ (common)

$\angle ADB = \angle ADC$ (each 90°)

$\therefore\ \Delta ABD \cong \Delta ACD$ (By RHS congruence rule)

$\Rightarrow BD = CD$ (by CPCT)

31. SAS

32. $\angle Q = \angle R = 35°$

33. $\angle A = 70°$

34. $AB = 5$ cm

35. 50°, 50°

36. In ΔBDE and ΔCDF

$BD = CD$ (given)

$DE = DF$ (given)

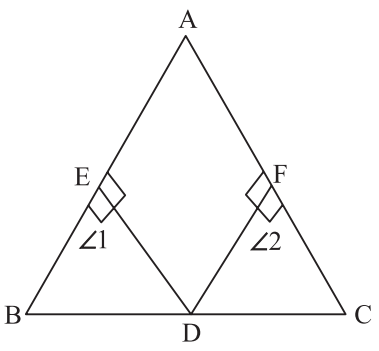
$\angle 1 = \angle 2$ (each 90°)

By RHS congruence rule

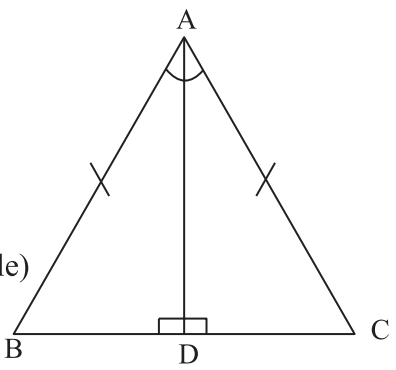
$\Delta BDE \cong \Delta CDF$

$\Rightarrow$ $\angle B = \angle C$ (By *CPCT*)

$\Rightarrow$ $AB = AC$ ($\because$ sides opposite to equal angles are equal)



37. Construction: $AD \perp BC$



In ΔADB and ΔADC

$AB = AC$ (given)

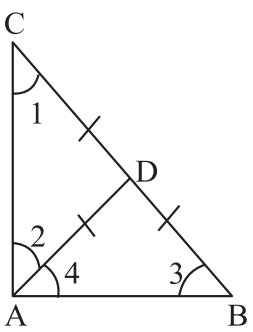
$AD = AD$ (common)

$\angle ADB = \angle ADC$ (each 90°)

$\therefore \quad \Delta ADB \cong \Delta ADC$ (By RHS congruence rule)

$\Rightarrow \angle B = \angle C$ (By *CPCT*)

38.



Angles opposite to equal sides are equal

In ΔACD $\angle 1 = \angle 2$ ----(1)

and In ΔABD $\angle 4 = \angle 3$ ----(2)

$\angle A + \angle B + \angle C = 180°$ (angles sum property)

$\angle 2 + \angle 4 + \angle 3 + \angle 1 = 180°$ (using eq^n 1, eq^n 2)

$\angle 2 + \angle 4 + \angle 4 + \angle 2 = 180°$

$2(\angle 2 + \angle 4) = 180°$

$$\angle 2 + \angle 4 = \frac{180°}{2} = 90°$$

$$\angle BAC = 90°$$

39. In ΔBAD and In ΔBCE

$AB = BC$ (given)

$\angle A = \angle C$ (given)

$\angle B = \angle B$ (common)

$\Delta BAD \cong \Delta BCE$ (ASA)

$\angle x = 75°$ (by CPCT)

40. In ΔABE and ΔABD

$AB = AB$, $AE = BD$

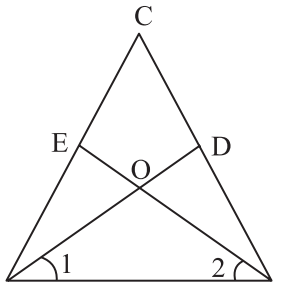
$\angle EAB = \angle DBA$

$\therefore \quad \Delta ABE \cong \Delta ABD$ (By *SAS*)

$\Rightarrow \quad \angle ABE = \angle BAD$ (By *CPCT*)

In $\angle OAB$

$\angle 1 = \angle 2 \Rightarrow OA = OB$



41. $AB = AC \Rightarrow \angle B = \angle C$

In ΔABD and ΔACE

$\angle BAD = \angle CAE$, $AB = AC$, $\angle B = \angle C$

$\therefore \quad \Delta ABD \cong \Delta ACE$(By *ASA*)

$\Rightarrow \quad AD = AE$(By *CPCT*)

$\therefore \quad ADE$ is an isosceles triangle.

42. $\angle EDM = \angle FDM$, $\angle FDM = \angle DFM$.

Using angle sum property in ΔDEF, find $\angle EDF$.

43. All sides of an equilateral triangle are equal,

$\therefore$ all angles will be equal (angles opposite to equal sides are equal)

44. In ΔBDC and ΔBEC

$BD = EC$, $BC = BC$, $\angle BEC = \angle BDC$ (90°)

$\therefore \quad \Delta BDC \cong \Delta BEC$ (By RHS)

$\therefore \quad \angle B = \angle C$ similarly $\angle A = \angle B$ & $\angle A = \angle C$

$\Rightarrow \quad \angle A = \angle B = \angle C$

$\Rightarrow \quad AB = BC = AC$

Hence ΔABC is an equilateral triangle.

45. $\Delta ABM \cong \Delta PQN$ (By *SSS*)

$\Rightarrow \quad \angle B = \angle Q$ (By *CPCT*)

$\therefore \quad \Delta ABC \cong \Delta PQR$ (By *SAS*)

46. In ΔQTR and ΔRSQ,

$QR = QR$, $\angle QTR = \angle RSQ$, $RT = SQ$

$\therefore$ $\Delta QTR \cong \Delta RSQ$ (By RHS)

$\therefore$ $\angle Q = \angle R$ (By *CPCT*) $\Rightarrow PQ = PR$ {It is an isosceles triangle}

In ΔPSQ and ΔPTR

$RT = SQ$, $\angle PTR = \angle PSQ$, $PR = PQ$

$\therefore$ $\Delta PSQ \cong \Delta PTR$ (By RHS)

47. $\angle 1 = \angle 2$ eq^{n}...(1)

$\angle 3 = \angle 4$ eq^{n}...(2)

eq^{n} (1) + eq^{n} (2)

$\Rightarrow \angle 1 + \angle 3 = \angle 2 + \angle 4$

$\angle CAB = \angle CAD$ --- (3)

$AC = AC$ --- (4)

$AB = AD$ --- (5)

using (3), (4), (5)

$\Delta ADC \cong \Delta ABC \Rightarrow \angle ADC = \angle ABC$

In ΔADQ & ΔABP

$\angle 2 = \angle 1$, $AB = AB$, $\angle ABP = \angle ADQ$

$\angle ADQ = \angle ABP$

$\Rightarrow \Delta ADQ \cong \Delta ABP$ (By *ASA*)

$\therefore$ $AP = AQ$ (By *CPCT*)

48. (a) $\Delta ABC \cong \Delta QRP$

(b) *SAS*

(c) $BC = RP$

49. $AB = CD$

Adding BC on both side then $\Delta ACE \cong \Delta DBF$ (By *SAS*)

50. $3x = 2x + 20$

$x - 3 2x = x = 20$

Chapter-7 Triangles

Practice Test

Time: 1 hr. **M.M. 20**

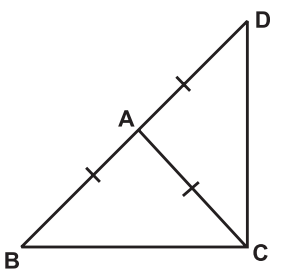
1. Find the measures of each exterior angle of an equilateral triangle. (1)

2. The _____ of an isosceles triangle divides it into two congruent triangles. (1)

3. The vertical angles of an isosceles triangle is thrice the one of its base angle. Find the base angle. (2)

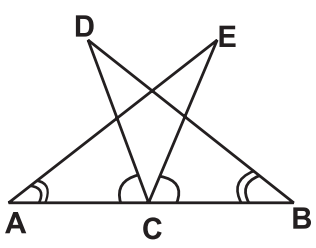
4. Prove that in an isosceles triangle, the angles opposite to the equal sides are equal. (2)

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



6. Prove that medians of an equilateral triangle are equal. (3)

7. In the given figure C is the midpoint of AB, $\angle DCA = \angle ECB$ and $\angle DBC = \angle EAC$. Prove that $DC = EC$ and $BD = AE$. (3)



8. In the given figure ABC is a right angled triangle, right angle 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. Show that $CM = \frac{1}{2} AB$. (5)