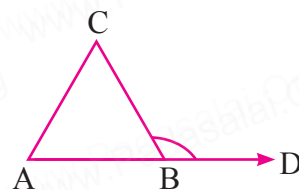
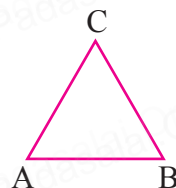


Chapter 4

Geometry

Triangles

- ◆ A triangle is a closed figure formed by three segments. It has three vertices, three sides and three angles.
- ◆ Based on sides, triangles can be classified into three types. They are,
 - (i) Equilateral triangle
 - (ii) Isosceles triangle
 - (iii) Scalene triangle
- ◆ Based on the angle, triangles can be classified into three types. They are
 - (i) Acute angled triangle
 - (ii) Right angled triangle
 - (iii) Obtuse angled triangle
- ◆ In any triangle drawn by joining three non-collinear points, the sum of the lengths of any two sides is greater than the length of the third side. This property is called as triangle inequality.
- ◆ In any triangle drawn by joining three non-collinear points, the sum of the lengths of any two sides is greater than the length of the third side. This property is called as triangle inequality.
- ◆ Angle sum property of triangle states that the sum of all angles in a triangle is 180° .
- ◆ Any triangle is made up of three vertices, three sides and three angles.
- ◆ In $\triangle ABC$, the side AB is extended to D . Here $\angle CBD$ is known as the exterior angle of $\triangle ABC$ at B .
- ◆ Also $\angle ABC$ and $\angle CBD$ are adjacent and they form a linear pair.
- ◆ The non adjacent angles of $\angle CBD$ namely $\angle CAB$ and $\angle ACB$ are called interior opposite angles of $\angle CBD$.
- ◆ An exterior angle of a triangle is equal to the sum of its interior opposite angles.
- ◆ The sum of all interior angles of a triangle is 360° .

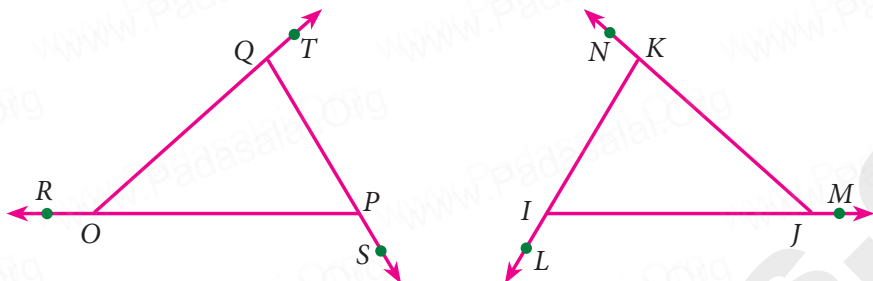




Activity

(Text book Page No. 70)

To understand exterior angle properties of a triangle list all the exterior angles of triangles that are shown below.



Measure and express each exterior angle as a sum of its interior opposite angles and complete the table.

Exterior angle	Sum of its interior opposite angle
$\angle PQT = 100^\circ$	$\angle QOP + \angle OPQ = 40^\circ + 60^\circ = 100^\circ$
$\angle QOR = 140^\circ$	$\angle OQP + \angle OPQ = 80^\circ + 60^\circ = 140^\circ$
$\angle OPS = 120^\circ$	$\angle PQO + \angle POQ = 80^\circ + 40^\circ = 120^\circ$
$\angle IKN = 100^\circ$	$\angle KIJ + \angle IJK = 60^\circ + 40^\circ = 100^\circ$
$\angle JIL = 120^\circ$	$\angle IJK + \angle JKI = 40^\circ + 80^\circ = 120^\circ$
$\angle KJM = 140^\circ$	$\angle JIK + \angle IKJ = 60^\circ + 80^\circ = 140^\circ$

From this activity we observe that an exterior angle of a triangle is equal to the sum of its interior opposite angles.



Activity

(Text book Page No. 71)

Imagine a person standing in one of the vertices (corners) and walking along the boundary of the triangle until he reaches the starting point. At each of the vertex of the triangle he would turn an angle equal to the exterior angle at that vertex. Hence after the complete journey around the triangle he would have turned through an angle equal to one complete revolution, that is 360° .

EXERCISE 4.1

1. Can 30° , 60° and 90° be the angles of a triangle?

Sol : Given angles 30° , 60° and 90°

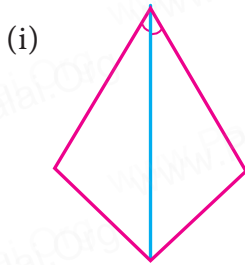
Sum of the angles = $30^\circ + 60^\circ + 90^\circ = 180^\circ$

\therefore The given angles form a triangle.

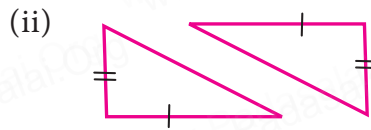
Congruency of Triangles

- ◆ Triangle is a closed figure formed by three line segments.
- ◆ There are three sides and three angles.
- ◆ If the corresponding sides and corresponding angles of two triangles are equal then the two triangles are said to be congruent to each other.
- ◆ **Side - side - side congruence Criterion (SSS) :**
If three sides of one triangle are equal to corresponding sides of the other triangle then the two triangles are congruent. This criterion of congruency is known as side - side side.
- ◆ **Side - Angle - Side congruence criterion (SAS):**
If two sides and the included angle of a triangle are equal to the corresponding two sides and the included angle of another triangle, then the two triangles are congruent to each other. This criterion is called Side - Angle - Side.
- ◆ **Angle - Side - Angle congruence criterion (ASA)**
If two angles and the included side of one triangle are congruent to the corresponding parts of another triangle, then the two triangles are congruent. This criterion is called Angle - Side - Angle criterion.
- ◆ **Right Angle - Hypotenuse - Side congruence criterion (RHS)**
If the hypotenuse and one side of a right angled triangle is equal to the hypotenuse and one side of another right angled triangle then the two right angled triangles are congruent.
This is called right angle - Hypotenuse - side criterion.
- ◆ If two angles and a non - included side of one triangle are congruent to the corresponding parts of another triangle, then also the triangles are congruent.
- ◆ Angle - Angle - Angle combination will triangles of same shape but not of same size. So it is not sufficient to prove the congruency of triangles.
- ◆ The combination of two sides and a non - included angle such as side - side - angle (or) Angle - side - side (That is SSA (or) ASS) are also will not prove congruency of triangles.
- ◆ If two triangles are congruent then their corresponding parts are congruent. We can say "Corresponding Parts of congruent triangles are congruent". It can be abbreviated as CPCTC.

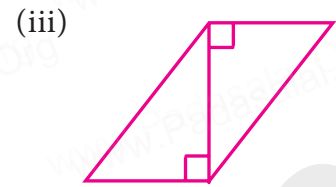
5. To conclude the congruency of triangles, mark the required information in the following figures with reference to the given congruency criterion.



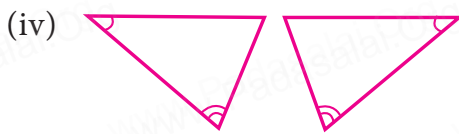
Criterion : ASA



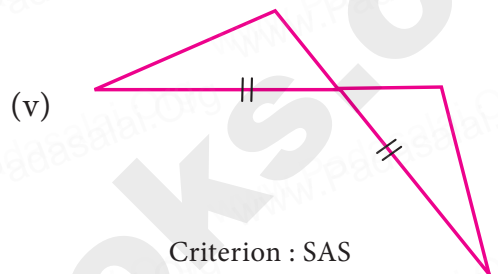
Criterion : SSS



Criterion : RHS



Criterion : ASA



Criterion : SAS

Sol : (i) In the given triangles one angle is equal and a side is common and so equal.

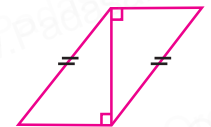
To satisfy ASA criterion one more angle should be equal such that the common side is the included side of both angles of a triangle.

The figure will be as follows.

(ii) In the two given triangles two sides of one triangle is equal to two sides of the other triangle. To satisfy SSS criterion the third sides must be equal.



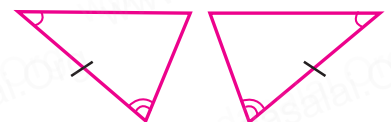
(iii) The given triangles have one side in common. They are right angled triangles.



To satisfy RHS criterion their hypotenuse must be equal.

(iv) In the given triangles two angles of one triangle is equal to two angles of the other triangles.

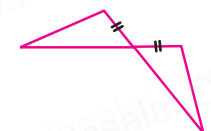
To satisfy ASA criterion included side of two angles must be equal.



(v) In both the triangles one of their sides are equal.

One of their angles are equal or they are vertically opposite angles.

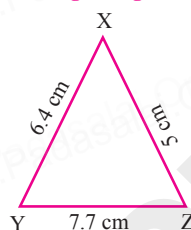
To satisfy SAS criterion, one more side is to be equal such that the angle is the included of the equal sides.



Construction:

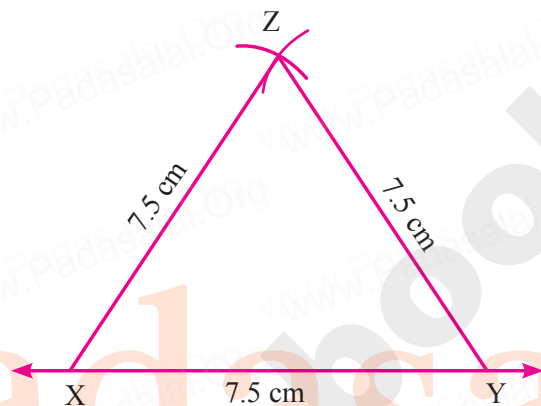
- Step 1: Draw a line. Marked Y and Z on the line such that $YZ = 7.7$ cm.
- Step 2: With Y as centre drawn an arc of radius 6.4 cm above the line YZ.
- Step 3: With Z as centre, draw an arc of radius 5 cm to intersect arc drawn in steps. Marked the point of intersection as X.
- Step 3: Joined YX and ZX. Now XYZ is the required triangle.

Rough Diagram

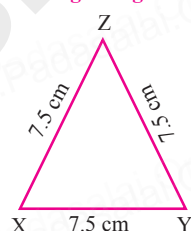


(ii) An equilateral triangle of side 7.5 cm

Sol :



Rough Diagram

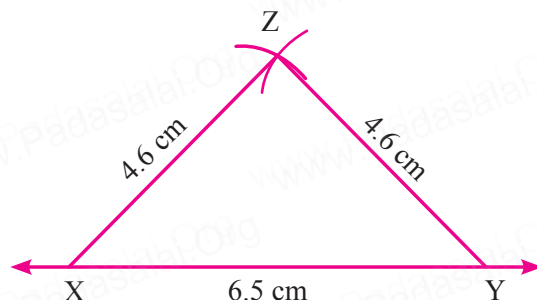


Construction:

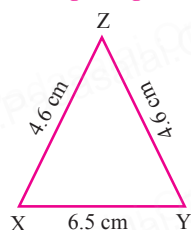
- Step 1: Drawn a line. Marked X and Y on the line such that $XY = 7.5$ cm.
- Step 2: With X as centre, drawn an arc of radius 7.5 cm above the line XY.
- Step 3: With Y as centre, drawn an arc of radius 7.5 cm to intersect arc drawn in steps. Marked the point of intersection as Z.
- Step 4: Joined XZ and YZ. Now XYZ is the required triangle.

(iii) An isosceles triangle with equal sides 4.6 cm and third side 6.5 cm

Sol :



Rough Diagram

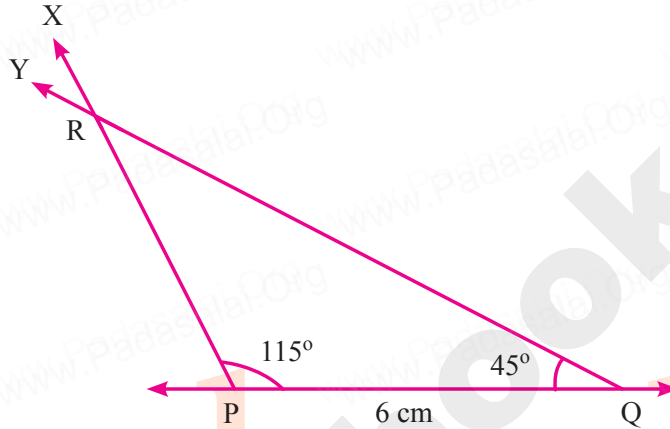


Construction:

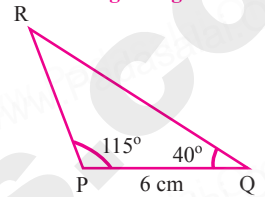
- Step 1: Drawn a line. Marked P and R on the line such that $PR = 7.8$ cm.
Step 2: At P, drawn a ray PX making an angle of 60° with PR.
Step 3: At R, drawn another ray RY making an angle of 35° with PR. Mark the point of intersection of the rays PX and RY as Q.
PQR is the required triangle.

(ii) $\angle P = 115^\circ$, $\angle Q = 40^\circ$ and $PQ = 6$ cm

Sol :



Rough Diagram

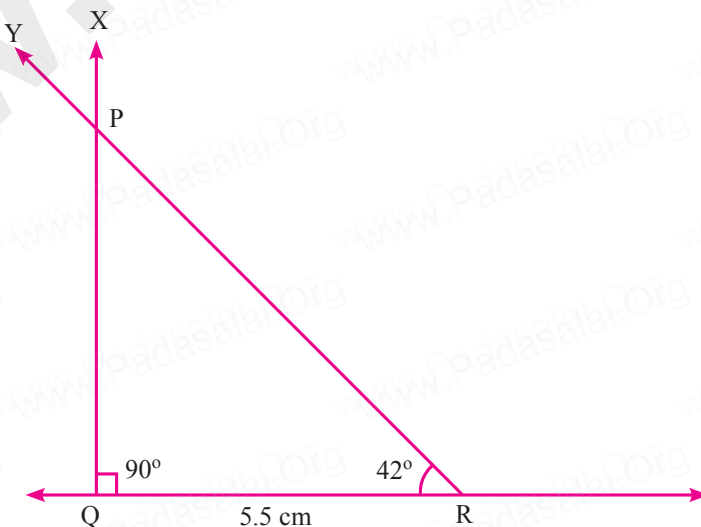


Construction:

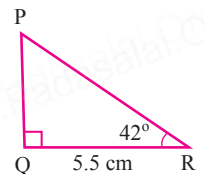
- Step 1: Drawn a line. Marked P and Q on the line such that $PQ = 6$ cm.
Step 2: At P, drawn a ray PX making an angle of 115° with PQ.
Step 3: At Q, drawn another ray QY making an angle of 40° with PQ. Marked the point of intersection of the rays PX and QY as R.
PQR is the required triangle.

(iii) $\angle Q = 90^\circ$, $\angle R = 42^\circ$ and $QR = 5.5$ cm

Sol :



Rough Diagram



UNIT TEST

Time: 1 hr

SECTION A

Max Marks : 25

I. Choose the best answer from the options given below.

(10 × 1 = 10)

1. Least number of possible acute angles in a triangle is

- (i) 0 (ii) 1 (iii) 2 (iv) 3

2. Angles of a triangle are in the ratio 1 : 2 : 3 the smallest angle is

- (i) 15° (ii) 90° (iii) 60° (iv) 30°

3. In an isosceles right triangle each of the acute angle is

- (i) 30° (ii) 45° (iii) 60° (iv) 90°

4. In a triangle ABC, which of the following is true.

- (i) $AB + BC < CA$ (ii) $AB + CA < BC$
(iii) $AC + BC > AB$ (iv) $AC + BC = AB$

5. The value of x is

- (i) 90° (ii) 45° (iii) 135° (iv) 100°

6. Two figures are said to be congruent if they have the same.

- (i) Length and width (ii) shape and size
(iii) Area (iv) Perimeter

7. Which of the following is not sufficient to prove congruency of triangles.

- (i) SSS (ii) SAS (iii) ASA (iv) AAA

8. In $\triangle PQR$, the included side between $\angle P$ and $\angle Q$ is.

- (i) \overline{PQ} (ii) \overline{QR} (iii) \overline{PR} (iv) \overline{AB}

9. In $\triangle ABC$, the included side between $\angle A$ and $\angle B$ is

- (i) $\angle A$ (ii) $\angle B$ (iii) $\angle C$ (iv) $\angle D$

10. Two angles are congruent if they have

- (i) the same length arms (ii) the same measure
(iii) the same vertex (iv) none of these

II. Answer the following question.

(5 × 2 = 10)

11. Find the value of x .

