

Coordinate Geometry

Learning Objectives :

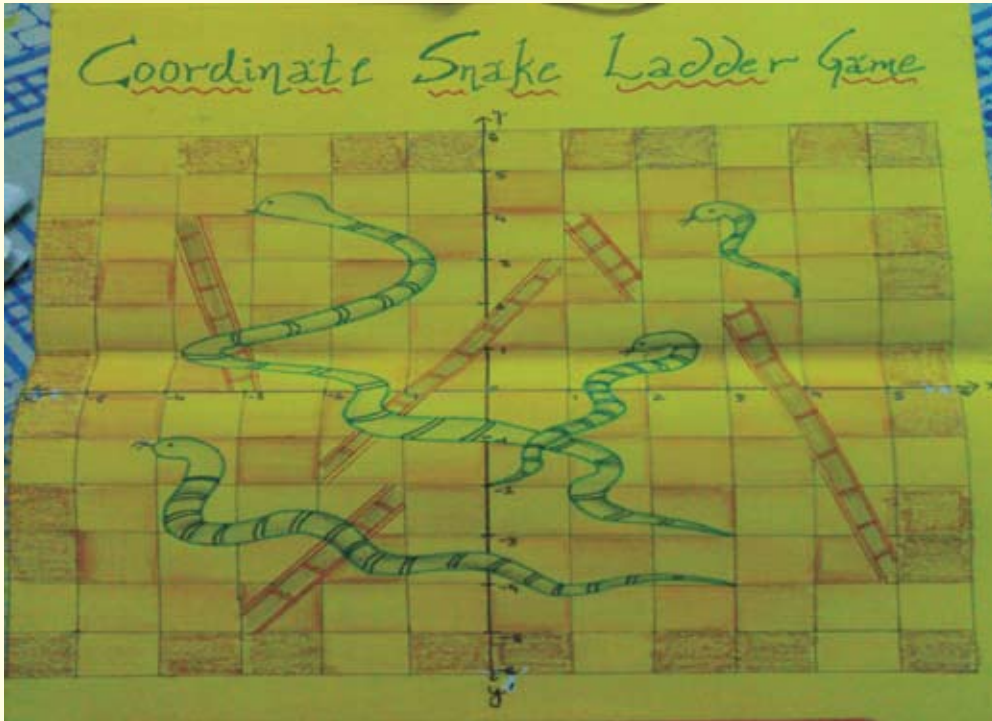
- Learning Objectives
- To reinforce the plotting of points in two dimensional Cartesian coordinate system.
- To learn to find the distance between two points on a plane.
- To find the coordinates of a point P which divides the line segment joining the points A & B internally in the ratio m:n.
- To find the mid point of line segment joining points P & Q.
- To apply the knowledge of coordinate geometry for finding the area of a triangle.

Suggested Formative Assessment tasks

Task-1: Play & learn

Topic	Coordinate Geometry
Nature of task	Pre Content
Content Coverage	Plotting of points on coordinate plane.
Learning Objectives	To reinforce the understanding of plotting of points on coordinate plane.
Task	Play & learn
Execution of task	This task may be performed in the classroom. Students can be given the photocopies of the game sheet & should be asked to work in pairs & play the game.
Duration	1 period
Criteria for assessment	Teacher may discuss about their experience in the game. It is not necessary to give marks for this assessment. It may be used for diagnostic purpose.
Follow up	If the students are not clear with the concept of plotting of points then teacher may explain again. The following link demonstrates the concept of coordinate geometry beautifully & students will find fun learning the concept. http://funbasedlearning.com/algebra/graphing/points/default.htm



Game Directions :**Number of Players : 2****Material required :**

- Coordinate Snake Ladder Game Sheet
- 2 Red & 2 Blue dice (numbers on one dice of each color as 1 to 6, numbers on another dice of each color as -1 to -6)
- Board piece for each player to locate his/her position.

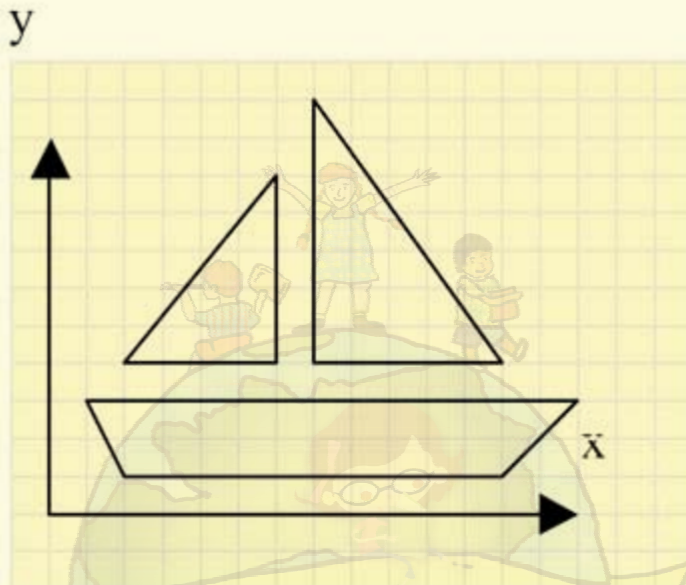
Game Direction :

- To start with, first player has to choose a red dice (randomly out of two red dice) & a blue dice (randomly out of two red dice). Red is for x -axis & Blue is for y -axis. Then the player has to throw the two dice simultaneously, locate the coordinates on the game sheet (Suppose he gets -3 on red & 4 on blue dice, then this will correspond to $(-3, 4)$ on game sheet) & put his/her board piece at that position.
- The second player will move in the same way.
- Snakes & ladder will act as in normal snake ladder game, snake will bring the position down & ladder will give a lift.
- The game ends when one of the player reaches $(-6, 6)$ first.



Follow up Task :**Plotting Pictures**

Have students plot and connect sets of coordinates that result in various shapes, such as a sailboat, a chimney, or a palm tree. For example, if students plot and connect the points (1, 2), (2, 3), (3, 3), (4, 2), (3, 1), and (2, 1), it forms a hexagon. Have students draw shapes on graph paper and then list the coordinates; give other students the coordinates for these designs to graph.



What are the coordinates that define this sailboat ?

Answer : (2, 1), (12, 1), (1, 13), (14, 3), (2, 4), (6, 9), (6, 4), (12, 4), (7, 4), (7, 11)

Task-2: Practice Sheet

Topic	Coordinate Geometry
Nature of Task	Post content
Content Coverage	Distance between two points on a coordinate plane
Learning objectives	Specify and Describe location of the cities using common language and geometric vocabulary Find the distance between points along horizontal and vertical lines of a coordinate system.
Task	Class Worksheet
Execution of task	The task can be performed in the last 20 minutes of the teaching session. A worksheet may be given to students in group.
Duration	1 period
Criteria for assessment	Teacher may prepare a rating scale according to the marks assigned to this task.
Follow up	Worksheet for practice may be given.



Class Worksheet

Find the coordinate (x, y) of the various cities of India, mentioned in the worksheet below using the figure 1:



Figure 1



Cities	Coordinates	Cities	Coordinates
New Delhi		Jaipur	
Mumbai		Chandigarh	
Kolkata		Guwahati	
Chennai		Patna	
Bangalore		Ernakulam	
Lucknow		Bhubaneshwar	
Hyderabad			

Find the distance between the various cities of India using distance formula, mentioned in the worksheet below using the figure 1:

	Jaipur	Bhopal	Chandigarh	Guwahati	Patna
New Delhi					
Mumbai					
Kolkata					
Chennai					
Bangalore					
Lucknow					
Hyderabad					
Ernakulam					
Bhubaneshwar					

Note: One unit measures 142.52 km



Task-3: Class Quiz/Oral Assessment

Topic	Coordinate Geometry
Nature of task	Post Content
Content Coverage	Plotting of points, Distance formula, Section formula, Area of triangle.
Learning Objectives	<ul style="list-style-type: none"> ● To plot the points in coordinate plane. ● To apply distance formula to find the distance between two points. ● To use Section formula to find a point between two given points with a given ratio. ● To find the area of a triangle.
Task	Class Quiz/Oral assessment
Execution of task	This task may be performed by sparing 2 periods after the completion of the chapter. The class may be divided in 4 teams (Ramanujan, Aryabhat, Shakuntala Devi, Rene Discartes). The teacher can keep writing the scores on board after each round.
Duration	2 periods
Criteria for assessment	Teacher may prepare a rating scale according to marks assigned to this task.
Follow up	Worksheet for practicing may be given

Suggested Rounds & questions for the quiz:**Rapid Fire Round:**

(In this round mental math should be encouraged, use of paper-pen should not be allowed)

1. The distance of the point P (2, 3) from the x -axis is:
 (A) 2 (B) 3 (C) 1 (D) 5
2. The distance between the points A (0, 6) and B (0, -2) is:
 (A) 6 (B) 8 (C) 4 (D) 2
3. The distance of the point P (-6, 8) from the origin is:
 (A) 8 (B) 27 (C) 10 (D) 6
4. The distance between the points (0, 5) and (-5, 0) is:
 (A) 5 (B) 52 (C) 25 (D) 10



5. AOBC is a rectangle whose three vertices are vertices A (0, 3), O (0, 0) and B (5, 0). The length of its diagonal is:
 (A) 5 (B) 3 (C) 34 (D) 4
6. The perimeter of a triangle with vertices (0, 4), (0, 0) and (3,0) is:
 (A) 5 (B) 12 (C) 11 (D) 7 + 5
7. The area of a triangle with vertices A (3, 0), B (7, 0) and C (8, 4) is:
 (A) 14 (B) 28 (C) 8 (D) 6
8. The points (-4, 0), (4, 0), (0, 3) are the vertices of a:
 (A) Right triangle (B) Isosceles triangle
 (C) Equilateral triangle (D) Scalene triangle
9. Point on x axis has coordinates:
 (A) (a, 0) (B) (0, a) (C) (-a, a) (D) (a, -a)
10. Point on y axis has coordinates:
 (A) (-a, b) (B) (a, 0) (C) (0, b) (D) (-a, -b)

Buzzer Round:

(In this round students will take time to solve & answer the questions)

1. Find the coordinates of the point (-4, 6) divide the line segment joining A (-6, 10) and B (3, -8)?
2. Find the ratio in which the line segment joining (6, 4) and (1, -7) is divided by x-axis.
3. If (2, 1), (3, 4), (0, 1) are three vertices taken in order of a parallelogram, find the fourth vertex.
4. The vertices of a triangle are (a, b - c), (b, c - a) and (c, a - b). Prove that its centroid lies on x-axis.
5. Determine the ratio in which the line $x - y - 2 = 0$ divides the line segment joining (3, -1) and (8, 9). Also find the coordinates of the point of division.
6. If the points (a, 0), (0, b) and (1, 1) are collinear then show that $1/a + 1/b = 1$.
7. Find the area of the quadrilateral formed by joining the points A (-4, 2), B (-3, -5), C (3, -2) and D (2, 3).
8. Determine if the points (1, 5), (2, 3) and (-2, -11) are collinear.

Framing Question Round:

(In this round, each team needs to frame 5 questions from the chapter. This should be a time bound round)



Task-4: MCQ

Topic	Coordinate Geometry
Nature of task	Post Content
Content Coverage	Complete Chapter
Task	MCQ
Execution of task	Printed assignment may be given after completing the chapter. After completion of worksheet, teacher can ask children to interchange their sheets & a quick evaluation can be done by class discussion.
Duration	10-15 minutes.
Criteria for assessment	Teacher may prepare a rating scale according to the marks assigned to this task.

Multiple Choice Questions

- Point A $(-5, 6)$ is at a distance of:

(A) $\sqrt{61}$ units from origin (B) $\sqrt{11}$ units from origin
 (C) 61 units from origin (D) 11 units from origin
- If the points $(1, x)$, $(5, 2)$ & $(9, 5)$ are collinear then value of x is:

(A) $5/2$ (B) $-5/2$ (C) -1 (D) 1
- The end points of diameter of circle are $(2, 4)$ & $(-3, -1)$. The radius of the circle is:

(A) $5\sqrt{2}/2$ (B) $5\sqrt{2}$ (C) $3\sqrt{2}$ (D) $\pm 5\sqrt{2}/2$
- The ratio in which x -axis divides the line segment joining the points $(5, 4)$ & $(2, -3)$ is:

(A) $5:2$ (B) $3:4$ (C) $2:5$ (D) $4:3$
- The point which divides the line segment joining the points $(7, -6)$ and $(3, 4)$ in ratio $1 : 2$ internally lies in the:

(A) I quadrant (B) II quadrant (C) III quadrant (D) IV quadrant
- The point which lies on the perpendicular bisector of the line segment joining the points A $(-2, -5)$ and B $(2, 5)$ is:

(A) $(0, 0)$ (B) $(0, 2)$ (C) $(2, 0)$ (D) $(-2, 0)$
- The fourth vertex D of a parallelogram ABCD whose three vertices are A $(-2, 3)$, B $(6, 7)$ and C $(8, 3)$ is:

(A) $(0, 1)$ (B) $(0, -1)$ (C) $(-1, 0)$ (D) $(1, 0)$
- If the point P $(2, 1)$ lies on the line segment joining points A $(4, 2)$ and B $(8, 4)$, then:

(A) $AP = 1/3 AB$ (B) $AP = PB$ (C) $PB = 1/3 AB$ (D) $AP = 1/2 AB$



Task-5: Home Assignment

Topic	Coordinate Geometry
Nature of task	Post Content
Content Coverage	Complete Chapter
Learning Objectives	<ul style="list-style-type: none"> ● To plot the points in coordinate plane. ● To apply distance formula to find the distance between two points. ● To use Section formula to find a point between two given points with a given ratio. ● To find the area of a triangle.
Task	Home Assignment (Short/Long questions)
Execution of task	Printed assignment may be given after completing the chapter.
Duration	2 days.
Criteria for assessment	Follow Rubric for H.W/Assignments
Follow up	Reference material in the form of important points to remember can be given as a support material.

Home Assignment: Short & long Questions

- The coordinate of the mid point of the line joining the point $(3p, 4)$ and $(-2, 2q)$ are $(5, p)$. Find the value of p and q .
- The consecutive vertices of a parallelogram ABCD are $A(1, 2)$, $B(1, 0)$ and $C(4, 0)$. Find the fourth vertex D.
- Determine, whether each of the given points $(-2, 1)$, $(2, -2)$ and $(5, 2)$ are the vertices of right angle.
- Find the point on x -axis which is equidistant from $(-2, 5)$ and $(2, 3)$.
- If the distance of $p(x, y)$ from $A(5, 1)$ and $B(-1, 5)$ are equal. Prove that $3x = 2y$.
- Show that the points $A(5, 6)$, $B(1, 5)$, $C(2, 1)$ and $D(6, 2)$ are vertices of a square.
- Show that the points $A(2, -2)$, $B(14, 10)$, $C(11, 13)$ and $(-1, 1)$ represent a rectangle.
- Show that the points $A(1, 0)$, $B(5, 3)$, $C(2, 7)$, $D(-2, 4)$ are the vertices of a rhombus.
- Prove that the points $(-2, -1)$, $(1, 0)$, $(4, 3)$ and $(1, 2)$ are the vertices of parallelogram.
- Find the lengths of the median of the triangle whose vertices are $(1, -1)$, $(0, 4)$ and $(-5, 3)$.



11. Prove that the diagonal of a rectangle bisect each other and are equal.
12. Find the ratio in which the point (11, 15) divides the line segment joining the point (15, 5) and (9, 20).
13. Find the ratio in which the point P (m, 6) divides the line segment joining the point A(-4, 3) and B(2, 8). Also find the value of m.
14. If two vertices of ΔABC are A(3, 2), B(-2, 1) and its centroid G has the coordinate $(\frac{5}{3}, -\frac{1}{3})$. Find the coordinates of the third vertex.
15. The co-ordinate of the mid point of the line joining the point (3p, 4) and (-2, 2q) are (5, p). Find the value of p and q.
16. The consecutive vertices of a parallelogram ABCD are A(1, 2), B(1, 0) and C(4, 0). Find the fourth vertex D.

Task-6: Remedial Worksheet

Topic	Coordinate Geometry
Nature of task	Delivery of content/Post Content
Content Coverage	Plotting of points, Distance formula, Section formula, Area of triangle.
Learning Objectives	To provide remedial measures on specific topics based on individual needs.
Task	Need based worksheets.
Execution of task	<p>After diagnostic test & before taking remedial test, teacher should take all possible cures and remedies in the teaching process which could be-</p> <ol style="list-style-type: none"> a) Category wise remedial classes-not more than 5 to 10 students in each class. (With the large class size ,this could better be achieved with group work. Teacher can divide the class in small groups of 4-5 students, in each group there should be one good performer who can help out other members of his/her group who are comparatively under achievers (based on the result of diagnostic test, class observation). b) Personal and individual attention by teacher. c) No humiliation. d) Special carefully devised UAA (under achiever's assignment) - Simpler-Simple-Complex.



	<p>e) Read-Re-read-Write-Re-Write-Reproduce-Drill.</p> <p>f) Group studies; group learning.</p> <p>g) Micro-notes.</p> <p>h) Teaching selected portion of syllabus only.</p> <p>For taking remedial tests teacher should group up children facing same problems & should prepare each group's need based worksheets.</p>
Duration	1 period
Criteria for assessment	<ul style="list-style-type: none"> ● Observation of group based remedial teaching. ● Rubric for remedial worksheets.
Follow up	Remedial practice sheets of subtopics & frequent retests.

Need Based Remedial Worksheets:

● Memory Based Remedial Sheet

Write formulae:

1. Distance formula
2. Section formula
3. Mid point formula
4. Centroid formula given the coordinates of the vertices of triangle
5. Area of triangle given the coordinates of its vertices

● Conceptual Understanding Based Remedial sheet

Fill in the blanks:

1. The coordinates of any general point on x -axis is _____.
2. The coordinates of any general point y -axis _____.
3. In order to prove, the three given points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of an equilateral triangle, we need to show that AB , BC & CA are _____.
4. In order to prove, the three given points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of an isosceles triangle, we need to show that _____.
5. In order to prove, the three given points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of a right triangle, we need to verify _____ theorem.



● **Application Based Remedial Sheet.**

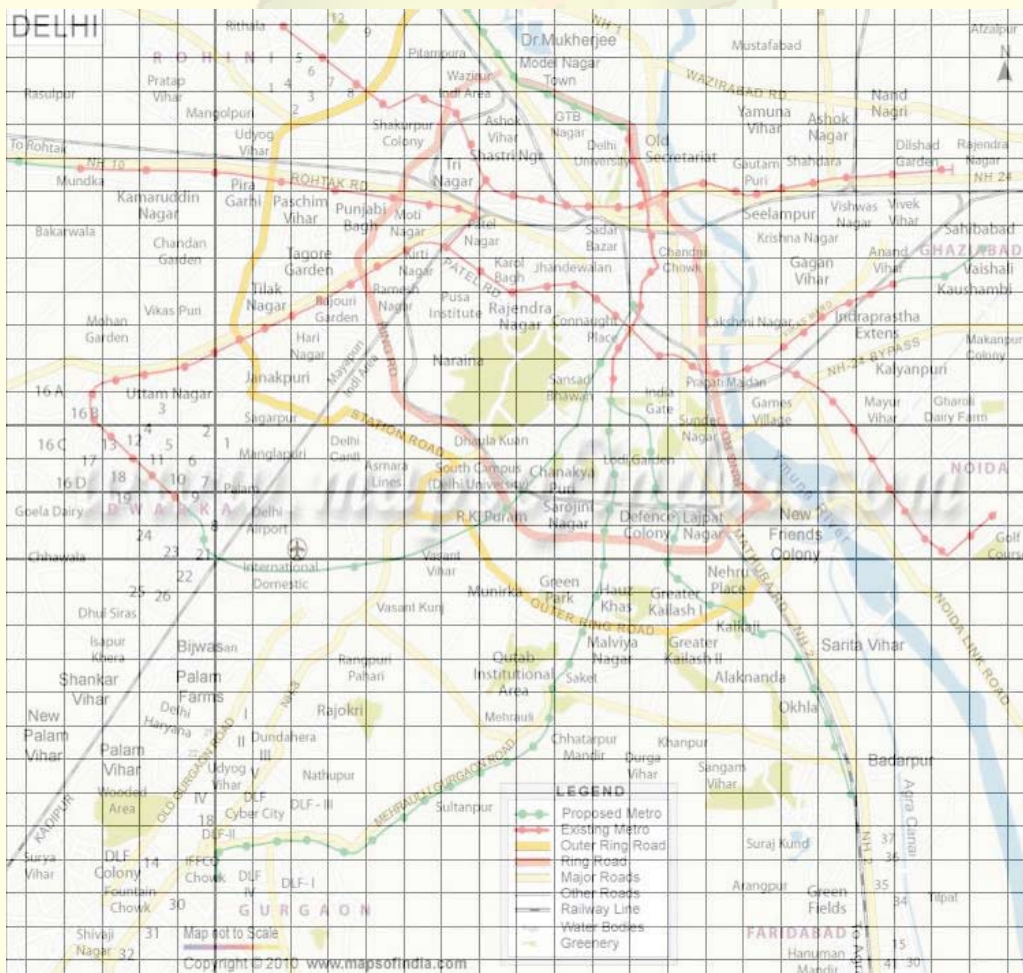
1. The base AB of two equilateral triangles ABC and ABC' with side $2a$ lies along the x -axis such that the mid point of AB is at the origin. Find coordinates of vertices C and C' of the triangles.
2. If P and Q are two Points whose coordinates are $(at^2, 2at)$ respectively and S is the point (a, b) . Show that $(1/SP) + (1/ SQ)$ is independent of t .
3. Find the co-ordinates of the centre of the circle passing through the points $(0, 0)$, $(-2, 1)$ and $(-3, 2)$. Also find the radius.
4. Determine the ratio in which the line segment $3x + y - 9 = 0$ divides the segment joining the points $(1, 3)$ and $(2,7)$.

Task-7: Project Work

Topic	Coordinate Geometry
Nature of task	Post Content
Content Coverage	Whole chapter
Learning Objectives	To apply the knowledge of Coordinate Geometry in real life.
Task	Project work
Execution of task	The class may be divided into groups of 6 to 8 students (Students living in the same neighborhood may be assigned in one group). Each group is supposed to work as a team for the completion of project. Few members can take responsibility of gathering required information for the project, others can work for making a rough draft from the gathered information. All members should discuss the draft & give their inputs. After finalizing few members can writes the report.
	The project work completes with the submission of report. A small seminar could be conducted where the team leader should present their work to the complete class.
Duration	10 to 15 days
Criteria for assessment	The project work could be assessed according to the following parameters: <ul style="list-style-type: none"> ● Team Spirit ● Identification of project ● Procedure adopted ● Preparation of Report ● Class presentation of the work
Follow up	–



Project Title	Plot a grid of coordinates on your city map and find the distances between important landmarks
Team size	4 students
Duration	1 week
Learning Objective	To understand and appreciate the use of coordinate geometry in real world
Hints and Suggestions	<p>Important landmarks could be home, school, shopping complex, etc.</p> <ol style="list-style-type: none"> 1. Get a map of their city and superimpose the coordinates on it. 2. Identify the coordinates of the important landmarks. 3. Calculate the graphical distance between the landmarks. 4. Using the scale calculate the actual distance in km/mi.



Project Title	Find out how airplane navigation and naval navigation uses coordinate geometry
Team size	4 students
Duration	1 week
Learning Objective	To understand and appreciate the use of coordinate geometry in navigation
Hints and Suggestions	Airplanes and Naval ships rely on the vast coordinate of the earth's magnetic field for communication



CHAPTER-8

Introduction to Trigonometry

Task-1: Do as directed

Topic	Introduction to Trigonometry
Nature of task	Content
Content Coverage	Basics of trigonometry ; T-Ratios of 30° , 45° , 60° , 90°
Learning Objectives	To recall definition of basic ratios To recall and find value of T-Ratio of special angles
Execution of task	The teacher may provide printed worksheet to the students.
Duration	1 Period
Criteria for Assessment	1 mark for each correct answer can be awarded.

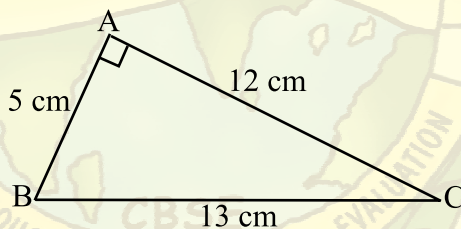


Fig. (1)

- In Fig. (1), $\sin C = \frac{5}{?}$
- The word 'trigonometry' is derived from the Greek words and
- If $\sin A = \sin A'$ (Fig. (2)) then find $B'C'$.

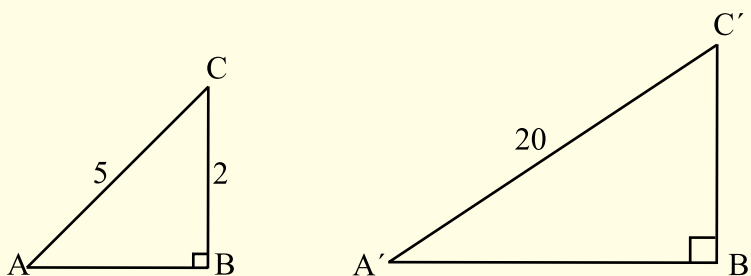


Fig. (2)



4. Write 'True' or 'False'.

- (A) $\sin A = \sin \times A$ (B) $\cos A = \frac{5}{3}$ for some angle A.
 (C) $\sec \theta = \frac{1}{\cos \theta}$, for an acute angle θ (D) $\sin 60^\circ = 2 \sin 30^\circ$
 (E) $\cos 75^\circ \neq \cos 45^\circ + \cos 30^\circ$. (F) If $\tan A = \frac{4}{3}$ then $\cos A = \frac{3}{4}$

5. Fill in the blanks :

- (A) $5 \cos 0^\circ + \sin 90^\circ = \dots\dots\dots$ (B) $\tan 0^\circ = \dots\dots\dots$
 (C) $\tan 90^\circ$ is $\dots\dots\dots$ (D) If $\sin \theta = 1$ then $\theta = \dots\dots\dots$
 (E) $2 \tan^2 45^\circ = \dots\dots\dots$ (F) $2 \cos^2 45^\circ = \dots\dots\dots$

6. Fill in the blanks.

- (A) $\sin \theta \dots\dots\dots$ when θ increases from 0° to 90° .
 (B) $\cos \theta \dots\dots\dots$ when θ increases from 0° to 90° .
 (C) $\frac{\cos 58^\circ}{\sin 32^\circ} = \dots\dots\dots$
 (D) $\sin 0^\circ. \sin 10^\circ. \sin 30^\circ. \sin 80^\circ. \sin 90^\circ = \dots\dots\dots$

7. Write 'True' or 'False'.

- (A) In a $\triangle ABC$, if $\angle A + \angle C = 90^\circ$, then $\sin A = \cos C$.
 (B) $\tan 60^\circ = \cot (90 - 30^\circ)$
 (C) $\sin \theta + \cos \theta = 1$
 (D) $\cot^2 A = \operatorname{cosec}^2 A - 1$
 (E) $\sin^2 54^\circ + \cos^2 36^\circ = 1$
 (F) $\operatorname{cosec} 50^\circ = \sec 40^\circ$

8. Prove that $(1 + \tan^2 \theta) (1 + \sin \theta) (1 - \sin \theta) = 1$

9. Evaluate $\tan 5^\circ \tan 25^\circ \tan 30^\circ \tan 65^\circ \tan 85^\circ$.



Task-2: MCQ Worksheet

Topic	Introduction to Trigonometry
Nature of task	Content
Content Coverage	Complete Chapter
Learning Objectives	<ul style="list-style-type: none"> T-Ratios of special angles. Trigonometry Identities
Execution of task	The teacher may give printed worksheet to the students.
Duration	1 Period
Criteria for Assessment	<ul style="list-style-type: none"> For each correct answer, 1 mark may be allotted. In case, MCQ is used as practise worksheet them, it is not necessary to assign marks.
Follow up	Classroom Discussion : Answers to the questions and common errors may be discussed in the class.

MCQ Worksheet

Q.1. Value of θ , for $\sin 2\theta = 1$, where $0^\circ < \theta < 90^\circ$ is :

- (A) 30° (B) 60° (C) 45° (D) 135°

Q.2. Value of $\sec^2 26^\circ - \cot^2 64^\circ$ is :

- (A) 0 (B) 1 (C) -1 (D) 2

Q.3. Product $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 89^\circ$ is :

- (A) 1 (B) 0 (C) -1 (D) 90

Q.4. $\sqrt{1 + \tan^2 \theta}$ is equal to :

- (A) $\cot \theta$ (B) $\cos \theta$ (C) $\operatorname{cosec} \theta$ (D) $\sec \theta$

Q.5. If $A + B = 90^\circ$, $\cot B = \frac{3}{4}$ then $\tan A$ is equal to :

- (A) $\frac{3}{4}$ (B) $\frac{4}{3}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$



Q.6. Maximum value of $\frac{1}{\operatorname{cosec} \theta}$, $0^\circ < \theta < 90^\circ$ is :

- (A) -1 (B) 2 (C) 1 (D) $\frac{1}{2}$

Q.7. If $\cos \theta = \frac{1}{2}$, $\sin \phi = \frac{1}{2}$ then value of $\theta + \phi$

- (A) 30° (B) 60° (C) 90° (D) 120°

Q.8. If $\sin (A + B) = 1 = \cos (A - B)$ then

- (A) $A = B = 90^\circ$ (B) $A = B = 0^\circ$ (C) $A = B = 45^\circ$ (D) $A = 2B$

Task-3: Remedial Worksheet

Topic	Introduction to Trigonometry
Nature of task	Need based
Content Coverage	Need based
Execution of task	<ul style="list-style-type: none"> • Common problems can be taken up in the class. • Individual remedial worksheets can be given to students as per need.
Duration	Individual learners need based.

1. Fill up :

- (A) $\tan 65^\circ$
 $= \tan (90^\circ - \square) =$
- (B) $\tan 25^\circ$
 $= \tan (90^\circ - \square) =$
- (C) $\cos 31^\circ$
 $= \cos (90^\circ - \square) =$
- (D) $\sin 39^\circ$
 $= \sin (90^\circ - \square) =$
- (E) $\sec^2 35^\circ$
 $= \sec^2 (90^\circ - \square) =$
- (F) $\operatorname{cosec}^2 40^\circ$
 $= \operatorname{cosec}^2 (90^\circ - \square) =$
- (G) $\sin^2 89^\circ$
 $= \sin^2 (90^\circ - \square) =$
- (H) $\sec^2 80^\circ$
 $= \sec^2 (90^\circ - \square) =$
- (I) $\tan^2 67^\circ$
 $= \tan^2 (90^\circ - \square) =$
- (I) $\sec 37^\circ$
 $= \sec (90^\circ - \square) =$



2. Express $\cot 79^\circ + \tan 80^\circ$ in terms of :

(A) trigonometric ratios of angles between 0° and 45°

$$\begin{aligned} & \cot 79^\circ + \tan 80^\circ \\ &= \cot (90^\circ - \boxed{}) + \tan (90^\circ - \boxed{}) \\ &= \end{aligned}$$

(B) Express $\bar{\cos} 75^\circ + \bar{\sin} 85^\circ$ in terms of trigonometric ratios of angles between 0° and 45° .

$$\begin{aligned} & \bar{\cos} 75^\circ + \bar{\sin} 85^\circ \\ &= \cos (90^\circ - \boxed{}) + \sin (90^\circ - \boxed{}) \\ &= \end{aligned}$$

3. Find the errors (if any) and correct it :

$$\begin{aligned} \text{(A)} \quad & \frac{\sin^2 20^\circ + \sin^2 70^\circ}{\cos^2 20^\circ + \cos^2 70^\circ} & \text{(B)} \quad & \frac{\sin^2 20^\circ + \sin^2 70^\circ}{\cos^2 20^\circ + \cos^2 70^\circ} \\ &= \frac{\sin^2 (90^\circ - 20^\circ) + \sin^2 70^\circ}{\cos^2 (90^\circ - 20^\circ) + \cos^2 70^\circ} & &= \frac{(\sin 20^\circ + \sin 70^\circ)^2}{(\cos 20^\circ - \cos 70^\circ)^2} \\ &= \frac{\sin^2 70^\circ + \sin^2 70^\circ}{\cos^2 70^\circ + \cos^2 70^\circ} \end{aligned}$$

$$\begin{aligned} \text{(C)} \quad & \frac{\sin^2 20^\circ + \sin^2 70^\circ}{\cos^2 20^\circ + \cos^2 70^\circ} & \text{(D)} \quad & \frac{\sin^2 20^\circ + \sin^2 70^\circ}{\cos^2 20^\circ + \cos^2 70^\circ} \\ &= \frac{\sin^2 20^\circ + \sin^2 (90^\circ - 20^\circ)}{\cos^2 20^\circ + \cos^2 (90^\circ - 20^\circ)} & &= \frac{\sin^2 90^\circ}{\cos^2 90^\circ} \\ &= \frac{\sin^2 20^\circ + \cos^2 20^\circ}{\cos^2 20^\circ + \sin^2 20^\circ} \end{aligned}$$

$$\begin{aligned} \text{(E)} \quad & \frac{\sin^2 20^\circ + \sin^2 70^\circ}{\cos^2 20^\circ + \cos^2 70^\circ} \\ &= \frac{\sin^2 20^\circ + \sin^2 (90^\circ - 70^\circ)}{\cos^2 20^\circ + \cos^2 (90^\circ - 70^\circ)} \\ &= \frac{\sin^2 20^\circ + \cos^2 20^\circ}{\cos^2 20^\circ + \sin^2 20^\circ} \\ &= 1 \end{aligned}$$



CHAPTER-9

Some Applications of Trigonometry

Suggested Formative Assessment Tasks

Task-1: Recognise & Fill

Topic	Application of Trigonometry
Nature of task	Pre content
Content Coverage	Angle of elevation, depression, line of sight
Task	Worksheet
Execution of task	Printed worksheet may be given to the students.
Duration	10-15 minutes.
Criteria for assessment	Teacher may discuss the worksheet and observe the level of understanding. It is not necessary to give marks for this assessment. It may be used for diagnostic purpose.

Worksheet

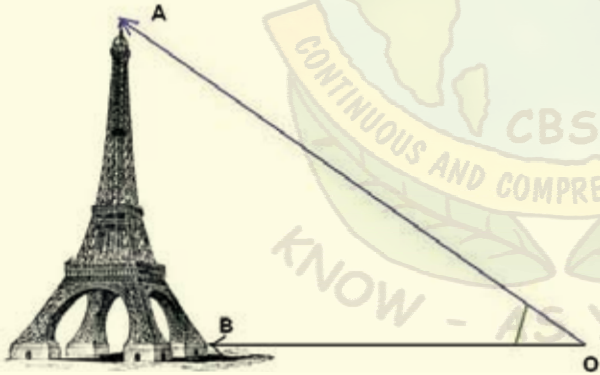

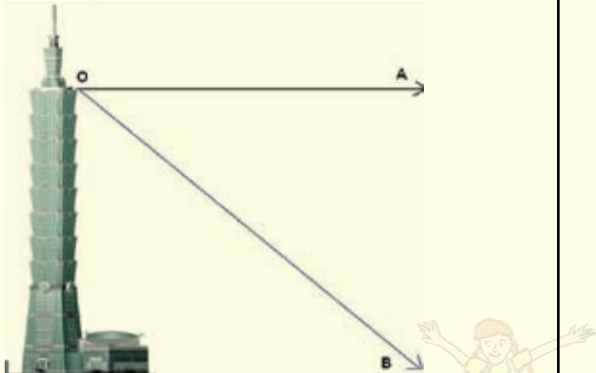
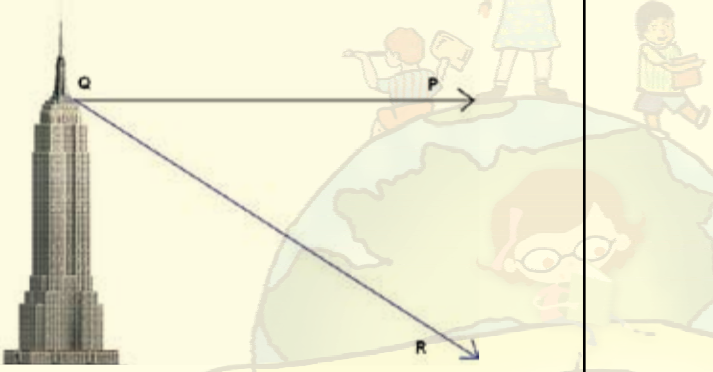
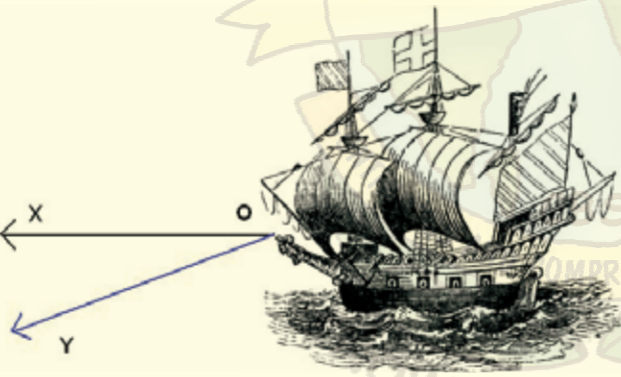
Figure	Angle of Elevation	Angle of depression	Line of Sight
			
			



Figure	Angle of Elevation	Angle of depression	Line of Sight
			
			
			




Task-2: Class Worksheet





Topic	Application of trigonometry
Nature of task	Content
Content Coverage	Figure formation from word problems.
Learning Objectives	To read and analyze word problem and to draw the corresponding figure.
Task	Class Worksheet.
Execution of task	Worksheet containing questions and blank space to draw figure may be given to each child. They would be then asked to draw the corresponding figures for each question Alternatively, Teacher may write the question on board.
Duration	1 period
Criteria for assessment	Teacher may prepare a rating scale according to marks assigned to this task.
Follow up	Worksheet for practicing may be given

Worksheet

For each problem given below, draw a figure to illustrate the situation. The first one is done for you:

<p>A tower stands vertically on the ground. From a point on the ground, which is 15 m away from the foot of the tower, the angle of elevation of the top of the tower is found to be 60°.</p>	
<p>An observer 1.5 m tall is 28.5 m away from a chimney. The angle of elevation of the top of the chimney from her eyes is 45°.</p>	



<p>From a point P on the ground the angle of elevation of the top of a 10 m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°.</p>	
<p>The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60°.</p>	
<p>The angles of depression of the top and the bottom of an 8 m tall building from the top of a multi-storeyed building are 30° and 45°, respectively.</p>	
<p>From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45°, respectively. The bridge is at a height of 3 m from the banks.</p>	
<p>A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m.</p>	
<p>A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground. The angle made by the rope with the ground level is 30°.</p>	



Task-3: Question Framing

Topic	Application of trigonometry
Nature of task	Content
Content Coverage	Framing word problems from given figure.
Learning Objectives	To frame a word problems from on a given figure.
Task	Worksheet.
Execution of task	Worksheet containing figures and blank space to write question may be given to each child. They would be then asked to frame atleast one question on the given figure.
Duration	1 period
Criteria for assessment	Teacher may discuss the questions framed by students and observe their level of thinking & imagination. It is not necessary to give marks for this assessment.

Worksheet

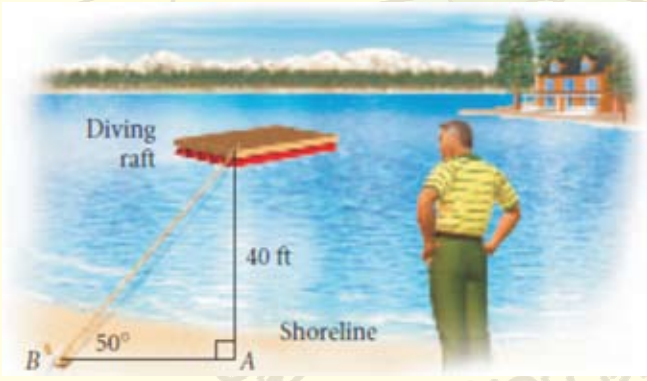
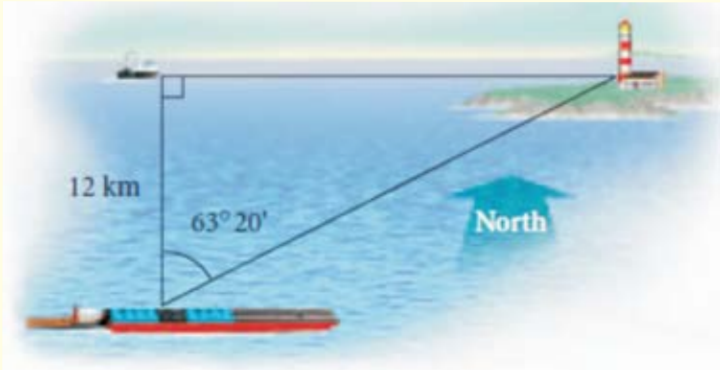
Figure	World Problem
	
	



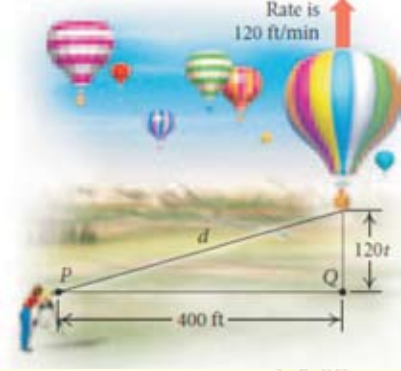
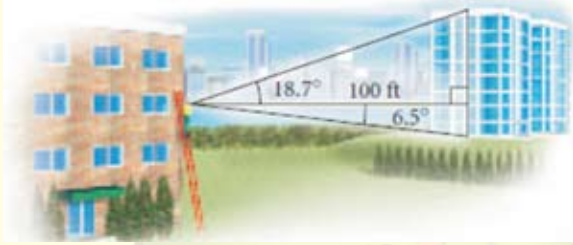
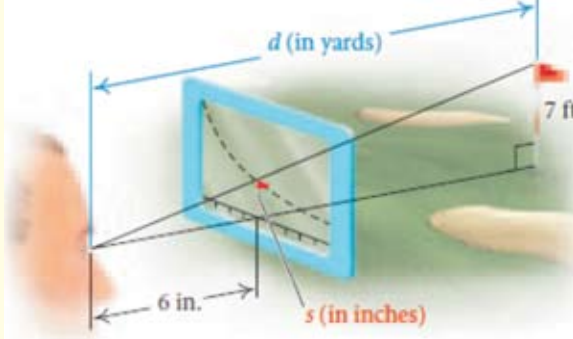

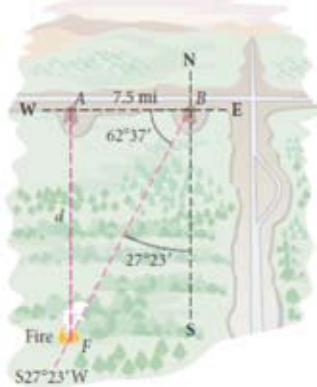
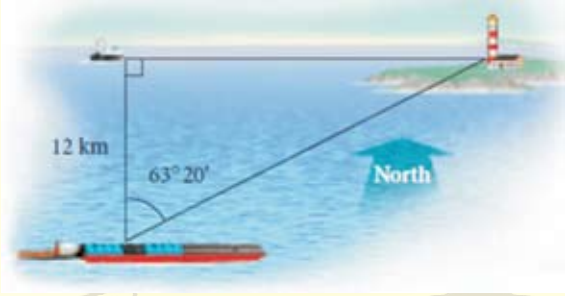
Figure	World Problem
	
	
	
	



Figure	World Problem
	
	

Task-4: Home Assignment

Topic	Application of trigonometry
Nature of task	Post Content
Content Coverage	Complete Chapter
Learning Objectives	<ul style="list-style-type: none"> To apply the knowledge of trigonometry in solving real life problems.
Task	Home Assignment
Execution of task	Printed assignment may be given after completing the chapter.
Duration	2 days.
Criteria for assessment	Follow Rubric for H.W/Assignments
Follow up	Reference material in the form of important points to remember can be given as a support material.



Home Assignment

1. A vertical stick 10 cm long casts a shadow 8 cm long. At the same time, a tower casts a shadow 30 m long. Determine the height of the tower.
2. A person standing on the bank of a river, observes that the angle subtended by a tree on the opposite bank is 60° . When he retreats 20 m from the bank, he finds the angle to be 30° . Find the height of the tree and the breadth of the river.
3. A boy is standing on ground and flying a kite with 150 m of string at an elevation of 30° . Another boy is standing on the roof of a 25 m high building and flying a kite at an elevation of 45° . Find the length of string required by the second boy so that the two kites just meet, if both the boys are on opposite side of the kites.
4. An aeroplane, flying horizontally 1000 m above the ground, is observed at an angle of elevation 60° from a point on the ground. After a flight of 10 seconds, the angle of elevation at the point of observation changes to 30° . Find the speed of the plane in m/s.
5. A vertically straight tree, 15 m high is broken by the wind in such a way that its top just touches the ground and makes an angle of 60° with the ground, at what height from the ground did the tree break ?
6. A man in a boat rowing away from a lighthouse 100 m high takes 2 minutes to change the angle of elevation of the top of the lighthouse from 60° to 45° . Find the speed of the boat.
7. A man standing on the deck of a ship, which is 10 m above the water level, observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill as 30° . Calculate the distance of the hill from the ship and the height of the hill.
8. The angle of elevation of a tower from point "a" and "b" from the base and the same straight line with it are complementary. Prove that the height of the tower is \sqrt{ab} .



Task-5: Hands on activity

Topic	Application of trigonometry
Nature of task	During delivery of content
Content Coverage	
Learning Objectives	To make a clinometer and use it to measure the height of an object.
Task	Math activity
Execution of task	An instruction sheet explaining the procedure to make clinometer and its use in measuring the height of an object can be given to students for reference. They will make the clinometer & use it to find the height of an object.
Duration	1 period
Criteria for assessment	This activity will be a part of Math activity , so it will be assessed according to the following parameters: Observation on thinking skills Class Ethics Performance of activity File Record Model of clinometer. (marks may be allotted by the teacher accordingly)
Follow up	Children should be encouraged to use clinometer to measure the height of various objects.

Instruction Sheet

Objective: To make a clinometer and use it to measure the height of an object.

Materials required: Stiff card, small pipe or drinking straw, thread, a weight (a metal washer is ideal).

Pre-requisite knowledge: Properties of right angled triangles.

Procedure:

(A) To make clinometer:

1. Prepare a semi-circular protractor using any hard board and fix a viewing tube (straw or pipe) along the diameter.
2. Punch a hole (o) at the centre of the semicircle.
3. Suspend a weight {w} from a small nail fixed to the centre.



4. Ensure that the weight at the end of the string hangs below the protractor.
5. Mark degrees (in sexagesimal scale with 00 at the lowest and 10 to 900 proceeding both clockwise and anticlockwise). [Fig 1].

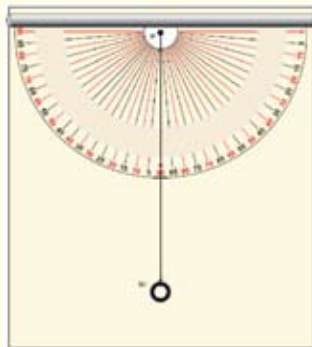


Fig. 1

(B) To determine the height of an object:

6. First measure the distance of the object from you. Let the distance be d .
7. Look through the straw or pipe at the top of the object. Make sure you can clearly see the top of the object.
8. Hold the clinometer steady and let your partner record the angle the string makes on the scale of the clinometer. Let this angle be θ .

Observations:

Using trigonometric ratio:

$$\tan \theta = \text{height} / \text{distance} = h/d$$

$$h = d \times \tan \theta$$

If, for example, $d = 100$ m and $\theta = 45^\circ$

$$h = 100 \times \tan 45^\circ = 100 \text{ m}$$

Remark:

Students may be asked to change the distance of the object (by either moving the object or by changing their position) and note how the angle of elevation varies. They will notice that though d and θ will vary, the product $h = d \tan \theta$ will be constant (within measurement error).

