



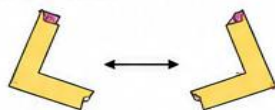
CHAPTER 1 : GEOMETRIC TWINS



SUMMARY OF CONCEPTS

1. CONGRUENCE – BASICS

- Figures that have the same shape and size are called **congruent**.
- Congruent figures can be superimposed exactly one over the other.



These figures are congruent.

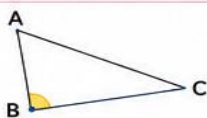
Note: A figure can be rotated or flipped before superimposing.

2. MEASUREMENTS TO RECREATE A FIGURE

- To recreate a figure exactly, we need sufficient measurements.

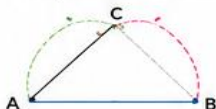
For this open figure:

- Two arm lengths (AB, BC) are not enough.
- Arm lengths AB, BC and the included angle $\angle ABC$ are enough.

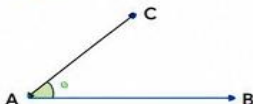


6. CONSTRUCTION OF TRIANGLES

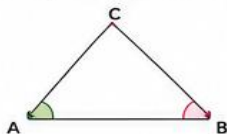
- Three sides given (SSS):** Draw base, then intersecting arcs from its endpoints with other two lengths.



- Two sides & included angle (SAS):** Draw base, construct angle, mark other side on the arm.

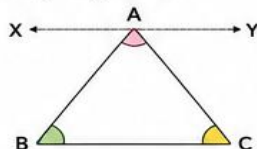


- Two angles & included side (ASA):** Draw base, construct angles at ends, intersection is third vertex.



7. ANGLE SUM PROPERTY

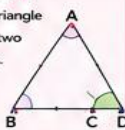
The sum of the interior angles of any triangle is 180° .



- Draw a line XY through A parallel to BC.
- By alternate angles:
 $\angle XAB = \angle B$ and $\angle YAC = \angle C$
- $\angle XAB + \angle BAC + \angle YAC = 180^\circ$
- Hence, $\angle A + \angle B + \angle C = 180^\circ$.

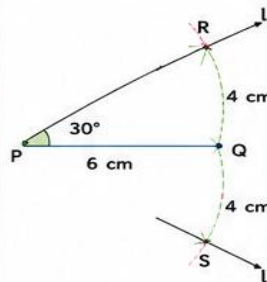
Exterior Angle Property

An exterior angle of a triangle equals the sum of the two opposite interior angles.



8. SPECIAL CASE – SSA

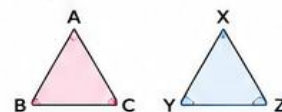
- Two sides and a non-included angle (SSA) do not always guarantee congruence.
- Two different triangles can be formed.
- Only in special cases (e.g., right triangle – RHS) congruence holds.



4. CONVENTIONS TO EXPRESS CONGRUENCE

- Write triangles in the same order of corresponding vertices.

Example:



$\triangle ABC \cong \triangle XYZ$ means

$A \leftrightarrow X, B \leftrightarrow Y, C \leftrightarrow Z$

$AB \leftrightarrow XY, BC \leftrightarrow YZ,$

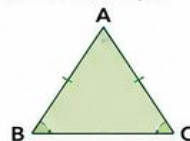
$AC \leftrightarrow XZ$

$\angle A \leftrightarrow \angle X, \angle B \leftrightarrow \angle Y,$

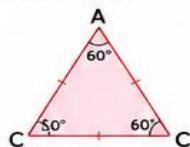
$\angle C \leftrightarrow \angle Z$

5. IN ISOSCELES & EQUILATERAL TRIANGLES

- In an **isosceles triangle**, angles opposite to equal sides are equal.



- In an **equilateral triangle**, all angles are 60° .

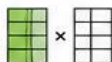


10. QUICK REFERENCE – FORMULAS & FACTS

Multiplication of Fractions

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$$

- Cancel common factors before multiplying.
- When one number is between 0 and 1 $\rightarrow$ product is less than the other number.
- When one number is greater than 1 $\rightarrow$ product is greater than the other number.



Division of Fractions

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{a \times d}{b \times c}$$

- Find reciprocal of divisor ($\frac{d}{c}$).
- Multiply by the dividend.
- When divisor $< 1 \rightarrow$ quotient is greater than dividend.
- When divisor $> 1 \rightarrow$ quotient is less than dividend.

Reciprocal of a Fraction

The reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$.

$$\left(\frac{a}{b}\right) \times \left(\frac{b}{a}\right) = 1$$

Angle Sum Property

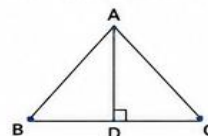
$$\angle A + \angle B + \angle C = 180^\circ$$

Equilateral Triangle

All sides equal $\rightarrow$ each angle $= 60^\circ$.

Altitude

A perpendicular from a vertex to the opposite side.



Observe carefully

Measure smartly

Compare

Match Corresponding Parts

Conclude Congruence

GEOMETRIC TWINS

WORKSHEET-1

Section A: MCQs(Part-1) ($10 \times 1 = 10$ marks)

- Two figures are said to be congruent if they have:
(a) the same shape only (b) the same size only
(c) the same shape and the same size (d) the same colour and shape
- Which of the following pairs of figures are always congruent?
(a) Any two squares (b) Any two circles
(c) Two circles with equal radii (d) Any two rectangles with the same perimeter
- Congruence of plane figures can be verified by:
(a) Superposition (b) Measuring angles only
(c) Measuring sides only (d) Comparing colours
- In Congruency Symbol $\cong$, the symbol $\sim$ indicates
(a) same shape (b) same size (c) same shape and same size (d) none of these
- If $\triangle ABC \cong \triangle QPR$, then which of the following is correct?
(a) $AB = QR$ (b) $BC = PQ$ (c) $AC = PR$ (d) $AB = PQ$ and $BC \neq QR$
- Which of the following real-life pairs BEST represents congruent figures?
(a) A photo and its enlarged copy (b) Two identical postage stamps
(c) A wall and its shadow (d) A coin and a button of the same colour
- Which rule is not use as the criterion for congruency of two triangles?
(a) ASA (b) RHS (c) SSS (d) AAA
- In $\triangle DEF$ and $\triangle LMN$, $\angle D = \angle L$, $\angle E = \angle M$, and $DE = LM$. The congruence rule applicable is:
(a) SSS (b) SAS (c) ASA (d) RHS
- If $\triangle ZXY \cong \triangle BAC$, then the corresponding angle of $\angle Y$ is:
(a) $\angle A$ (b) $\angle B$ (c) $\angle C$ (d) None of these
- In everyday life, congruent figures are found in:
(a) Tiles on a floor (b) A growing tree (c) Shadows of objects (d) Rainbows

MCQs(Part-2) ($10 \times 1 = 10$ marks)

11. Two triangles have sides measuring **8 cm, 10 cm, and 12 cm** respectively. Which congruence criterion proves that they are congruent?

- (a) SAS (b) ASA (c) SSS (d) RHS

12. Which of the following pairs of figures can be congruent?

- (a) Two rectangles of dimensions $5 \text{ cm} \times 8 \text{ cm}$ and $8 \text{ cm} \times 5 \text{ cm}$
(b) Two circles of radii 4 cm and 5 cm
(c) Two squares of sides 5 cm and 7 cm
(d) Two triangles with equal perimeters only

13. If $\triangle PQR \cong \triangle XYZ$, then the side corresponding to QR is:

- (a) XY (b) YZ (c) XZ (d) PX

14. Which of the following transformations does not change the congruence of a figure?

- (a) Stretching (b) Reflection in a mirror
(c) Enlarging the figure (d) Reducing the figure

15. Two right triangles have equal hypotenuse and one corresponding leg equal. They are congruent by:

- (a) SAS (b) SSS (c) RHS (d) ASA

16. If $\triangle ABC \cong \triangle DEF$, then which statement is correct?

- (a) $\angle A = \angle E$ (b) $BC = EF$ (c) $AC = DE$ (d) $AB = EF$

17. A carpenter makes two wooden triangular frames using side lengths 6 cm, 8 cm, and 10 cm. What can be concluded about the frames?

- (a) They have equal area only. (b) They are similar but not congruent.
(c) They are congruent. (d) Nothing can be concluded.

18. Which of the following information is not sufficient to prove two triangles congruent?

- (a) Three corresponding sides are equal.
(b) Two sides and the included angle are equal.
(c) Two corresponding angles and one corresponding side are equal.
(d) Three corresponding angles are equal.

19. A square-shaped floor tile is rotated by 90° . Which statement is true?

- (a) It is no longer congruent to the original tile. (b) Only its area remains the same.
(c) It remains congruent to the original tile. (d) Its perimeter changes.

20. In two congruent triangles, one angle measures 75° . The corresponding angle in the other triangle measures:

- (a) 105° (b) 75° (c) 90° (d) Cannot be determined

WORKSHEET-2

Section B: Short Answer ($10 \times 2 = 20$ marks)

1. What do you mean by congruent figures? Give two real-life examples of congruent objects found in your classroom.

2. Name the congruence criterion used in each case and justify briefly:

(a) Two triangles have sides 5 cm, 7 cm, 9 cm each.

(b) Two triangles have two equal sides and the angle between them equal.

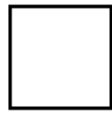
3. What measurements would you take to create a figure congruent to a given:

(a) Circle

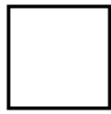
(b) Rectangle

4. Suppose Δ HOT is congruent to Δ SUN. List all the other correct ways of expressing this congruence using symbol.

5. Look at the four shapes below: Number given below figure represent length by breadth of figure.



[A] 3×3



[B] 3×3



[C] 3×4



[D] 4×4

Identify which shapes are congruent.

- (a) Which shapes are congruent to each other? Write the letters.
(b) Explain why shapes C and D are NOT congruent.

6. In $\triangle MON$ and $\triangle TUE$: $MO = UT = 6$ cm, $ON = TE = 8$ cm, $\angle O = \angle T = 90^\circ$. Name the congruence rule and write the congruence statement.

7. If $\triangle PQR \cong \triangle YZX$, $PQ = 5.4$ cm, $QR = 6.8$ cm, $PR = 7.2$ cm. Find XY , YZ , and XZ without measuring.

8. In the figure below, $\triangle ABC \cong \triangle PQR$. Write all the corresponding sides and angles.

9. During the lesson on Geometric Twins, a discussion raised among the students of class VII.

Neha says, "All squares are congruent."

Ravi says, "Only squares with the same side are congruent."

Now Teacher asked the remaining students that Who is correct and why?. Many view-points were shared and listened, but finally Nishant arrived at the correct answer. Therefore the answer to it is

10. If $\triangle DEF = \triangle PQR$, write the part(s) of $\triangle PQR$ that correspond to

(a) $\angle Q$

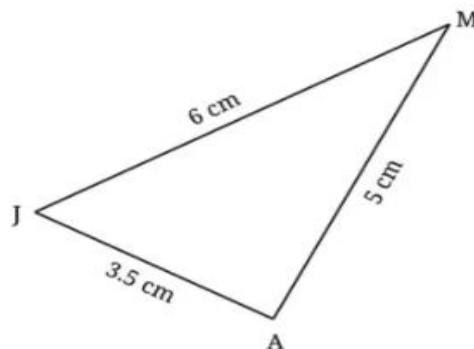
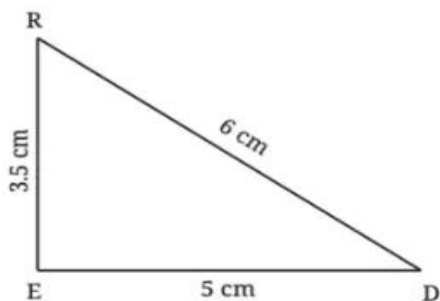
(b) $\angle F$

(c) EF

(d) DF

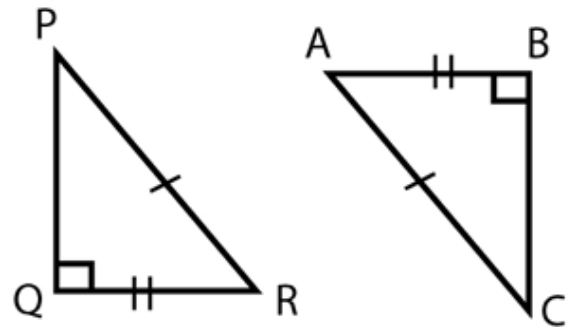
Section C: Short Answer ($6 \times 3 = 18$ marks)

11. Determine whether the triangles are congruent. If yes, express the congruence.

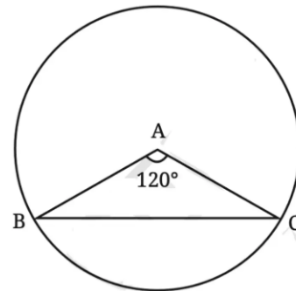


12. Determine whether the triangles are congruent.

If yes, express the congruence.



13. Find $\angle B$ and $\angle C$, if A is the Centre of the circle.



14. Each of the following cases contains certain measurements taken from two triangles. Identify the pairs in which the triangles are congruent to each other, with reason. Express the congruence whenever they are congruent.

- (a) $AB = DF$, $\angle B = \angle D = 90^\circ$, $AC = FE$
 (d) $\angle A = \angle D$, $\angle B = \angle E$, $AC = DF$

15. State whether the following statements are True or False.

- (a) Congruent figures always have the same shape and size.
 (b) Two figures with equal area are always congruent.
 (c) Rotating a figure changes its congruence.

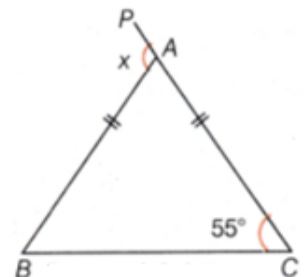
16. O is the midpoint of both diagonals AC and BD of quadrilateral ABCD.

Draw the figure and Show that $\triangle AOB \cong \triangle COD$.

Section D : Long Answer Questions (4 x 5 = 20 marks)

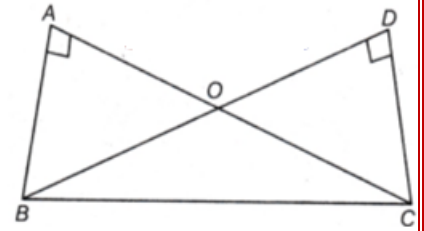
17. In the given figure, if $AB = AC$, $\angle ACB = 55^\circ$.

Find $\angle ABC$, $\angle BAC$ and if $\angle PAB = x$, then find the value of x .

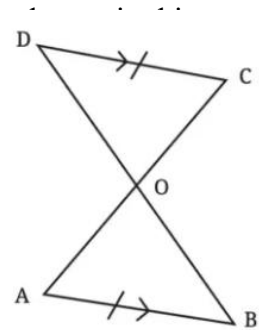


18. In the following figure, $\triangle ABC$ and $\triangle DCB$ are right angled at A and D, respectively and $AC = DB$.

- Write the pair of corresponding equal parts in $\triangle ABC$ and $\triangle DCB$ with suitable reasons.
- Write the Congruence criterion.
- Write the order for congruence of triangles.



19. Given that CD and AB are parallel, and $AB = CD$, what are the other equal parts in the figure? Are the two resulting triangles congruent? If so, express the congruence.)



20. In $\triangle ABC$, $AB = AC$ and D is the midpoint of BC. Draw the figure and then Prove that $\triangle ABD \cong \triangle ACD$ by writing corresponding equal parts.

Case Study Based Questions ($2 \times 4 = 8$ marks)

21. Design a Kite

Arjun is designing a kite. The kite has two pairs of congruent triangles. The kite ABCD has a vertical axis AC and a horizontal axis BD such that O is their intersection point, $AO = 30$ cm, $OC = 20$ cm, $BO = OD = 15$ cm.

- (a) Draw the figure for the abovesaid kite.
- (b) Name the two pairs of congruent triangles in the kite.
- (c) State the congruence criterion for each pair and prove one pair congruent.

22. Railway Bridge



Rohan is an aspiring architect. He is observing a railway bridge made of steel beams. He notices that the structure is composed of several triangular sections. He focuses on one particular section, where two triangles, $\triangle ABC$ and $\triangle PQR$ are used to support a heavy load.

His supervisor informs him that these two triangles are exactly the same in shape and size, meaning that $\triangle ABC = \triangle PQR$ under the correspondence $A \leftrightarrow P$, $B \leftrightarrow Q$ and $C \leftrightarrow R$.

- (i) If the length of side $AB = 5$ cm and $BC = 7$ cm, what must be the length of side PQ ?
- (ii) Rohan measures $\angle ABC$ to be 60° and $\angle BAC$ to be 80° . What is the measure of $\angle PRQ$?
- (iii) Which congruence criterion would Rohan use if he only knew that $AB = PQ$, $AC = PR$ and $\angle BAC = \angle QPR$?

Self Assessment:

I understood all the concepts ☐ Yes ☐ No

I need more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood all the concepts ☐ Yes ☐ No

He/She need more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment:

Answers of Worksheet-1:

Q	1	2	3	4	5	6	7	8	9	10
Ans	c	c	a	a	d	b	d	c	c	a
Q	11	12	13	14	15	16	17	18	19	20
Ans	c	a	b	b	c	b	c	d	c	b

Answers of Worksheet-2:

Q	1	2	3	4	5
Ans		(a) SSS (b) SAS.	Radius length and breadth	1. $\triangle HOT \cong \triangle SUN$ 2. $\triangle OTH \cong \triangle UNS$ 3. $\triangle TOH \cong \triangle NUS$ 4. $\triangle HTO \cong \triangle SNU$ 5. $\triangle OHT \cong \triangle USN$ 6. $\triangle THO \cong \triangle NSU$	A and B are congruent
	6	7	8	9	10
	Rule: SAS Statement: $\triangle MON \cong \triangle UTE$	$YZ = PQ = 5.4 \text{ cm}$ $XZ = QR = 6.8 \text{ cm}$ $XY = PR = 7.2 \text{ cm}$	$AB = PQ$ $BC = QR$ $AC = PR$ $\angle A = \angle P,$ $\angle B = \angle Q$ $\angle C = \angle R.$	figures to be congruent their dimensions	(a) $\angle Q = \angle E$ (b) $\angle F = \angle R$ (c) $EF = QR$ (d) $DF = PR$
	11	12	13	14	15
	$\triangle RED \cong \triangle JAM$	$\triangle PQR \cong \triangle CBA$	$\angle C = \angle B = 30^\circ$	Yes	(a) True (b) False (c) False
	16	17	18		
	proof	$x = 110^\circ$	i) $\angle A = \angle D$ (Each 90°) $AC = BD$ (Given) $BC = BC$ (common) ii) By RHS Congruence rule iii) any of 6 possible ways like $\triangle ABC \cong \triangle DCB$		
	19	20	21		22
	Yes	proof	ii) ($\triangle AOB$ & $\triangle AOD$) and ($\triangle BOC$ & $\triangle COD$) iii) $\triangle AOB \cong \triangle AOD$		(i) 5 cm (ii) 40° (iii) SAS