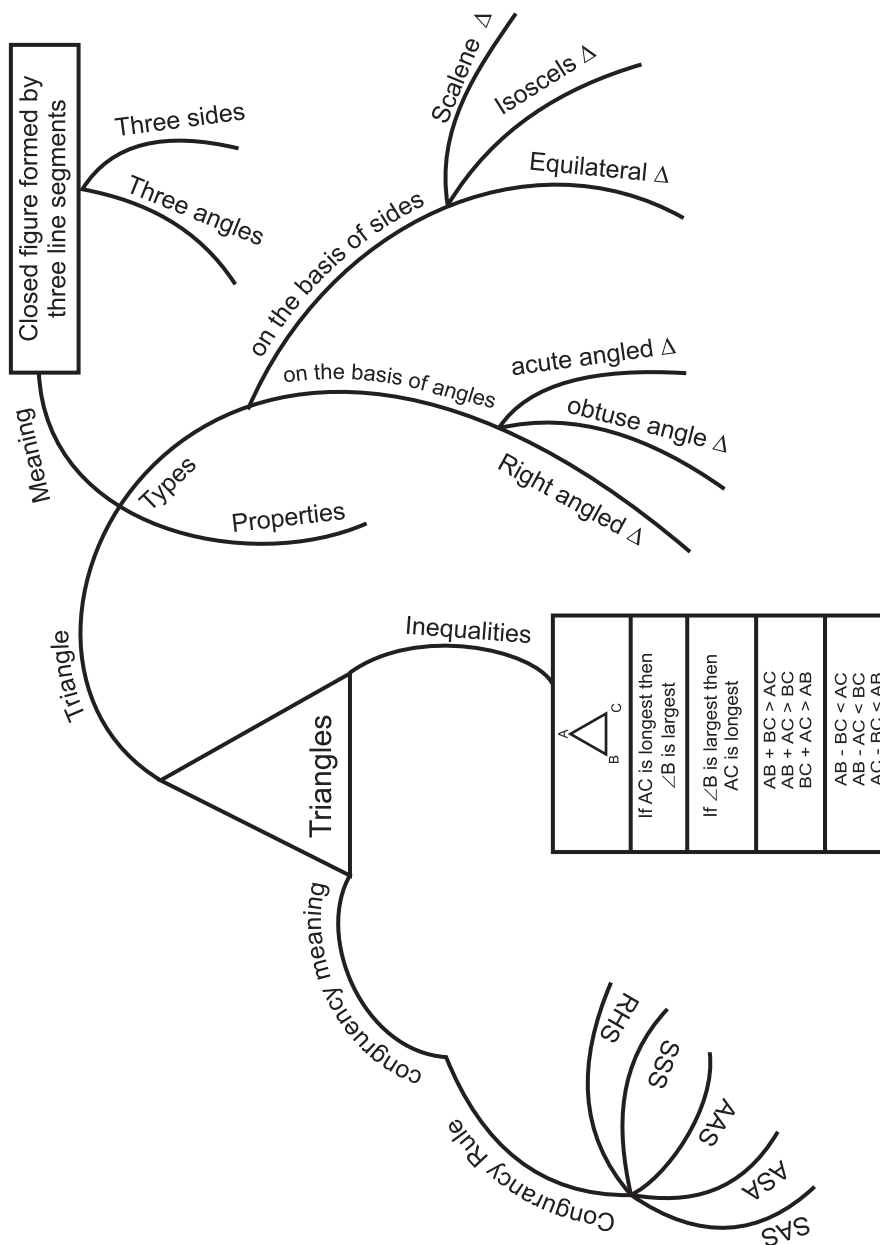


CHAPTER-7

TRIANGLES

MIND MAP



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 $\triangle ABC \cong \triangle DEF$.
- 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 are 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 another triangle.

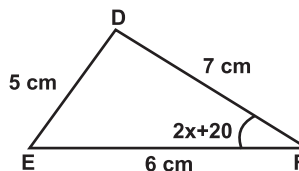
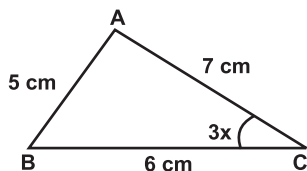
- Angles opposite to equal sides of a triangle are equal.
- Sides opposite to equal angles of a triangle are equal.
- In a triangle, angle opposite to the longer side is larger (greater)
- In a triangle, side opposite to the larger (greater) angle is longer.
- Sum of any two sides of a triangle is greater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

PART-A

- Which of the following is not a criterion for congruency of triangles ?
 - SSS
 - RHS
 - AAA
 - SAS
- If $AB \cong CD$ then
 - $AB < CD$
 - $AB + CD = 0$
 - $AB = CD$
 - $AB > CD$
- If $\triangle ABC \cong \triangle DEF$ then.
 - $AC = DE$
 - $BC = DF$
 - $FE = CB$
 - $AB = DF$
- If one angle of a triangle is equal to the sum of the other two angles, then the triangle is
 - an equilateral triangle
 - an isosceles triangles
 - an obtuse triangle
 - a right triangle
- If $AB = QR$, $BC = PR$ and $CA = PQ$, then
 - $\triangle ABC \cong \triangle PQR$
 - $\triangle CBA \cong \triangle PRQ$
 - $\triangle BAC \cong \triangle RPQ$
 - $\triangle PQR \cong \triangle BCA$
- In $\triangle ABC$ and $\triangle DFE$, $AB = FD$, $\angle A = \angle D$. The two triangles will be congruent by SAS axiom if
 - $BC = EF$
 - $AC = DE$
 - $AC = EF$
 - $BC = DE$
- If $\triangle ABC \cong \triangle FDE$, $AB = 5\text{ cm}$, $\angle B = 40^\circ$, $A = 80^\circ$. Then which of the following is correct ?
 - $DF = 5\text{ cm}$, $\angle F = 60^\circ$
 - $DF = 5\text{ cm}$, $\angle E = 60^\circ$
 - $DF = 5\text{ cm}$, $\angle C = 60^\circ$
 - Both (B) and (C)
- In $\triangle ABC$, $AB = AC$, $\angle B = 40^\circ$. Then $\angle C$ is equal to
 - 50°
 - 40°
 - 80°
 - 140°

9. In $\triangle ABC$, $AB = BC$, $\angle B = 40^\circ$, Then $\angle A$ is equal to
 - a) 70°
 - b) 40°
 - c) 140°
 - d) 100°
10. In right $\triangle ABC$, $AB = BC$. Then $\angle A$ is equal to
 - a) 45°
 - b) 90°
 - c) 60°
 - d) None of these
11. In $\triangle PQR$, $\angle R = \angle P$, $QR = 4$ cm and $PR = 5$ cm. Then $PQ =$ _____
 - a) 4 cm
 - b) 5 cm
 - c) 1 cm
 - d) 9 cm
12. If a, b, c are the lengths of the sides of a triangle, then
 - a) $a - b > c$
 - b) $a + b < c$
 - c) $c = a + b$
 - d) $c < a + b$
13. It is not possible to construct a triangle when the lengths of its sides are
 - a) 3 cm, 4 cm, 5 cm
 - b) 3 cm, 5 cm, 5 cm
 - c) 5.3 cm, 2.2 cm, 3.1 cm
 - d) 9.3 cm, 5.2 cm, 7.4 cm
14. In $\triangle ABC$, $\angle B = 90^\circ$ then
 - a) $AC = AB$
 - b) $AC < AB$
 - c) $AC < BC$
 - d) $AC > AB$
15. If $\triangle ABC$ is obtuse angled at C , then
 - a) $AB > BC$
 - b) $AB = BC$
 - c) $AB < BC$
 - d) $AC > AB$
16. In $\triangle PQR$, if $\angle R > \angle Q$, then
 - a) $QR > PR$
 - b) $PQ > PR$
 - c) $PQ < PR$
 - d) $QR < PR$
17. In $\triangle ABC$ and $\triangle PQR$. If $AB = QP$, $\angle B = \angle P$, $BC = PR$ then which one of the following congruence conditions applies :
 - a) SAS
 - b) ASA
 - c) SSS
 - d) RHS
18. In $\triangle ABC$ and $\triangle DEF$, if $\angle A = \angle F$, $\angle B = \angle D$ and $AB = FD$, then which one of the following congruence conditions applies :
 - a) SAS
 - b) ASA
 - c) SSS
 - d) RHS

19.



[illegible]

-
- A diagram of a kite $ABCD$ with vertices A , B , C , and D . The diagonal AC is horizontal and labeled 5 cm . The side AB is labeled 3 cm . Right angle symbols are shown at vertices B and D .

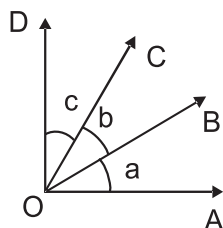
26. Two figures are congruent if they have the _____ shape and same _____.
27. Two circles are congruent if they have _____ radii.
28. Two equilateral triangles are congruent. if they have _____ sides.
29. Two square are congruent if they have _____ sides.
30. The sum of any two sides of a triangle is _____ than the third side.

31. The difference of any two sides of a triangle is _____ than the third side.
32. In a right triangle, the hypotenuse is the _____ side
33. If two angles of a triangle are unequal, then the smaller angle has the _____ side opposite to it.
34. If two sides of a triangle are unequal, then the larger side has _____ angle opposite to it.
35. In a triangle, sides opposite to equal angles are _____

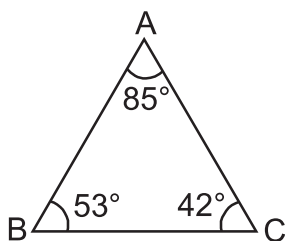
State which of the following statements are true and false.

36. In a triangle, the greatest angle has the longest side opposite to it.
37. Two triangles are congruent if three angles of one triangle are equal to three angles of the other triangle.
38. In a triangle, the shortest side has the smallest angle opposite to it.
39. It is necessary to write the correspondence of vertices correctly for writing congruence of triangles in symbolic form.
40. If all the line segments that can be drawn from a point to a line not containing it, the perpendicular line segment is the shortest one.
41. If $\triangle ABC \cong \triangle DEF$ then
 - (i) $AB =$ _____
 - (ii) $BC =$ _____
 - (iii) $CA =$ _____
 - (iv) $\angle E =$ _____
 - (v) $\angle EDF =$ _____
 - (vi) $\angle BCA =$ _____
42. Circle $O_1 \cong$ Circle O_2 . If radius of circle $O_1 = 6$ cm then diameter of circle O_2 is _____.

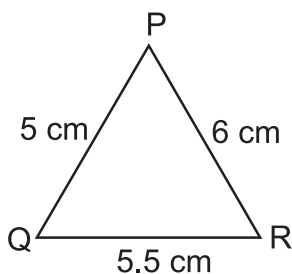
43. In the given figure, if $a = b = c$ then $\angle AOC \cong$ _____



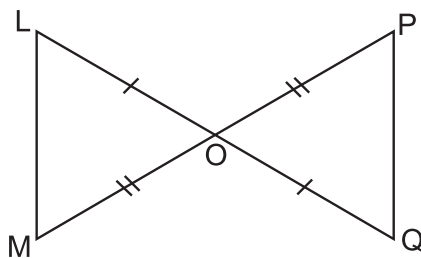
44. Which is the longest side of the triangles given in the figure ?



45. Which is the largest angle in the $\triangle PQR$?



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



Part – B

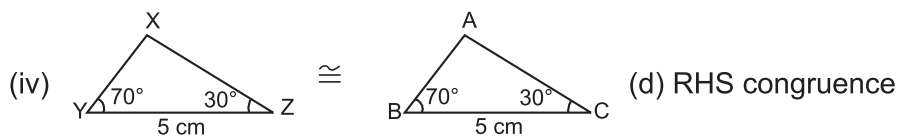
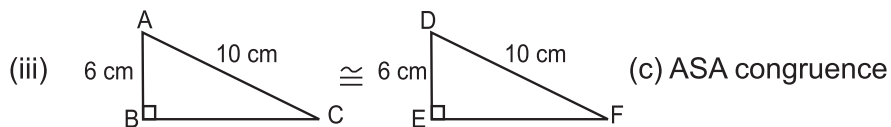
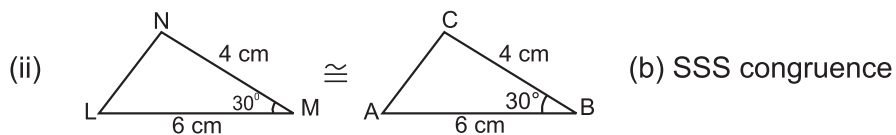
47. Match the columns :

Column A

Column B

(i) \cong (a) SAS congruence

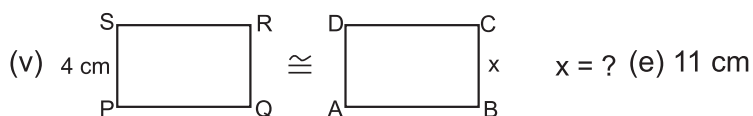
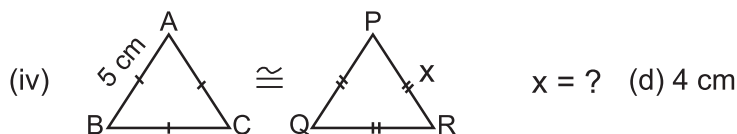
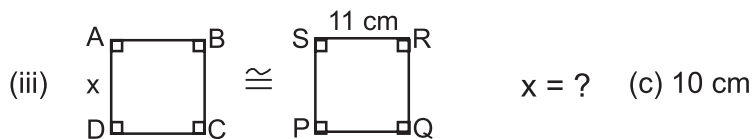
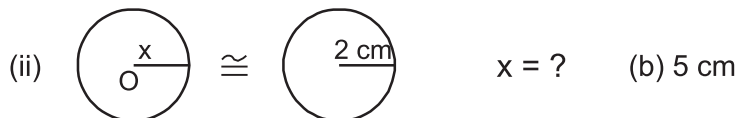
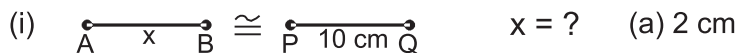
Triangle PQR has vertices P (top), Q (bottom left), and R (bottom right). Side $PQ = 6 \text{ cm}$, side $PR = 7 \text{ cm}$, and side $QR = 8 \text{ cm}$. Triangle KLM has vertices K (top), L (bottom left), and M (bottom right). Side $KL = 6 \text{ cm}$, side $KM = 7 \text{ cm}$, and side $LM = 8 \text{ cm}$. The triangles are shown to be congruent with a congruence symbol \cong between them.



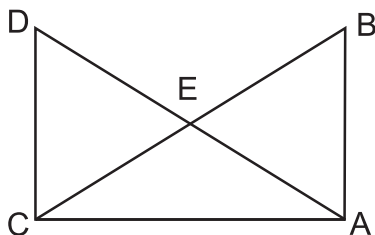
48. Match the columns :

Column A

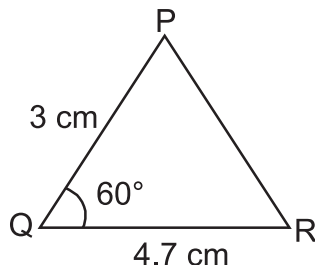
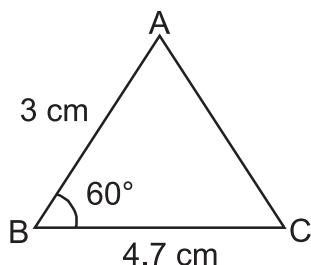
Column B



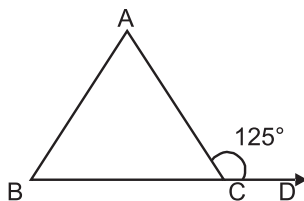
49. In the given figure. If $AB = CD$, $AD = BC$ then prove that $\triangle ADC \cong \triangle CBA$



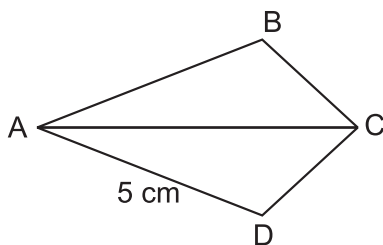
50. If $\triangle ABC$ is an isosceles triangle such that $AB = AC$, then prove that altitude AD from A on BC bisects it.
51. Which criteria of congruence of triangles is satisfied in the given figure.



52. In a $\triangle PQR$, $\angle P = 110^\circ$, $PQ = PR$. Find $\angle Q$ and $\angle R$.
53. In the given figure $AB = AC$ and $\angle ACD = 125^\circ$. Find $\angle A$



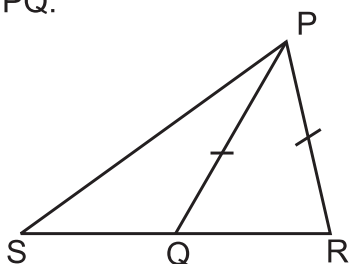
54. In $\triangle ABC$, if $\angle A = 55^\circ$, $\angle B = 75^\circ$ then find out the smallest and longest side of the triangle.
55. In the given figure, AC bisects $\angle A$ and $\angle C$. If $AD = 5$ cm find AB .



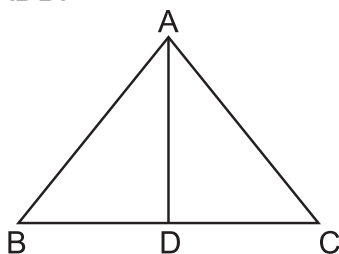
56. The vertex angle of an isosceles triangle is 80° . Find out the measure of base angles.

Part – C

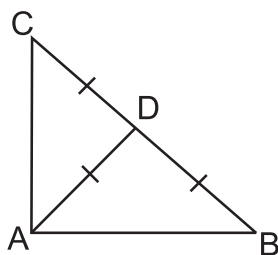
57. In the given figure, Q is a point on the side SR of $\triangle PSR$ such that $PQ = PR$. Prove that $PS > PQ$.



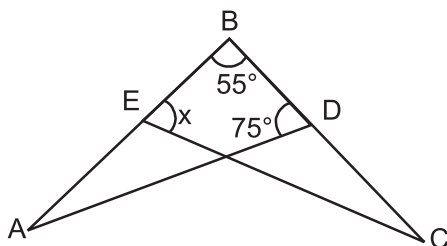
58. ABC is a triangle and D is the mid-point of BC. The Perpendicular from D to AB and AC are equal. Prove that triangle is isosceles.
59. Prove that angles opposite to the equal sides of an isosceles triangle are equal.
60. In the given figure, $AC > AB$ and AD bisects $\angle BAC$.
Prove that $\angle ADC > \angle ADB$.



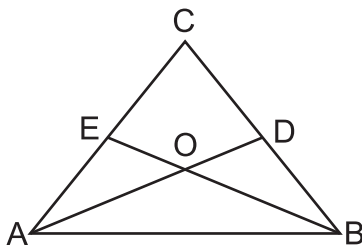
61. S is any point in the interior of a $\triangle PQR$. Prove that $SQ + SR < PQ + PR$.
62. In the given figure, if $AD = BD = CD$, Find $\angle BAC$



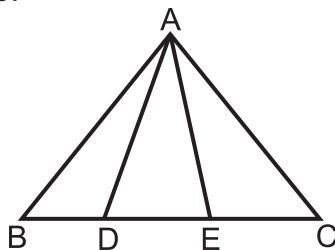
63. In the given figure, if $AB = BC$ and $\angle A = \angle C$ then find the value of x .



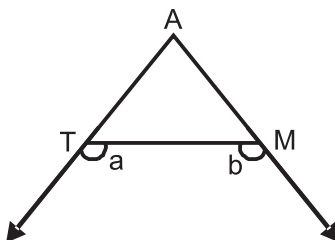
64. In the given figure $\angle ABC = \angle BAC$, D and E are points on BC and AC respectively such that $DB = AE$. If AD and BE intersect at O then prove that $OA = OB$.



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

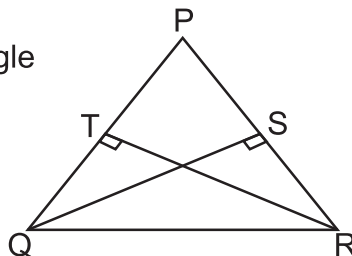


66. In $\triangle DEF$, $\angle E = 2 \angle F$ DM is the angle bisector of $\angle EDF$ that intersects EF at M. If $DM = MF$, then prove that $\angle EDF = 72^\circ$
67. Prove that the angles of an equilateral triangle are 60° each.
68. In the given figure, $\angle a > \angle b$, show that $\angle ATM < \angle AMT$.

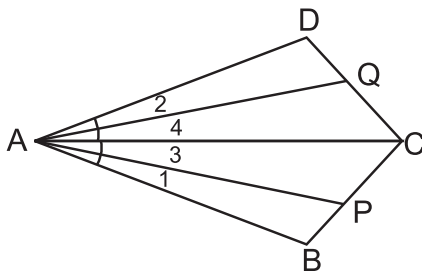


Part-D

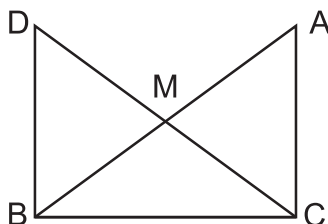
69. AF, BD and CE altitudes of $\triangle ABC$ are equal. Prove that ABC is an equilateral triangle.
70. Prove that two triangles are congruent if two angles and the included side of one triangle are equal to the two angles and the included side of the other triangle.
71. O is any point in the interior of a $\triangle ABC$. Prove that $(OA + OB + OC) > \frac{1}{2}(AB + BC + CA)$
72. Prove that the perimeter of a triangle is greater than the sum of its three altitudes.
73. Two sides AB, BC and median AM of one $\triangle ABC$ are respectively equal to sides PQ, QR, and median PN of $\triangle PQR$. Show that.
- $\triangle ABM \cong \triangle PQN$
 - $\triangle ABC \cong \triangle PQR$
74. In the given figure, PQR is a triangle in which altitudes QS and RT to sides PR and PQ are equal. show that.
- $\triangle PQS \cong \triangle PRT$
 - PQR is an isosceles triangle



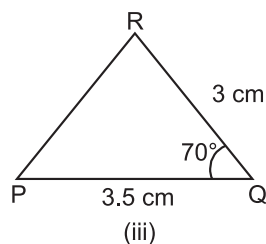
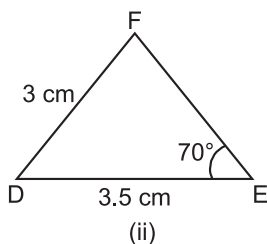
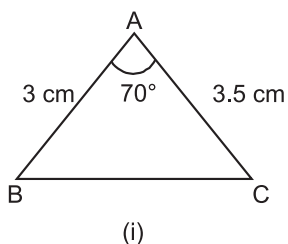
75. In the given figure, $AB = AD$, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$. Prove that $AP = AQ$.



76. 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 $CM = \frac{1}{2} AB$

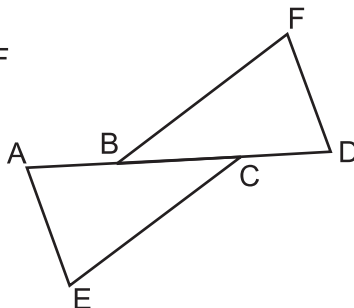


77. Prove that the sum of any two sides of a triangle is greater than its third side.
78. Vandana wishes to literate the poor children of the nearby slum area. She makes flash cards for them as shown in the given figure.



- Which two flash cards are congruent?
 - Which criteria of congruency is satisfied here?
 - Write the third side of both the triangles which are equal by CPCT.
79. Prove that the sum of any two sides of a triangle is greater than twice the median drawn to the third side.
80. In the given figure, $AB = CD$, $CE = BF$ and $\angle ACE = \angle DBF$. Prove that

- $\triangle ACE \cong \triangle DBF$
- $AE = DF$



CHAPTER-7
TRIANGLES
ANSWERS

1. c) AAA
2. c) $AB = CD$
3. c) $FE = CB$
4. d) a right triangle
5. b) $\triangle CBA \cong \triangle PRQ$
6. b) $AC = DE$
7. d) Both (B) and (C)
8. b) 40°
9. a) 70°
10. a) 45°
11. a) 4cm
12. d) $c < a + b$
13. c) 5.3 cm, 2.2 cm, 3.1 cm
14. d) $AC > AB$
15. a) $AB > BC$
16. b) $PQ > PR$
17. a) SAS
18. b) ASA
19. c) 20
20. c) RP
21. b) $\angle B$
22. d) Both (b) and (d)
23. d) None of these
24. a) $AB = AC$
25. c) 3 cm
26. Same, Size
27. equal
28. equal
29. equal
30. greater
31. less
32. largest
33. smaller
34. greater

35. equal
36. True
37. False
38. True
39. True
40. True
41. (i) DE
(ii) EF
(iii) FD
(iv) $\angle B$
(v) $\angle BAC$
(vi) $\angle EFD$
42. 12cm
43. $\angle BOD$
44. BC
45. $\angle Q$
46. $\triangle LOM \cong \triangle QOP$
47. (i) (b)
(ii) (a)
(iii) (d)
(iv) (c)
48. (i) (c)
(ii) (a)
(iii) (e)
(iv) (b)
(v) (d)
51. SAS
52. $\angle Q = \angle R = 35^\circ$
53. $\angle A = 70^\circ$
54. Smallest Side = AB
Longest Side = AC
55. AB = 5cm
56. $50^\circ, 50^\circ$
62. $\angle BAC = 90^\circ$
63. 75°
78. (a) (i) and (iii)
(b) $\triangle ABC \cong \triangle QRP$ (SAS Congruency)
(c) BC = PR

PRACTICE TEST

Time : 50 Min.

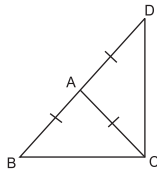
Triangles

M.M. 20

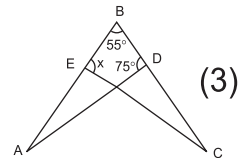
1. Find the measure of each exterior angle of an equilateral triangle. (1)
2. Which of the following is not a criterion for congruence of triangles? (1)

(a) SSA
(b) SAS

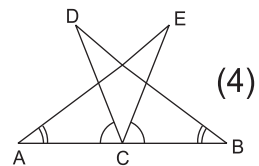
(c) ASA
(d) SSS
3. In a $\triangle ABC$, If $AB = AC$ and $\angle A = 70^\circ$. Find $\angle B$ and $\angle C$. (2)
4. The vertical angle of an isosceles triangle is 100° . Find its base angles. (2)
5. In the given figure, ABC is a triangle in which $AB = AC$, side BA is produced to D such that $AB = AD$. Prove that $\angle BCD = 90^\circ$. (3)



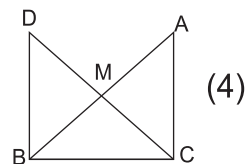
6. In the given figure, if $AB = BC$ and $\angle A = \angle C$. Then find the value of x .



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 $BD = AE$.



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 .



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