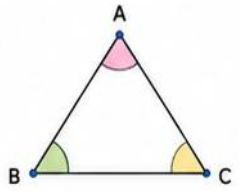
CHAPTER 7 : A TALE OF THREE INTERSECTING LINES

SUMMARY OF CONCEPTS

1. TRIANGLE – BASICS

- A triangle is a closed figure with 3 vertices and 3 sides.
- It has 3 angles.



Naming a Triangle

A triangle is named using its vertices. The order of vertices can be any.

Example: △ABC, △BCA, △CAB

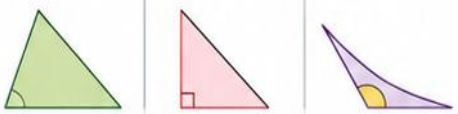
2. TYPES OF TRIANGLES

(A) By Sides

Equilateral	Isosceles	Scalene
(All sides equal)	(Two sides equal)	(All sides different)

(B) By Angles

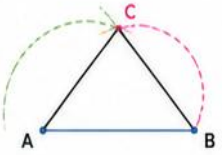
Acute-angled	Right-angled	Obtuse-angled
(All angles are acute)	(One angle is 90°)	(One angle is obtuse)



3. CONSTRUCTING TRIANGLES

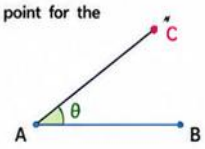
(A) When Three Sides are Given (SSS)

1. Draw the base AB = given longest side.
2. With centres A and B, draw arcs with the other two lengths as radii.
3. Their intersection is C.
4. Join AC and BC.



(B) When Two Sides and Included Angle are Given (SAS)

1. Draw the base (one given side).
2. At one end, construct the given angle.
3. On the other arm, mark the point for the other side length.
4. Join the two points.



4. TRIANGLE INEQUALITY

For any triangle with sides a, b, c:

$a < b + c \quad b < c + a \quad c < a + b$

- If the three lengths satisfy the above inequalities, a triangle exists.
- If any one inequality is not satisfied, a triangle does not exist.

Visual Test (Using Circles)

Take the longest side as base AB. Draw circles with the other two lengths as radii from A and B.

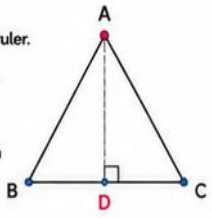
- Circles intersect internally → Triangle exists
- Circles touch at one point → No triangle
- Circles do not intersect → No triangle

5. CONSTRUCTING ALTITUDES

An altitude is a perpendicular from a vertex to the opposite side.

Steps to construct altitude from A to BC:

1. Place ruler along BC.
2. Place set square along the ruler. Slide it till the vertical edge passes through A.
3. Draw the perpendicular from A to meet BC at D.

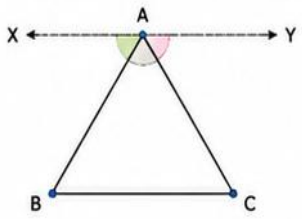


Key Points

- Right triangle: One side is an altitude.
- Other altitudes: From B to AC, and from C to AB.
- Altitudes lie inside the triangle.

6. ANGLE SUM PROPERTY

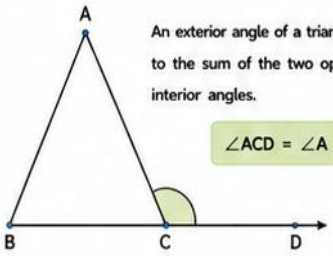
The sum of the three angles of any triangle is 180°.



Proof idea:

- Draw a line XY through A parallel to BC.
- By alternate angles: ∠XAB = ∠B and ∠YAC = ∠C.
- ∠XAB + ∠BAC + ∠YAC = 180° (straight line).
- Hence, ∠A + ∠B + ∠C = 180°.

7. EXTERIOR ANGLE PROPERTY



An exterior angle of a triangle is equal to the sum of the two opposite interior angles.

$\angle ACD = \angle A + \angle B$

Useful for finding unknown angles.

8. IMPORTANT DEFINITIONS

- **Vertex** : A corner point of a triangle.
- **Side** : A line segment joining two vertices.
- **Angle** : Formed by two sides at a vertex.
- **Altitude** : Perpendicular from a vertex to the opposite side.
- **Equilateral Triangle** : All sides equal.
- **Isosceles Triangle** : Two sides equal.
- **Scalene Triangle** : All sides different.
- **Right Triangle** : One angle is 90°.
- **Acute Triangle** : All angles are acute (less than 90°).
- **Obtuse Triangle** : One angle is obtuse (greater than 90°).

9. KEY TAKEAWAYS

- Triangle inequality tells whether a triangle can exist.
- Triangles can be constructed using SSS, SAS or ASA (two angles and included side).
- The sum of interior angles of a triangle is 180°.
- An exterior angle equals the sum of the two opposite interior angles.
- Altitudes help in many constructions and proofs.
- Triangles are classified by sides and by angles.

Remember: Observe → Visualise → Reason → Construct → Conclude

A TALE OF THREE INTERSECTING LINES

WORKSHEET-1

Section A: MCQs (PART-1) (10 × 1 = 10 marks)

1. When two sides of a triangle are equal, it may be a ……

a) Equilateral Triangle b) Isosceles Triangle

c) Equilateral or Isosceles Triangle d) None of these

2. Adjacent angles share:

a) A common arm and vertex b) No common Vertex
c) Only one side d) always have Equal measures

3. If three sides AB, BC & AC is made by joining three points with each other A, B and C to form a straight
line, then
a) AB + BC > AC b) AB + BC = AC c) AB + BC < AC d) None of these.

4. Two circles intersect maximum at _____ points.

a) 2 b) 1 c) 0 d) None of these

5. When two circles of radii R_1 and R_2 intersect each other at maximum no of points, then distance between
the centers of circles is
a) more than $R_1 + R_2$ b) less than $R_1 + R_2$ c) Equal to $R_1 + R_2$ d) More than both R_1 and R_2

6. Angles forming a Linear Pair may not be _____

a) Both Right angles b) one Obtuse & one Acute c) Both Acute d) None of these

7. Which pair of angles are always equal?

a) Adjacent angles b) Complementary angles c) Vertically opposite angles d) Supplementary angles

8. A perpendicular line segment from a vertex to its opposite side is called ,,,,,,,,,,,,,,,,,,,,,,,,,,

a) Median b) Altitude c) Diagonal d) Perpendicular Bisector

9. How many points of intersection are there when three distinct lines intersect in a plane such that no two lines are parallel?
a) 1 b) 2 c) 3 d) 0

10. Right angled triangle cannot be a/an _____ triangle

a) Isosceles b) Scalene c) Equilateral d) None of these

MCQs (PART-2) (10 × 1 = 10 marks)

11 A carpenter has three wooden strips of lengths **8 cm, 11 cm, and 18 cm**. What should he conclude?

a) They can form an equilateral triangle.
b) They can form an isosceles triangle.
c) They cannot form a triangle.
d) They form a right triangle.

12. In a triangle, two angles measure **52°** and **68°**. The third angle is:

a) 50°
b) 60°
c) 70°
d) 80°

13. Which of the following sets of lengths can be used to construct a triangle?

a) 7 cm, 9 cm, 17 cm
b) 6 cm, 8 cm, 13 cm
c) 5 cm, 6 cm, 12 cm
d) 4 cm, 7 cm, 12 cm

14. A triangle has angles **90°**, **35°**, and **55°**. It is classified as:

a) Acute-angled triangle
b) Right-angled triangle
c) Obtuse-angled triangle
d) Equilateral triangle

15. In $\triangle ABC$, $\angle A = 45°$ and $\angle B = 65°$. The exterior angle at vertex C is:

a) 70°
b) 90°
c) 110°
d) 135°

16. Which instrument is most suitable for drawing an altitude accurately in a triangle?

a) Divider only
b) Compass only
c) Set square with a ruler
d) Protractor only

17. Which statement is always true for an equilateral triangle?

a) It has one right angle.
b) It has three unequal sides.
c) All its angles are equal.
d) It has one obtuse angle.

18. Two sides of a triangle are **9 cm** and **12 cm**. Which of the following **cannot** be the length of the third side?

a) 5 cm
b) 10 cm
c) 15 cm
d) 22 cm

19. If one side of a triangle is used as the base, the altitude corresponding to that base is always:

a) Parallel to the base
b) Equal in length to the base
c) Perpendicular to the base (or its extension)
d) Bisects the base

20. A triangle has side lengths **5 cm, 5 cm, and 8 cm**. It is classified according to its sides as:

a) Scalene triangle
b) Right triangle
c) Isosceles triangle
d) Equilateral triangle

WORKSHEET-2

Section B: Short Answer (10 × 2 = 20 marks)

1. List all the elements of ΔATM.

2. If two angles of a triangle are 80° and 60°, find out the measure of the third angle?

3. If two sides of a triangle are 3 cm and 4 cm. What could be all possible integer values of third side of a triangle.

4. Directions: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true but Reason (R) is false.
(d) Assertion (A) is false but Reason (R) is true.

(i) Assertion (A): A triangle can be formed with sides 5 cm, 7 cm, and 13 cm.
Reason (R): The sum of the lengths of any two sides of a triangle must be greater than the third side.

(ii) Assertion (A): A triangle may have angles measuring 60°, 40°, and 80°.
Reason (R): In a triangle, the sum of the three interior angles is always 180°.

5. State whether the Jollowlng statements are true (T) or False (F).

(i). We can construct a triangle if its two sides are given.

(ii) 4. The altitude of a triangle is always inside the triangle.

6.How many altitudes a triangle can have? In which triangle, altitude is outside the figure.

7. If the angles of a triangle are in the ratio 3: 4: 5, then find the three angles of a triangle.

8. Name the pairs of vertically opposite angles when lines AB and CD intersect at point O.

9. Two angles of a triangle are 30° & 60°. Name the triangle based on its angles. Mention the locations of altitude of a triangle with respect to the figure.

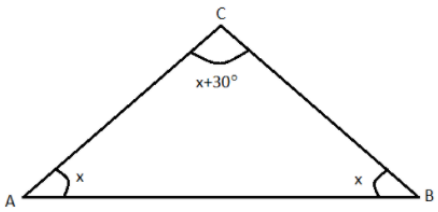
10. Fill in the blanks:

(i) The acute angles of a right-angled triangle are 40° & ……

(ii) A triangle with all angles less than ……. degrees is called an acute-angled triangle.

Section C: Short Answer (6 × 3 = 18 marks)

11. Three offices are set at three locations A, B and C in a city in the form of a triangular network as shown in the figure. The angle made at the corners is shown as below.
Find measure of angle x.
Which two offices are equidistant from the third office.



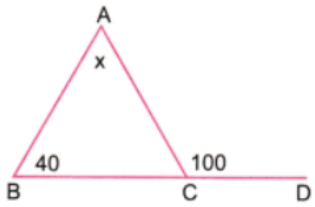
12. Construct a triangle with given measurements: 30°, 6 cm and 90°.

13. Can we say anything about the existence of a triangle for given sets of lengths 10 km, 15 km and 25 km. Explain your answer.

14. In Δ SAT, where ∠A = ∠T and ∠S = 50°. What is the measure of ∠A and ∠T? Classify the Δ SAT on the basis of angles measure and categorize, if possible, the triangle classified on sides based.

15. An exterior angle of a triangle Is 150°, and one of the interior opposite angles is double the other. Find all the interior angles of the triangle.

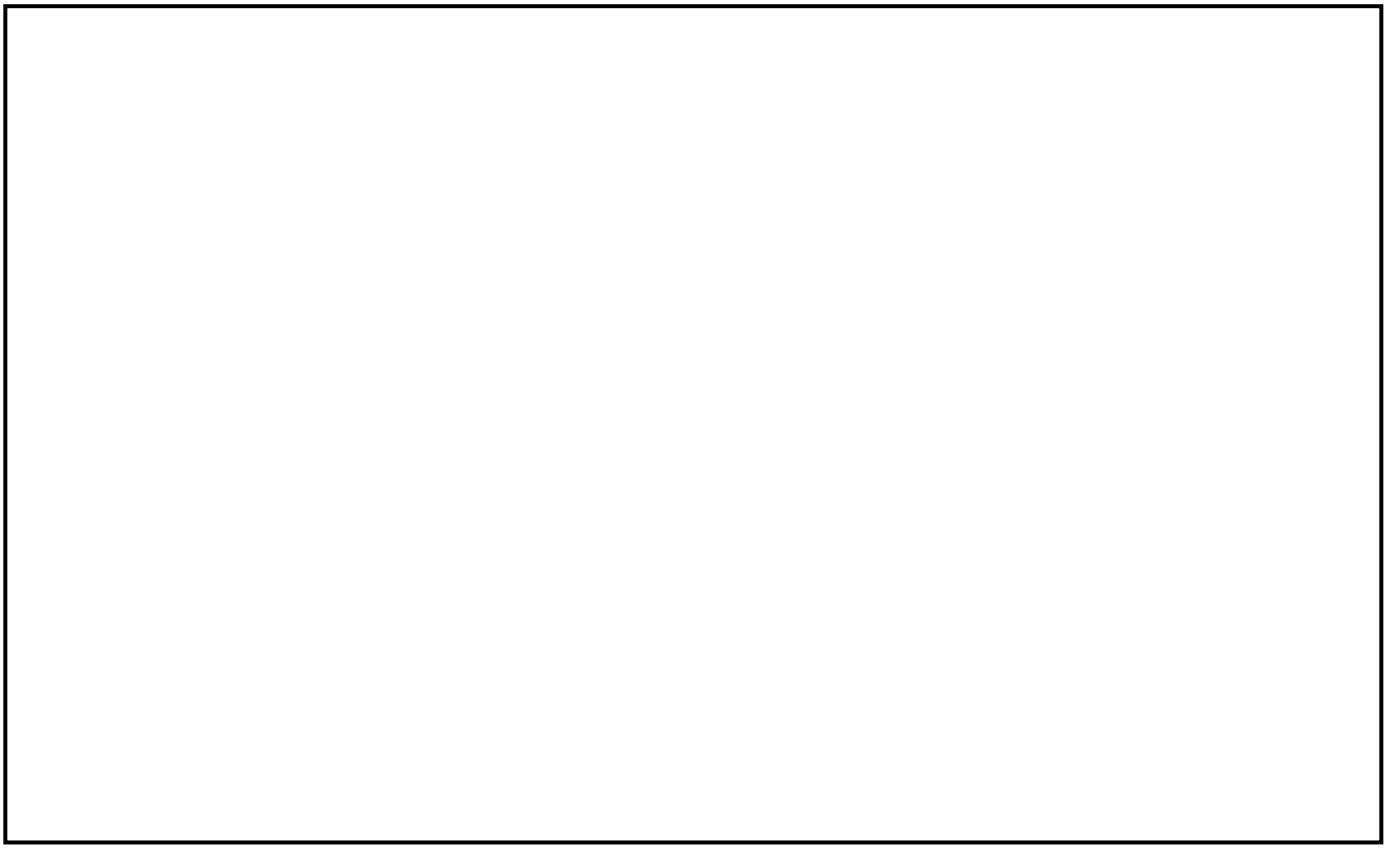
16. In the given figure, find the value of angle x and find ∠ ACB.



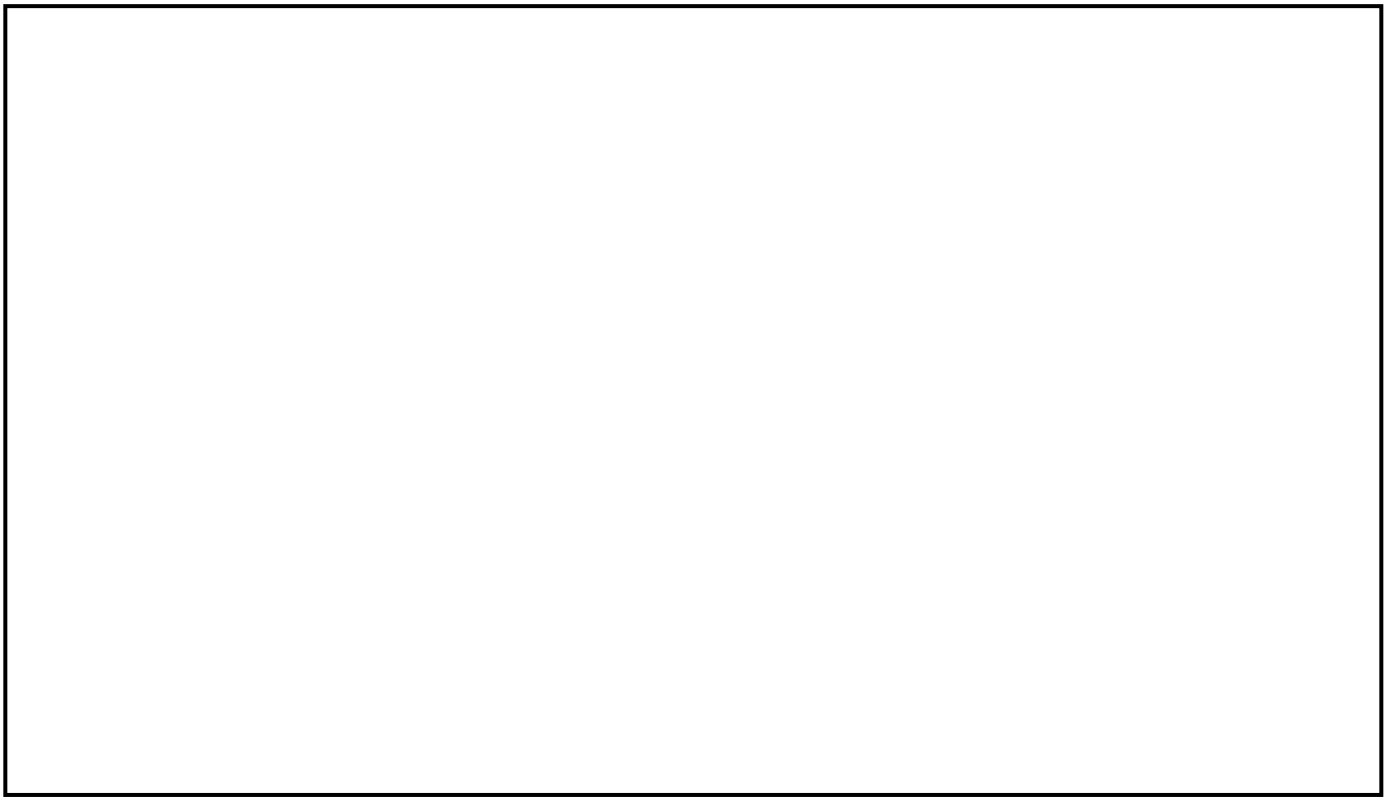
Section D: Long Answer (4 × 5 = 20 marks)

17. If two adjacent angles formed by pair of intersecting lines are (3y + 15)° and (2y − 5)°, find the value of y and both angles.

18. Construct a triangle FAT with AT = 5 cm, FA = 6 cm, FT = 5 cm. Construct an altitude from F to AT.



19. Construct a triangle DRY with RY = 4 cm, DR = 7 cm, $\angle R = 140°$. Construct an altitude from D to RY



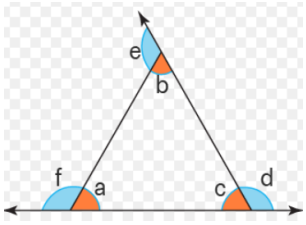
20. Six angles are given in the figure as a, b, c, d, e, f. (1+ 1 + 2 + 1)

(i) Write a relationship between angles c and d with property.

(ii) Write relationship between interior angles of a triangle.

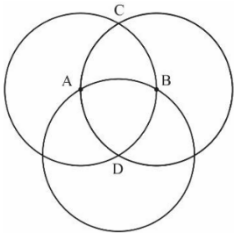
(iii) Write a relationship between exterior angle and two of its interior angles.

(iv) Write a relationship between exterior angles of a triangle.



Case Study Based Questions (2 × 4 = 8 marks)

21. Four Friends Anju, Bhawna, Chetna and Divya are sitting in the playground and playing the game of passing the ball to each other from A to C to C to B and B to D and then to A in clock-wise direction. The circles which is formed in the figure are congruent of radius 7 cm. (1 + 1 + 1 + 1)



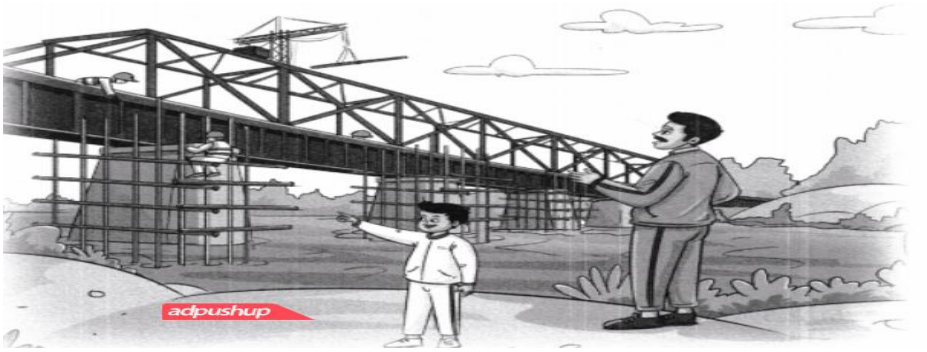
(i) What is the distance travel by ball in the game between A and B.

(ii) What is the distance covered during one complete round of passing the ball game.

(iii) Which point/ points are equidistant from A and B.

(iv) Name the type of triangle formed by points A, B and C. Name the type of triangle formed by points A, C and D.

22. **Bridge**



One morning, Rohan went to the morning walk with his father near a river and saw a bridge that was under construction.
Rohan.: Papa! Look at this bridge, It Is composed of a series of triangles.
Papa: Yes, this Is called a truss bridge. Triangular shapes are used for good support and distributes the weights evenly without disturbing the structure. (1 + 1 + 2)

i. What minimum parts required out of six parts of a triangle to be constructed.
ii. Can triangle be constructed using three angles of a triangle.
iii. The sum of the two equal angles of an isosceles triangle is equal to the third angle. Find the largest of all angles.

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 needs more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment:

Answers of Worksheet-1:

Q.No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans	c	a	b	a	b	c	c	b	c	c
Q.No	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans	c	b	b	b	c	c	c	d	c	c

Answers of Worksheet-2:

Q.No	**1**	**2**	**3**
	3 sides &3 angles	40°	2,3,4,56
	4	**5**	**6**
	(d) , (a)	i.False ii. False	3, Obtuse angled triangle
	7	**8**	**9**
	45°, 60° and 75°	2	Right angled triangle. 2 Side and 1 inside
	10	**11**	**12**
	i. 50° ii. 90°	50° , C	Construct by ASA
	13	**14**	**15**
	Not Possible, as inequality condition for triangle is not satisfied	∠A = ∠T = 65°. Acute angles and Isosceles triangle	50°, 100° and 30°
	16	**17**	18
	x = 60° ∠ ACB = 80°	y = 34° & Angles are 117° & 63°	Construct SSS & Altitude
	19	20	21
	Construct SAS & Altitude	(i) c + d = 180° (ii) a + b + c = 180° (iii) b + c = f or a + b = d or a + c = e (iv) d + e + f = 360°.	i. 10 cm ii. 20 cm iii. C & D iv.Equilateral Isosceles.
	22		
	i.3 ii. No iii. 90°		