BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI-110034

WEEK: 23rd - 27th November 2020

SUBJECT: MATHEMATICS

CLASS: VII

NUMBER OF BLOCKS: 3

TOPIC: CHAPTER 7: **CONGRUENCE OF TRIANGLES**

GUIDELINES

Dear students kindly refer to the following notes / video links for the chapter,

"**Congruence of Triangles** and thereafter do the questions in your Maths notebook .

NOTE – STUDENTS CAN GO THROUGH THE CHAPTER, 'Congruence of Triangles' USING THE FOLLOWING LINK
https://ncert.nic.in/ncerts/l/gemh107.pdf

SUBTOPICS:

- **CONGRUENCE OF PLANE FIGURES**
- **CONGRUENCE AMONG LINE SEGMENTS**
- **CONGRUENCE OF ANGLES**
- **CONGRUENCE OF ANGLES**
- **CRITERIA FOR CONGRUENCE OF TRIANGLES**

TEACHING AIDS USED

- Power point presentations, PDF documents, videos and digital white boards with the help of screen presentation.
- Explaining on white board with marker (showing with the help of device's camera)

LEARNING OBJECTIVES:

Each student will be able to:

- **Recall identical figures.**
- **Develop the definition of congruent figures.**
- **Interpret the meaning of congruence and extend it to triangles.**
- **Recognize congruent triangles and also classify them in different congruence relations – SSS, SAS, ASA, RHS.**

BLOCK – 1

INTRODUCTION

You are now ready to learn a very important geometrical idea, **Congruence**. In particular, you will study a lot about congruence of triangles.
To understand what congruence is, we turn to some activities.

Do This

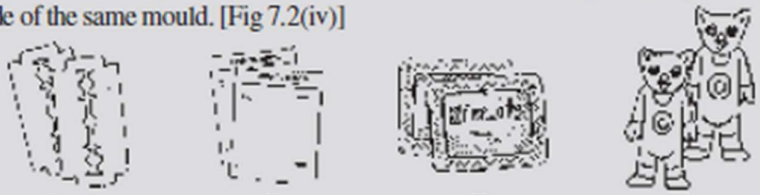
Take two stamps (Fig 7.1) of same denomination. Place one stamp over the other. What do you observe?

Fig 7.1

One stamp covers the other completely and exactly. This means that the two stamps are of the same shape and same size. Such objects are said to be congruent. The two stamps used by you are congruent to one another. Congruent objects are exact copies of one another.

Can you, now, say if the following objects are congruent or not?

1. Shaving blades of the same company [Fig 7.2 (i)].
2. Sheets of the same letter-pad [Fig 7.2 (ii)].
3. Biscuits in the same packet [Fig 7.2 (iii)].
4. Toys made of the same mould. [Fig 7.2(iv)]



(i) (ii) (iii) (iv)

Fig 7.2

LESSON DEVELOPMENT

CONGRUENCE OF PLANE FIGURES

Look at the two figures given here (Fig 7.3). Are they congruent?

When are two line segments congruent? Observe the two pairs of line segments given here (Fig 7.4).

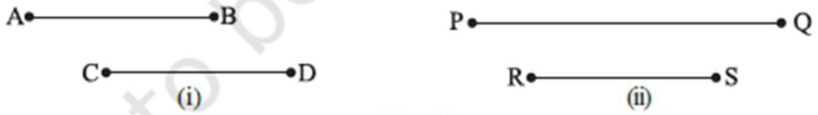


Fig 7.4

Use the 'trace-copy' superposition method for the pair of line segments in [Fig 7.4(i)]. Copy $\overline{CD}$ and place it on $\overline{AB}$. You find that $\overline{CD}$ covers $\overline{AB}$, with C on A and D on B. Hence, the line segments are congruent. We write $\overline{AB} \cong \overline{CD}$.

Repeat this activity for the pair of line segments in [Fig 7.4(ii)]. What do you find? They are not congruent. How do you know it? It is because the line segments do not coincide when placed one over other.

You should have by now noticed that the pair of line segments in [Fig 7.4(i)] matched with each other because they had same length; and this was not the case in [Fig 7.4(ii)].

If two line segments have the same (i.e., equal) length, they are congruent. Also, if two line segments are congruent, they have the same length.

CONGRUENCE AMONG LINE SEGMENT

CONGRUENCE OF ANGLES

If two angles have the same measure, they are congruent. Also, if two angles are congruent, their measures are same

CONGRUENCE OF TRIANGLES

Look at the four angles given here (Fig 7.5).

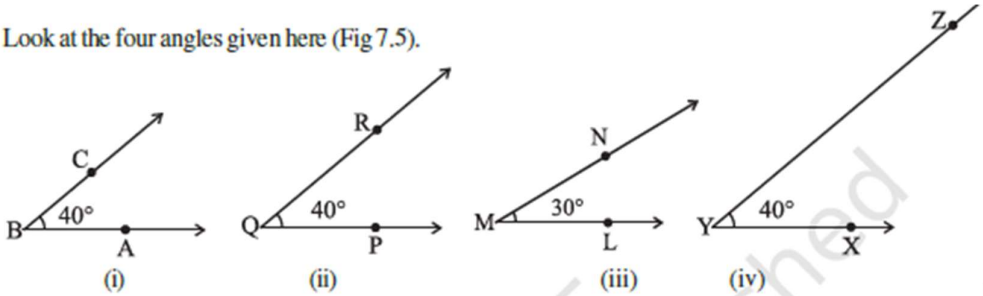


Fig 7.5

Make a trace-copy of ∠PQR. Try to superpose it on ∠ABC. For this, first place Q on B and QP along $\overrightarrow{BA}$. Where does $\overrightarrow{QR}$ fall? It falls on $\overrightarrow{BC}$.

Thus, ∠PQR matches exactly with ∠ABC.

That is, ∠ABC and ∠PQR are congruent.

(Note that the measurement of these two congruent angles are same).

We write $\angle ABC \cong \angle PQR$ (i)

or $m\angle ABC = m\angle PQR$ (In this case, measure is 40°).

Now, you take a trace-copy of ∠LMN. Try to superpose it on ∠ABC. Place M on B and $\overrightarrow{ML}$ along $\overrightarrow{BA}$. Does $\overrightarrow{MN}$ fall on $\overrightarrow{BC}$? No, in this case it does not happen. You find that ∠ABC and ∠LMN do not cover each other exactly. So, they are not congruent.

(Note that, in this case, the measures of ∠ABC and ∠LMN are not equal).

What about angles ∠XYZ and ∠ABC? The rays $\overrightarrow{YX}$ and $\overrightarrow{YZ}$, respectively appear [in Fig 7.5 (iv)] to be longer than $\overrightarrow{BA}$ and $\overrightarrow{BC}$. You may, hence, think that ∠ABC is 'smaller' than ∠XYZ. But remember that the rays in the figure only indicate the direction and not any length. On superposition, you will find that these two angles are also congruent.

We write $\angle ABC \cong \angle XYZ$ (ii)

or $m\angle ABC = m\angle XYZ$

In view of (i) and (ii), we may even write

$$\angle ABC \cong \angle PQR \cong \angle XYZ$$

We saw that two line segments are congruent where one of them, is just a copy of the other. Similarly, two angles are congruent if one of them is a copy of the other. We extend this idea to triangles.

Two triangles are congruent if they are copies of each other and when superposed, they cover each other exactly.

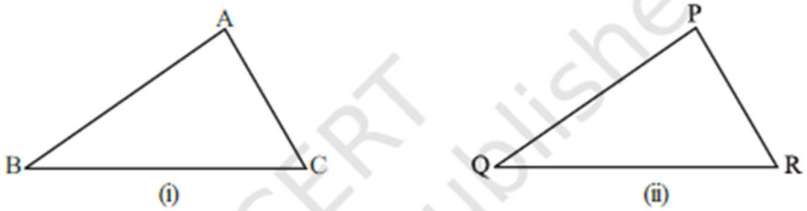


Fig 7.6

ΔABC and ΔPQR have the same size and shape. They are congruent. So, we would express this as

$$\Delta ABC \cong \Delta PQR$$

This means that, when you place ΔPQR on ΔABC, P falls on A, Q falls on B and R falls on C, also falls along $\overline{AB}$, $\overline{QR}$ falls along $\overline{BC}$ and $\overline{PR}$ falls along $\overline{AC}$. If, under a given correspondence, two triangles are congruent, then their corresponding parts (i.e., angles and sides) that match one another are equal. Thus, in these two congruent triangles, we have:

Corresponding vertices : A and P, B and Q, C and R.

Corresponding sides : $\overline{AB}$ and $\overline{PQ}$, $\overline{BC}$ and $\overline{QR}$, $\overline{AC}$ and $\overline{PR}$.

Corresponding angles : $\angle A$ and $\angle P$, $\angle B$ and $\angle Q$, $\angle C$ and $\angle R$.

If you place ΔPQR on ΔABC such that P falls on B, then, should the other vertices also correspond suitably? *It need not happen*! Take trace, copies of the triangles and try to find out.

This shows that while talking about congruence of triangles, not only the measures of angles and lengths of sides matter, but also the matching of vertices. In the above case, the correspondence is

$$A \leftrightarrow P,\ B \leftrightarrow Q,\ C \leftrightarrow R$$

We may write this as $ABC \leftrightarrow PQR$

Exercise 7.1

1. Complete the following statements:
   (a) Two line segments are congruent if _____.
   (b) Among two congruent angles, one has a measure of 70°; the measure o the other angle is _____.
   (c) When we write $\angle A = \angle B$, we actually mean _____.
2. Give any two real-life examples for congruent shapes.
3. If $\Delta ABC \cong \Delta FED$ under the correspondence $ABC \leftrightarrow FED$, write all th corresponding congruent parts of the triangles.
4. If $\Delta DEF \cong \Delta BCA$, write the part(s) of ΔBCA that correspond to
   (i) $\angle E$ (ii) $\overline{EF}$ (iii) $\angle F$ (iv) $\overline{DF}$

You can refer to the following link:

https://youtu.be/evpQTwFbN-8

https://youtu.be/Wxo_oZwuIpc

https://youtu.be/qKzuv0KXMVU

https://youtu.be/_AbcfewFCLo

From NCERT textbook the following questions are to be done in Mathematics notebook

ASSIGNMENT : EX 7.1; Q1,Q4

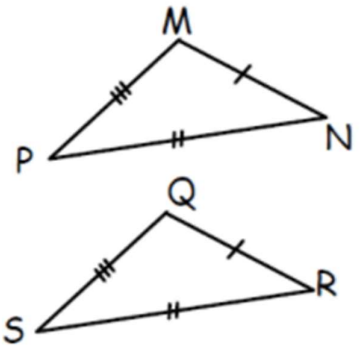
BLOCK – 2

LESSON DEVELOPMENT

CRITERIA FOR CONGRUENCE OF TRIANGLES

Side-Side-Side or SSS Congruence Postulate is a rule which can be used to prove the congruence of two triangles.

If Side $\overline{MN} \cong \overline{QR}$,
Side $\overline{NP} \cong \overline{RS}$, and
Side $\overline{PM} \cong \overline{SQ}$,
then $\Delta MNP \cong \Delta QRS$.



Explanation :

If three sides of one triangle are congruent to three sides of another triangle, then the two triangles are congruent.

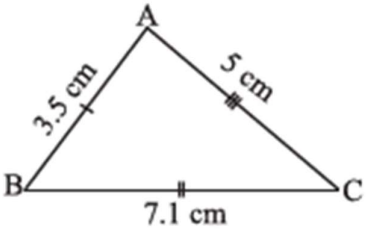
SSS Congruence criterion:

EXAMPLE 2 In triangles ABC and PQR, AB = 3.5 cm, BC = 7.1 cm, AC = 5 cm, PQ = 7.1 cm, QR = 5 cm and PR = 3.5 cm. Examine whether the two triangles are congruent or not. If yes, write the congruence relation in symbolic form.

SOLUTION Here, AB = PR (= 3.5 cm),
BC = PQ (= 7.1 cm)
and AC = QR (= 5 cm)

This shows that the three sides of one triangle are equal to the three sides of the other triangle. So, by SSS congruence rule, the two triangles are congruent. From the above three equality relations, it can be easily seen that A ↔ R, B ↔ P and C ↔ Q.

So, we have $\Delta ABC \cong \Delta RPQ$



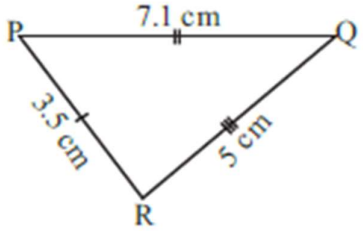


Fig 7.12

Try These

1. In Fig 7.14, lengths of the sides of the triangles are indicated. By applying the SSS congruence rule, state which pairs of triangles are congruent. In case of congruent triangles, write the result in symbolic form:

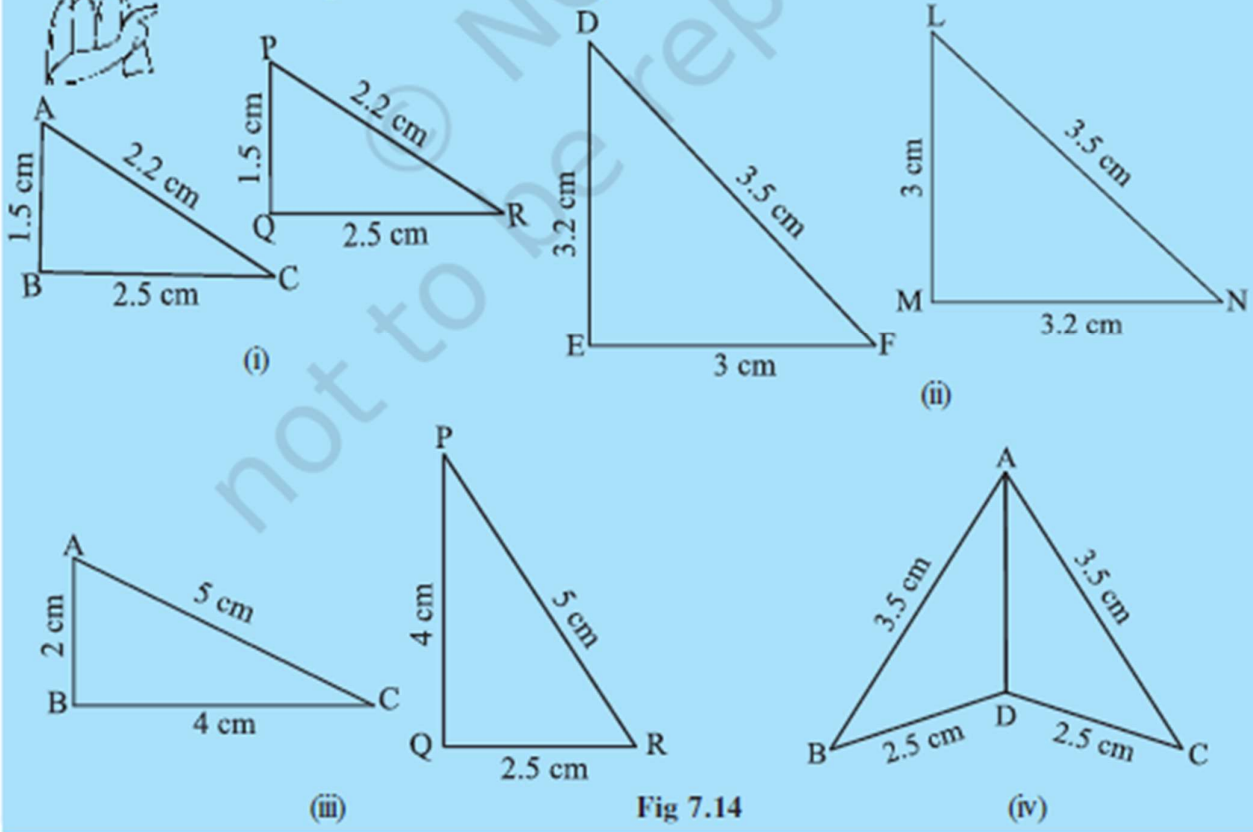


Fig 7.14

Following try these to be discussed in class

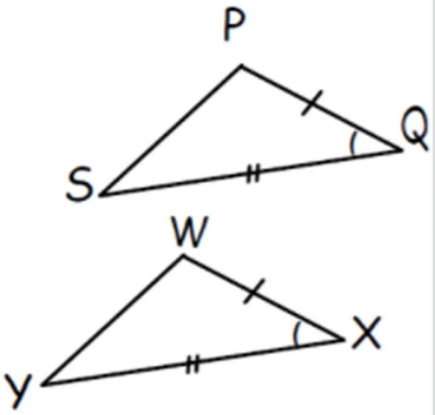
You can refer to the following link:

https://youtu.be/hS5hAlUV8E4

SAS Congruence criterion:

Side-Angle-Side or SAS Congruence Postulate is a rule which can be used to prove the congruence of two triangles.

If Side $\overline{PQ} \cong \overline{WX}$,
Angle $\angle Q \cong \angle X$, and
Side $\overline{QS} \cong \overline{XY}$,
then $\Delta PQS \cong \Delta WXY$.

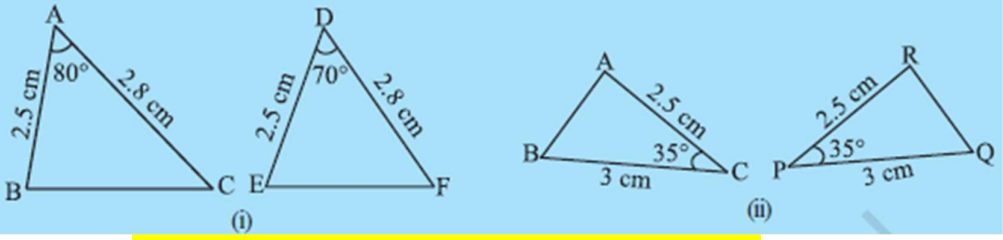


Explanation :

If two sides and the included angle of one triangle are equal to two sides and the included angle of another triangle, then the two triangles are congruent.

TRY THESE

1. Which angle is included between the sides $\overline{DE}$ and $\overline{EF}$ of ΔDEF?
2. By applying SAS congruence rule, you want to establish that $\Delta PQR \cong \Delta FED$. It is given that $PQ = FE$ and $RP = DF$. What additional information is needed to establish the congruence?
3. In Fig 7.24, measures of some parts of the triangles are indicated. By applying SAS congruence rule, state the pairs of congruent triangles, if any, in each case. In case of congruent triangles, write them in symbolic form.



Following try these to be discussed in class

You can refer to the following link:

https://youtu.be/2Yg44e6E6j4

From NCERT textbook the following question is to be done in Mathematics notebook

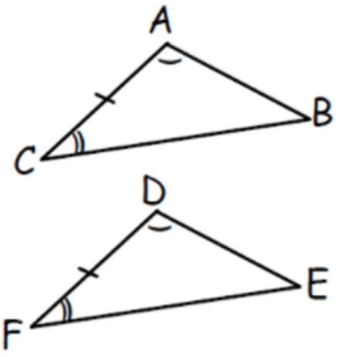
ASSIGNMENT : Try these (page number-144) Q3 iii),iv)

BLOCK – 3

LESSON DEVELOPMENT

Angle-Side-Angle or ASA Congruence Postulate is a rule which can be used to prove the congruence of two triangles.

If Angle $\angle A \cong \angle D$,
Side $\overline{AC} \cong \overline{DF}$, and
Angle $\angle C \cong \angle F$,
then $\Delta ABC \cong \Delta DEF$.



Explanation :

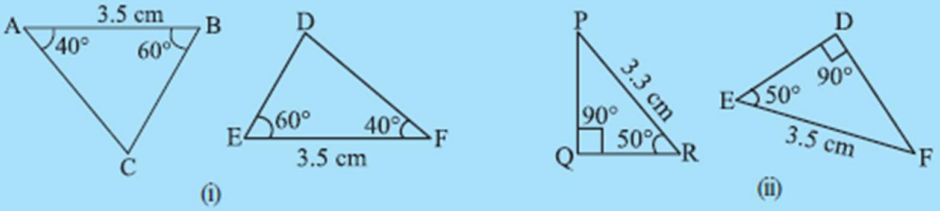
If two angles and the included side of one triangle are equal to two angles and the included side of another triangle, then the two triangles are congruent.

ASA Congruence criterion

Following try these to be discussed in class

TRY THESE

1. What is the side included between the angles M and N of ΔMNP?
2. You want to establish ΔDEF ≅ ΔMNP, using the ASA congruence rule. You are given that ∠D = ∠M and ∠F = ∠P. What information is needed to establish the congruence? (Draw a rough figure and then try!)
3. In Fig 7.27, measures of some parts are indicated. By applying ASA congruence rule, state which pairs of triangles are congruent. In case of congruence, write the result in symoblic form.



Remark

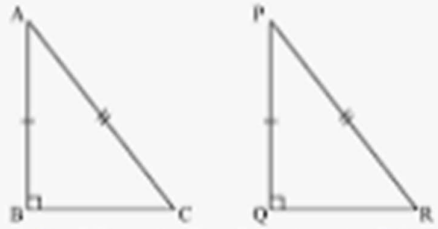
Given two angles of a triangle, you can always find the third angle of the triangle. So, whenever, two angles and one side of one triangle are equal to the corresponding two angles and one side of another triangle, you may convert it into 'two angles and the included side' form of congruence and then apply the ASA congruence rule.

You can refer to the following link :

https://youtu.be/_jHvfTL4NQo

RHS Congruence criterion

RHS stands for Right – Hypotenuse – side.
If the hypotenuse and one side of a right triangle are equal to the hypotenuse and one side of the other right triangle, then the two triangles are congruent to each other.
This criterion is known as the **RHS congruence rule**.

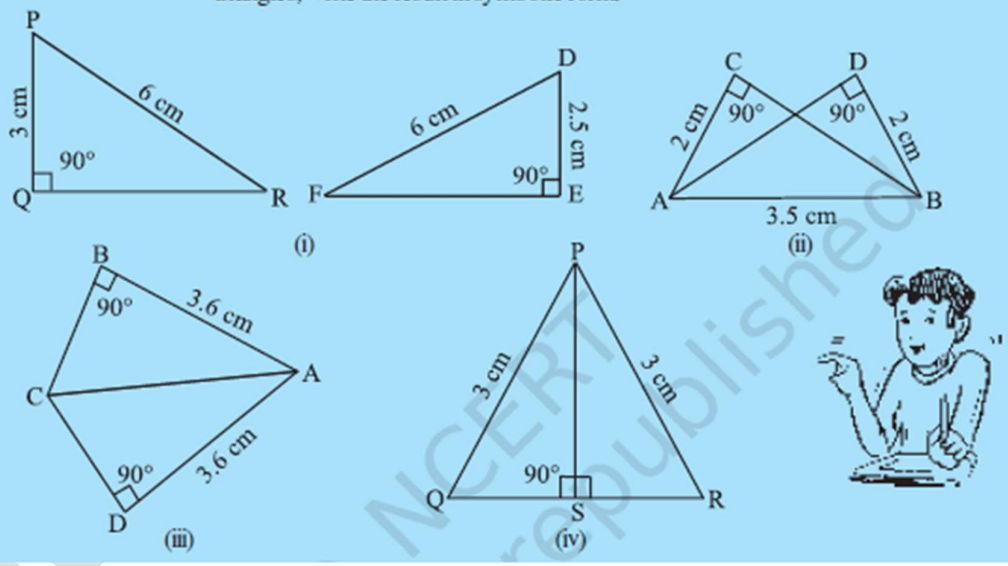


If in the given figure, $\angle B = \angle Q$, $AC = PR$, and $AB = PQ$, then $\Delta ABC \cong \Delta PQR$.

Following try these to be discussed in class

TRY THESE

1. In Fig 7.32, measures of some parts of triangles are given. By applying RHS congruence rule, state which pairs of triangles are congruent. In case of congruent triangles, write the result in symbolic form.



You can refer to the following link :

https://youtu.be/TAj5ZsUXJxw

ASSIGNMENT

From NCERT textbook the following question is to be done in Mathematics notebook

Exercise 7.2, Q2

NOTE: EX 7.2 Questions 5,6,7,8,9 and 10 are deleted from the syllabus.

SUMMERY: POINTS TO REMEMBER

1. Congruent objects are exact copies of one another.
2. The method of superposition examines the congruence of plane figures.
3. Two plane figures, say, F_1 and F_2 are congruent if the trace-copy of F_1 fits exactly on that of F_2. We write this as $F_1 \cong F_2$.
4. Two line segments, say, $\overline{AB}$ and $\overline{CD}$, are congruent if they have equal lengths. We write this as $\overline{AB} \cong \overline{CD}$. However, it is common to write it as $\overline{AB} = \overline{CD}$.
5. Two angles, say, $\angle ABC$ and $\angle PQR$, are congruent if their measures are equal. We write this as $\angle ABC \cong \angle PQR$ or as $m\angle ABC = m\angle PQR$. However, in practice, it is common to write it as $\angle ABC = \angle PQR$.
6. SSS Congruence of two triangles:
   Under a given correspondence, two triangles are congruent if the three sides of the one are equal to the three corresponding sides of the other.
7. SAS Congruence of two triangles:
   Under a given correspondence, two triangles are congruent if two sides and the angle included between them in one of the triangles are equal to the corresponding sides and the angle included between them of the other triangle.

ASSIGNMENT

Online Practice assignment (only to practise online)

https://www.khanacademy.org/math/in-in-class-7th-math-cbse/x939d838e80cf9307:congruence-of-triangles/x939d838e80cf9307:untitled-935/e/corresponding-parts-of-congruent-triangles?modal=1

https://www.khanacademy.org/math/in-in-class-7th-math-cbse/x939d838e80cf9307:congruence-of-triangles/x939d838e80cf9307:criteria-for-congruence-of-triangles/e/congruent_triangles_1?modal=1

MATHS MANUAL ACTIVITY (There is no such thing as AAA Congruence of two triangles)

Aim:To verify that two triangles with equal corresponding angles need not be congruent.
Material required: Coloured paper, glue, a pair of scissors, and pencil.

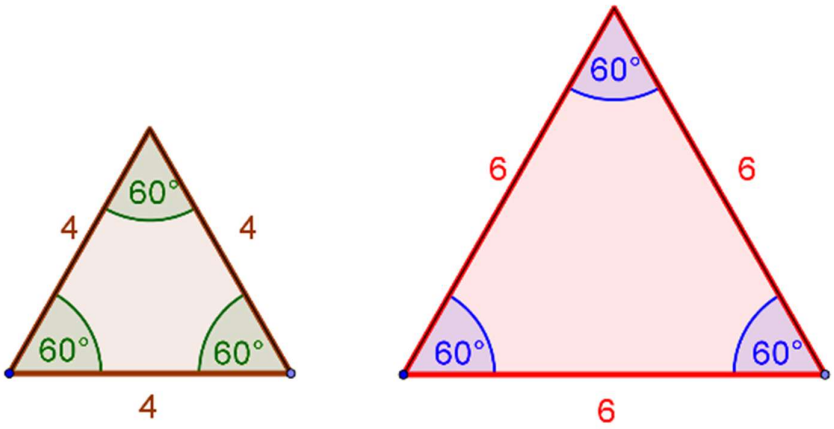
Procedure:

Step 1: On a coloured paper, draw two equilateral triangles of sides 4cm and 6cm respectively.

Step 2: Label the triangles as ABC and DEF.

Step 3: Cut triangle ABC and triangle DEF.

Step 4: Keep triangle ABC over triangle DEF and observe, do they overlap completely?



Observation: **We can clearly observe that triangles do not overlap each other completely, one of them is enlarged copy of the other. They would be congruent only if they are exact copies of one another.**

Result: **AAA- is not a Criterion for Congruence of Triangles**

You can refer to the following link:

https://youtu.be/gTFFAjbJNkA