CBSE-i

MATHEMATICS

coordinate geometry and transformations

CENTRAL BOARD OF SECONDARY EDUCATION
DELHI
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The Curriculum initiated by Central Board of Secondary Education -International (CBSE-i) is a progressive step in making the educational content and methodology more sensitive and responsive to the global needs. It signifies the emergence of a fresh thought process in imparting a curriculum which would restore the independence of the learner to pursue the learning process in harmony with the existing personal, social and cultural ethos.

The Central Board of Secondary Education has been providing support to the academic needs of the learners worldwide. It has about 11500 schools affiliated to it and over 158 schools situated in more than 23 countries. The Board has always been conscious of the varying needs of the learners in countries abroad and has been working towards contextualizing certain elements of the learning process to the physical, geographical, social and cultural environment in which they are engaged. The International Curriculum being designed by CBSE-i, has been visualized and developed with these requirements in view.

The nucleus of the entire process of constructing the curricular structure is the learner. The objective of the curriculum is to nurture the independence of the learner, given the fact that every learner is unique. The learner has to understand, appreciate, protect and build on values, beliefs and traditional wisdom, make the necessary modifications, improvisations and additions wherever and whenever necessary.

The recent scientific and technological advances have thrown open the gateways of knowledge at an astonishing pace. The speed and methods of assimilating knowledge have put forth many challenges to the educators, forcing them to rethink their approaches for knowledge processing by their learners. In this context, it has become imperative for them to incorporate those skills which will enable the young learners to become 'life long learners'. The ability to stay current, to upgrade skills with emerging technologies, to understand the nuances involved in change management and the relevant life skills have to be a part of the learning domains of the global learners. The CBSE-i curriculum has taken cognizance of these requirements.

The CBSE-i aims to carry forward the basic strength of the Indian system of education while promoting critical and creative thinking skills, effective communication skills, interpersonal and collaborative skills along with information and media skills. There is an inbuilt flexibility in the curriculum, as it provides a foundation and an extension curriculum, in all subject areas to cater to the different pace of learners.

The CBSE has introduced the CBSE-i curriculum in schools affiliated to CBSE at the international level in 2010 and is now introducing it to other affiliated schools who meet the requirements for introducing this curriculum. The focus of CBSE-i is to ensure that the learner is stress-free and committed to active learning. The learner would be evaluated on a continuous and comprehensive basis consequent to the mutual interactions between the teacher and the learner. There are some non-evaluative components in the curriculum which would be commented upon by the teachers and the school. The objective of this part or the core of the curriculum is to scaffold the learning experiences and to relate tacit knowledge with formal knowledge. This would involve trans-disciplinary linkages that would form the core of the learning process. Perspectives, SEWA (Social Empowerment through Work and Action), Life Skills and Research would be the constituents of this 'Core'.

The Core skills are the most significant aspects of a learner's holistic growth and learning curve.

The International Curriculum has been designed keeping in view the foundations of the National Curricular Framework (NCF 2005) NCERT and the experience gathered by the Board over the last seven decades in imparting effective learning to millions of learners, many of whom are now global citizens.

The Board does not interpret this development as an alternative to other curricula existing at the international level, but as an exercise in providing the much needed Indian leadership for global education at the school level. The International Curriculum would evolve on its own, building on learning experiences inside the classroom over a period of time. The Board while addressing the issues of empowerment with the help of the schools' administering this system strongly recommends that practicing teachers become skillful learners on their own and also transfer their learning experiences to their peers through the interactive platforms provided by the Board.

I profusely thank Shri G. Balasubramanian, former Director (Academics), CBSE, Ms. Abha Adams and her team and Dr. Sadhana Parashar, Head (Innovations and Research) CBSE along with other Education Officers involved in the development and implementation of this material.

The CBSE-i website has already started enabling all stakeholders to participate in this initiative through the discussion forums provided on the portal. Any further suggestions are welcome.

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1. Syllabus 1
2. Scope document 2
3. Teacher's Support Material 3
   - Teacher Note 4
   - Activity Skill Matrix 7
   - Warm Up W1 8
     Planting trees at given points
   - Warm Up W2 8
   - Speak aloud 8
   - Pre -Content P1 9
     Making shapes by joining points
   - Pre -Content P2 9
     Recalling Pythagoras theorem
   - Content Worksheet CW1 10
     Distance formula
   - Content Worksheet CW2 10
     Application of distance formula
   - Content Worksheet CW3 11
     Section formula
   - Content Worksheet CW4 11
     Application of Section formula
   - Content Worksheet CW5 12
     Transformations
   - Post Content Worksheet PCW1 13
   - Post Content Worksheet PCW2 13
   - Post Content Worksheet PCW3 13
   - Post Content Worksheet PCW4 13
   - Post Content Worksheet PCW5 13
<table>
<thead>
<tr>
<th></th>
<th>Assessment Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td><strong>Study Material</strong></td>
</tr>
<tr>
<td>5.</td>
<td><strong>Student's Support Material</strong></td>
</tr>
<tr>
<td></td>
<td>SW1: Warm Up (W1)</td>
</tr>
<tr>
<td></td>
<td><strong>Planting trees at given points</strong></td>
</tr>
<tr>
<td></td>
<td>SW2: Warm Up (W2)</td>
</tr>
<tr>
<td></td>
<td><strong>Speak aloud</strong></td>
</tr>
<tr>
<td></td>
<td>SW3: Pre Content (P1)</td>
</tr>
<tr>
<td></td>
<td><strong>Making shapes by joining points</strong></td>
</tr>
<tr>
<td></td>
<td>SW4: Pre Content (P2)</td>
</tr>
<tr>
<td></td>
<td><strong>Recalling Pythagoras theorem</strong></td>
</tr>
<tr>
<td></td>
<td>SW5: Content (CW1)</td>
</tr>
<tr>
<td></td>
<td><strong>Distance formula</strong></td>
</tr>
<tr>
<td></td>
<td>SW6: Content (CW2)</td>
</tr>
<tr>
<td></td>
<td><strong>Application of distance formula</strong></td>
</tr>
<tr>
<td></td>
<td>SW7: Content (CW3)</td>
</tr>
<tr>
<td></td>
<td><strong>Section formula</strong></td>
</tr>
<tr>
<td></td>
<td>SW8: Content (CW4)</td>
</tr>
<tr>
<td></td>
<td><strong>Application of section formula</strong></td>
</tr>
<tr>
<td></td>
<td>SW9: Content (CW5)</td>
</tr>
<tr>
<td></td>
<td><strong>Transformations</strong></td>
</tr>
<tr>
<td></td>
<td>SW10 : Post Content (PCW1)</td>
</tr>
<tr>
<td></td>
<td>SW11 : Post Content (PCW2)</td>
</tr>
<tr>
<td></td>
<td>SW 12 : Post Content (PCW3)</td>
</tr>
<tr>
<td></td>
<td>SW 13 : Post Content (PCW4)</td>
</tr>
<tr>
<td></td>
<td>SW 14 : Post Content (PCW5)</td>
</tr>
<tr>
<td>6.</td>
<td><strong>Suggested Videos &amp; Extra Readings. Videos &amp; Extra Readings.</strong></td>
</tr>
</tbody>
</table>
### SYLLABUS
**Class – X, Unit – 6 (Core)**

<table>
<thead>
<tr>
<th>Revisit coordinate geometry</th>
<th>Location of a point in plane as ((x, y)), representation of line as (y = mx + c), where (m) is gradient and (c) is (y)-intercept.</th>
</tr>
</thead>
</table>
| **Distance between two points in a coordinate plane** | Distance of a point \(P(x, y)\) from origin\((0,0)\) as
\[ OP = \sqrt{x^2 + y^2} \]
Distance formula to find distance between points \(A (x_1, y_1)\) and \(B(x_2, y_2)\) as
\[ AB = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} \]
| **Section formula** | point of internal division |
| **Transformations** | Translation as transformation that slides figure, translation of a point from \(P(x, y)\) to \(Q(x+a, y+a)\),
Translation of a line,
Reflection as transformation that flips everything over, reflection across \(x\)-axis, reflection across \(y\)-axis, reflection across the line \(x=\text{constant}\), reflection across the line \(y = \text{constant}\) |
**SCOPE DOCUMENT**

Key concepts/terms:
- Distance formula
- Section formula
- Translation
- Reflection

**Learning Objectives:** The students will be able to
- Locate a point \((x, y)\) in Cartesian plane.
- Determine whether the given point lies on the line \(y = mx + c\)
- Draw the line \(y = mx + c\) in Cartesian plane by determining the points on the line can tell the gradient / slope of given line, its \(x\) or \(y\) intercept, its point of intersection with \(x\) – axis or \(y\) – axis.
- Can find the distance between two points in a cartesian plane using distance formula.
- Determine the point of internal division of line.
- Describe transformation of a figure on plane as movement of a figure in place when all points lie on figure change their coordinates in the same manner.
- Understand translation as transformation that slides figure in let or right, up or down and can also write it with proper notation.
- Understand reflection across \(x\)-axis or \(y\)-axis line \(x=\text{const.}\) and \(y = \text{const}\) and can also write point of reflection across axis of symmetry in right notation.

**Cross-Curricular Link :**

1. A coordinate system is setup to that \((0, 0)\) is the centre of the sun \((67,499,999, 67,512,000)\) the centre of the earth and \((67,600,000, 62,728,916)\) the centre of the moon. If all distances are in miles, find the distance from the centre of earth and the distance from the center of the earth to the center of the moon.

2. During a total solar eclipse, the centre of the sun, moon and with earth are collinear and the moon is located between the sun and the earth. Using the distances from above statement, give the coordinate of the centers of the moon and earth during a total solar eclipse if the sun is placed at the origin and the moon and earth are placed on the positive \(x\)-axis,
Teacher’s Support Material
TEACHER’S NOTE

The teaching of Mathematics should enhance the child’s resources to think and reason, to visualize and handle abstractions, to formulate and solve problems. As per NCF 2005, the vision for school Mathematics includes:

1. Children learn to enjoy mathematics rather than fear it.

2. Children see mathematics as something to talk about, to communicate through, to discuss among them, to work together on.

3. Children pose and solve meaningful problems.

4. Children use abstractions to perceive relationships, to see structures, to reason out things, to argue the truth or falsity of statements.

5. Children understand the basic structure of Mathematics: Arithmetic, algebra, geometry and trigonometry, the basic content areas of school Mathematics, all offer a methodology for abstraction, structuration and generalisation.

6. Teachers engage every child in class with the conviction that everyone can learn mathematics.

Students should be encouraged to solve problems through different methods like abstraction, quantification, analogy, case analysis, reduction to simpler situations, even guess-and-verify exercises during different stages of school. This will enrich the students and help them to understand that a problem can be approached by a variety of methods for solving it. School mathematics should also play an important role in developing the useful skill of estimation of quantities and approximating solutions. Development of visualisation and representations skills should be integral to Mathematics teaching. There is also a need to make connections between Mathematics and other subjects of study. When children learn to draw a graph, they should be encouraged to perceive the importance of graph in the teaching of Science, Social
Science and other areas of study. Mathematics should help in developing the reasoning skills of students. Proof is a process which encourages systematic way of argumentation. The aim should be to develop arguments, to evaluate arguments, to make conjunctures and understand that there are various methods of reasoning. Students should be made to understand that mathematical communication is precise, employs unambiguous use of language and rigour in formulation. Children should be encouraged to appreciate its significance.

At the secondary stage students begin to perceive the structure of Mathematics as a discipline. By this stage they should become familiar with the characteristics of Mathematical communications, various terms and concepts, the use of symbols, precision of language and systematic arguments in proving the proposition. At this stage a student should be able to integrate the many concepts and skills that he/she has learnt in solving problems.

The unit focuses on following learning objectives:

- Locate a point \((x, y)\) in Cartesian plane.
- Determine whether the given point lies on the line \(y = mx + c\)
- Draw the line \(y = mx + c\) in Cartesian plane by determining the points on the line, can tell the gradient / slope of given line, its \(x\) or \(y\) intercept, its point of intersection with \(x\) – axis or \(y\) – axis.
- Can find the distance between two points in a cartesian plane using distance formula.
- Determine the point of internal division of line.
- Determine the area of a triangle and quadrilateral when vertices are given.
- Describe transformation of a figure on plane as movement of a figure in plane when all points lie on figure change their coordinates in the same manner.
- Understand translation as transformation that slides figure in left or right, up or down and can also write it with proper notation.

- Understand reflection across x-axis or y-axis, line x=const. and y = const and can also write point of reflection across axis of symmetry in right notation.

This unit exposes the students to application of coordinate geometry. At the end of this unit they should be able to appreciate the relation between algebra and geometry.

Warm up activities are meant to revise the previously learnt concepts as well to clarify the basics to those who were not able to grasp the concepts earlier. Students can visualize that Equation $y=mx+c$ actually represents a line, with the knowledge of plotting the points on Cartesian plane and the skill of getting the points lying on the line.

Pre-content activities help the learners to create new shapes with the given points and to read the plotted points in a joyful manner.

Finding the distance formula with the help of Pythagoras Theorem will create an appreciation for link between Euclidean Geometry, Algebra and Cartesian Geometry. It will also develop sense that basic knowledge used in logical manner can give rise to very significant results. As the chapter will built up students will realize that Pythagoras Theorem is base of Coordinate Geometry and all results of Euclidean Geometry can be proved in the Cartesian System too. The discussion can be held in class that beauty of Mathematics lies in the fact that in every new system generated all known results holds.

Using distance formula students can verify all the properties of triangle and quadrilaterals. When used analytically it is also possible to find unknown vertices, relation between the variables representing any point on plane etc.

Section formula also gives the idea of finding unknown point lying on line when the ratio of the parts in which the line is divided, is given.
Transformation is another interesting application of coordinate geometry which shows that movement of any point/line/object w.r.t. origin does not change the position of point w.r.t. origin. Real life examples of movement of escalator as translation motion, mirror image as reflection shall be illustrated and students shall be encouraged to identify more examples from their surroundings.

**ACTIVITY SKILL MATRIX**

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Name of Activity</th>
<th>Skill to be developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm UP(W1)</td>
<td>Plotting of points</td>
<td>Knowledge, plotting of point</td>
</tr>
<tr>
<td>Warm UP(W2)</td>
<td>Speak aloud</td>
<td>Observation, Recall, Relate</td>
</tr>
<tr>
<td>Pre-Content (P1)</td>
<td>Making shapes by joining points</td>
<td>Plotting, recognition</td>
</tr>
<tr>
<td>Pre-Content (P2)</td>
<td>Finding coordinates</td>
<td>Application</td>
</tr>
<tr>
<td>Content (CW 1)</td>
<td>Distance formula</td>
<td>Concept Development</td>
</tr>
<tr>
<td>Content (CW 2)</td>
<td>Application of distance formula</td>
<td>Calculation Skills</td>
</tr>
<tr>
<td>Content (CW 3)</td>
<td>Section formula</td>
<td>Concept development, Thinking Skill,</td>
</tr>
<tr>
<td>Content (CW 4)</td>
<td>Application of section formula</td>
<td>Thinking Skills, Calculation Skills</td>
</tr>
<tr>
<td>Content (CW 5)</td>
<td>Area of triangle</td>
<td>Thinking skill, problem solving</td>
</tr>
<tr>
<td>Content (CW 6)</td>
<td>Transformation</td>
<td>Observation, Skill of reading points</td>
</tr>
<tr>
<td>Post - Content (PCW 1)</td>
<td>Assignment</td>
<td>Knowledge, Understanding, problem solving</td>
</tr>
<tr>
<td>Post - Content (PCW 2)</td>
<td>MCQ</td>
<td>Concept, knowledge</td>
</tr>
<tr>
<td>Post - Content (PCW 3)</td>
<td>Framing Questions</td>
<td>Conceptual knowledge, critical thinking</td>
</tr>
<tr>
<td>Post - Content (PCW 4)</td>
<td>Fill in the blanks</td>
<td>Knowledge</td>
</tr>
<tr>
<td>Post - Content (PCW 5)</td>
<td>Mind mapping</td>
<td>Organizing skill, synthesis</td>
</tr>
</tbody>
</table>
ACTIVITY 1 – WARM UP (W1)
(Planting Trees at Given Points)

**Specific objective:** To recall the position of a point in the rectangular coordinate system.

**Description:** Warm up activity W1 is intended to make students plot the position of given points in four quadrants. In class 9, students have gained the knowledge of coordinate system. They know about plotting of coordinates.

**Execution:**
Distribute the warm up worksheet W1. Ask the students to mark a plant on the given points. Discuss the position of points in four quadrants.

**Parameters for assessment:**
- Able to plot coordinates in quadrants
- Able to plot coordinates on both axes

ACTIVITY 2 – WARM UP (W2)
(Speak Aloud- Abscissa and Ordinate)

**Specific objective:** To learn to speak the abscissa and ordinate of a given point.

**Description:** Warm up activity W2 is designed to gear up the students for learning more about coordinate geometry.

**Execution:** Teacher may write the coordinate of a point on the board and ask the students to speak its abscissa and the ordinate.

**Parameters for assessment:**
Able to tell the abscissa and ordinate of a given set of coordinates
ACTIVITY 3 – PRE CONTENT (P1)

(Making Shapes by Joining Points)

**Specific objective:** To recall making a geometrical shape on a coordinate plane.

**Description:** Pre-content activity P1 helps the students to recall the plotting of points in the rectangular coordinate system.

**Execution:** Students will be asked to make shapes like triangle, square, rectangle, trapezium etc on the given graph paper. They will further be asked to write the coordinates of the vertices of given shapes.

**Parameters for assessment:**

- Able to make geometrical shapes on a coordinate plane
- Able to write the coordinates of vertices of a geometrical shape

ACTIVITY 4 – PRE CONTENT (P2)

(Recalling Pythagoras Theorem)

**Specific objective:** To recall Pythagoras theorem.

**Description:** P2 is pre content activity for recalling the Pythagoras theorem.

**Execution:** Distribute worksheet P2. Ask the students to find the hypotenuse of each drawn righttriangle on the grid.

**Parameters for assessment**

- Able to apply Pythagoras theorem
- Able to calculate sides of a right triangle
**ACTIVITY 5 -CONTENT (CW1)**

*(Distance Formula)*

**Specific objective:** To learn to find the distance formula using Pythagoras theorem.

**Description:** CW1 is based on the understanding of distance formula.

**Execution:** Ask the students to visit the link specified in CW1. They will further learn to write the expression for distance formula. Also, encourage the students to calculate the distance between two points using the formula.

**Parameters for assessment**

<table>
<thead>
<tr>
<th>Able to write distance formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to calculate distance between two given points</td>
</tr>
</tbody>
</table>

**ACTIVITY 6 -CONTENT (CW2)**

*(Application of Distance Formula)*

**Specific objective:** To learn to apply distance formula in problems.

**Description:** CW2 is based on the application of distance formula.

**Execution:** Distribute worksheet CW2 and ask the students to solve the problems. Discuss the answers.

**Parameters for assessment**

<table>
<thead>
<tr>
<th>Able to find the distance between two points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to tell whether three given coordinates will make a scalene triangle, an isosceles triangle or an equilateral triangle</td>
</tr>
<tr>
<td>Able to tell whether four given coordinates will make a square, a rectangle, a parallelogram or a rhombus</td>
</tr>
</tbody>
</table>
ACTIVITY 7 -CONTENT (CW3)

(Section Formula)

Specific objective: To learn to understand section formula.

Description: CW3 is based on the section formula.

Execution: Distribute worksheet CW3 and ask the students to solve the problems. Discuss the answers.

Parameters for assessment

<table>
<thead>
<tr>
<th>Has knowledge of Section formula.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can define a situation where the section formula is used.</td>
</tr>
</tbody>
</table>

ACTIVITY 8 -CONTENT (CW4)

(Application of Section Formula)

Specific objective: To learn to apply section formula in problems.

Description: CW4 is based on the application of section formula.

Execution: Distribute worksheet CW3 and ask the students to solve the problems. Discuss the answers.

Parameters for assessment

<table>
<thead>
<tr>
<th>Able to apply section formula in given situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to use section formula in geometrical problems</td>
</tr>
</tbody>
</table>
ACTIVITY 9 - CONTENT (CW5)

(Transformations)

Specific objective: To learn to understand the concept of transformations.

Description: CW7 is based on the concept of transformations- reflection, rotation and translation.

Execution: Distribute worksheet CW6 and ask the students to solve the problems.

Parameters for assessment

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to find the reflection of a geometrical shape w.r.t. the given line</td>
</tr>
<tr>
<td>Able to translate a geometrical shape as per the given scale.</td>
</tr>
</tbody>
</table>
Post Content (PCW1)

(Assignment)

Post Content (PCW2)

(MCQ’s)

Post Content (PCW3)

(Framing questions)

Post Content (PCW4)

(Fill in the blanks)

Post Content (PCW5)

(Mind Mapping)
STUDY MATERIAL
INTRODUCTION:

You are already familiar with some basic concepts of coordinate geometry such as coordinate axes, origin, coordinates of a point etc. These concepts help us in locating the position of a point in a plane, usually called the Cartesian plane or coordinate plane, and drawing graph of a linear equation in two variables.

In this unit, we shall first revisit these concepts briefly and then proceed to find distance between two given points in a Cartesian plane, points of division of a line segment in a given ratio, area of a triangle and a quadrilateral with given vertices. We shall also discuss transformations of a plane figure using the coordinates of points.

1. Revisiting Basic Concepts

- **Cartesian plane or coordinate plane**

Recall that we take two perpendicular lines in a plane to represent coordinate axes (Fig 1) $X'OX$ is called $x$-axis and $YOY'$ is called $y$-axis.

The point of intersection $O$ of the lines is called the **origin**.

The plane itself is called the coordinate plane or the **Cartesian plane**. The two axes divide the plane into four quadrants I, II, III and IV, as shown in Fig. 1.

Note that the two axes are not the part of any quadrant.
OX and OY are called the positive directions of x-axis and the y-axis, respectively. Similarly, OX’ and OY’ are called the negative directions of the x-axis and the y-axis, respectively.

- **Coordinates of a Point**

Distance of any point, say P, from the y-axis is called the x-coordinate of the point and the distance of this point from the x-axis is called its y-coordinate.

If these coordinates are x and y respectively, then the point P is written as P(x,y). (Fig. 2)

- **Points in different Quadrants**

In quadrant I, both the coordinates x and y are measured along the positive directions of x and y axes, and hence both are positive. So, the point like P (3, 4), Q(1,3) etc lie in quadrant I (See Fig 3)
In quadrant II, x coordinate is measured along negative direction of x axis and y coordinate along positive direction. The points like P(-3, 1), Q(-1, 4) lie in quadrant II (See Fig. 4)

Similarly, points like P(-1, -3), Q(-3, -1) lie in quadrant III and points like R(1, -2), S (3, -3) lie in quadrant IV (See Fig 5)
Thus, points in quadrant I are in the form (+, +) points in quadrant II are in the form (-, +) points in quadrant III are in the form (-,-) and points in quadrant IV are in the form (+, -) (See Fig 6)

![Coordinate Plane](image)

- **Points on coordinate axes**

Recall that:

(i) Points on the x-axis are of the form (x, 0), i.e., y-coordinate is 0.

(ii) Points on the y-axis are of the form (0, y) i.e., x-coordinates is 0.

(iii) Clearly the origin 0 lies on both the axes and its coordinates are (0, 0).

**Example 1:**

Write the following (Fig. 7):

(i) Coordinates of the points P, Q, R, S,

(ii) The point identified by the coordinates (2, -3)

(iii) The point lying in quadrant III.

(iv) Coordinates of Z and A.

![Graph with points](image)
Solution:

(i) Coordinates of P are (3, 2)
Coordinates of Q are (-3, 4)
Coordinates of R are (-2, -3)
Coordinates of S are (4, -2)

(ii) Point T

(iii) Point R

(iv) Coordinates of Z are (-4, 0)
And that of A are (6, 0)

Example 2: Locate (plot) the following points in Cartesian plane.

P(3, -2), Q (-4, -1), R(1, 5)
S(-2, 3) and T (0, 2)

Solution:

The points are plotted as shown in Fig 8.

Fig.8
• **Representation of a line** $y = mx + c$

Recall that an equation of the form $ax + by + c = 0$, where $a$, $b$ and $c$ are real numbers such that $a$ and $b$ are not both zero, is called a **linear equation in two variables** $x$ and $y$. For example, $2x + 3y = 6$, $x - y = -5$ are linear equations in two variables.

You also know how to represent these equations graphically in the Cartesian plane.

For example, for representing $2x + 3y = 6$,

$$y = \frac{6 - 2x}{3}$$

we first find **at least** two solutions:

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>3</th>
<th>-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Now we locate (plot) the points $(0,2)$, $(3,0)$ and $(-3,4)$ in the Cartesian plane and join them to obtain a line. This line is the graph of given equation, or this line represents of equation. (Fig. 9)
We can always write a linear equation in two variables in the form \( y = mx + c \)

For example, the equation \( 2x + 3y = 6 \), can be written as
\[
y = -\frac{2}{3}x + \frac{6}{3}
\]

If is of the form
\[
y = mx + c, \text{ where } m = -\frac{2}{3} \text{ and } c = 2.
\]

Similarly, \( x - y = -5 \) can be written as
\[
y = x + 5
\]

If is of the form
\[
y = mx + c, \text{ where } m = 1 \text{ and } c = 5
\]

and so on.

The graph of \( y = mx + c \) is a straight line (as it is a linear equation in two variables).

\( m \) is called the gradient which refers to “steepness” or slope of the line and \( c \) is called the y-intercept of the line.

As you can see from the above examples, the gradient of a straight line representing
\[
2x + 3y = 6, \text{ i.e. } y = \frac{-2}{3}x + 2
\]

is given by \( m = \frac{-2}{3} \) and \( c = y - \text{intercept} = 2 \) (See Fig 9)

Similarly, the gradient of the straight line representing
\[
x - y = -5, \text{ i.e. } y = x + 5 \text{ is } 1 \text{ and } c = 5 \) (See Fig 10)
Note that for a given line \( y = mx + c \), the gradient/slope and \( y \) intercept are always constant.

**Example 3:** Find the gradient and \( y \)-intercept of the lines representing the following equations:

(i) \( 3x - 4y = -7 \)
(ii) \( 8x = 7y + 1 \)
(iii) \( 3x + 4y = 0 \)
(iv) \( y + 8 = 0 \)

**Solution:**

(i) \( 3x - 4y = -7 \), can be written as

\[
4y = 3x + 7
\]

\[
y = \frac{3}{4}x + \frac{7}{4}
\]

Here \( m = \frac{3}{4} \) and \( y \) – intercept, \( c = \frac{7}{4} \)

(ii) \( 8x = 7y + 1 \) can be written as

\[
y = \frac{8}{7}x - \frac{1}{7}
\]
So, \( m = \frac{8}{7} \) and \( c = -\frac{1}{7} \)

\[ x + 4y = 0 \]

(iii) \( 4y = -3x \)

or, \( y = -\frac{3}{4}x \)

So, \( m = -\frac{3}{4} \) and \( c = 0 \)

\[ y + 8 = 0 \]

(iv) \( y = -8 = 0x - 8 \)

So, \( m = 0 \) and \( c = -8 \)

**Example 4:** Draw the graph of \( y = 3x + 3 \) and find

(i) its points of intersection with x-axis and y-axis

(ii) x intercept and y intercept

(iii) whether the points (-2, -3) and (3, -2) lie on the graph or not.

**Solution:** \( y = 3x + 3 \)

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
The graph of \( y = 3x + 3 \) is shown in Fig 11 which is a straight line.

(i) Point of intersection of the line with x-axis is \( (1, 0) \)
    
    Point of intersection of the line with y-axis is \( (0, 3) \)

(ii) \( x \)-intercept is ‘-1’ (It is the intercept of the line on the x - axis)

    \( y \)-intercept is ‘3’ You can also find it directly as \( c = 3 \)

(iii) From the graph, we see that \((-2, -3)\) lies on the line and \((3, -2)\) does not lie on the line.

You can also check the above facts by directly substituting the values of \( x \) and \( y \) in the equation it self.
2. Distance Between Two Points in a Cartesian Plane

Let the coordinates of the two points P and Q be \((x_1, y_1)\) and \((x_2, y_2)\) respectively (See Fig. 12)

Draw \(PR \perp x\) axis and \(QS \perp x\) axis.

Also draw \(PT \perp QS\).

Clearly, \(RS = x_2 - x_1 = PT\).

\[ QT = y_2 - y_1 \]

\(\triangle PQT\) is a right triangle. Using Pythagoras Theorem

\[ (PQ)^2 = (PT)^2 + (QT)^2 \]

\[ = (x_2 - x_1)^2 + (y_2 - y_1)^2 \]

or \(PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\) (1)

This is referred to as distance formula.
Example 5: Find the distance between the points

(i) (1, 3), (5, 6)
(ii) (-1, 5), (2, 1)
(iii) (-3, -3), (4, 5)
(iv) (0, 0), (a, b)
(v) (3, -6), (-2, 2)

Solution:

(i) Using the distance formula
\[ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \]
we have \[ d = \sqrt{(5 - 1)^2 + (6 - 3)^2} \]
\[ = \sqrt{4^2 + 3^2} \]
\[ = \sqrt{25} \]
\[ = 5 \]

(ii) Using the distance formula
\[ d = \sqrt{(2 - (-1))^2 + (1 - 5)^2} \]
\[ = \sqrt{(2 + 1)^2 + (-4)^2} \]
\[ = \sqrt{9 + 16} = \sqrt{25} \]
\[ = 5 \]

(iii) \[ d = \sqrt{(4 - (-3))^2 + [5 - (-3)]^2} \]
\[ = \sqrt{7^2 + 8^2} \]
\[ = \sqrt{113} \]
\[d = \sqrt{(a - 0)^2 + (b - 0)^2}\]
\[= \sqrt{a^2 + b^2}\]

Distance of the point P (a, b) from the origin is given by \(d = \sqrt{a^2 + b^2}\)

\[d = \sqrt{(-2 - 3)^2 + [2 - (-6)]^2}\]
\[= \sqrt{25 + 64}\]
\[= \sqrt{89}\]

**Example 6:** Determine whether the following points are collinear or not:

(i) \(A (3, 1), B (6,4)\) and \(C (8,6)\)

(ii) \(P (1,5), Q (2,3)\) and \(R (-2, -11)\)

**Solution:** Here, \(AB = \sqrt{(6 - 3)^2 + (4 - 1)^2} = 3\sqrt{2}\)

\(BC = \sqrt{(8 - 6)^2 + (6 - 4)^2} = 2\sqrt{2}\)

\(CA = \sqrt{(8 - 3)^2 + (6 - 1)^2} = 5\sqrt{2}\)

Here, \(CA = AB + BC \quad (5\sqrt{2} = 3\sqrt{2} + 2\sqrt{2})\)

So, A, B and C are collinear points.

(iii) Here, \(PQ = \sqrt{(2 - 1)^2 + (3 - 5)^2} = \sqrt{5}\)

\(QR = \sqrt{(-2 - 2)^2 + (-11 - 3)^2} = \sqrt{212}\)

\(RP = \sqrt{(1 + 2)^2 + (5 + 11)^2} = \sqrt{265}\)

As \(PR \neq PQ + QR\), so P, Q and R are not collinear.
3. Section Formula

Consider any two points \( A(x_1, y_1) \) and \( B(x_2, y_2) \) in a plane. Let \( P(x, y) \) be the point which divides the line segment \( AB \) in the ratio \( m_1 : m_2 \) (See Fig. 13).

![Fig. 13](image)

From \( A, P \) and \( B \), draw \( AK, PM \) and \( BL \) perpendicularly to the \( x \)-axis.

Also, draw \( AS \perp PM \) and \( PT \perp BL \).

Now, \( AS = KM = OM - OK = x - x_1 \) and \( ML = PT = OL - OM = x_2 - x \)

Similarly, \( PS = y - y_1 \) and \( BT = y_2 - y \)

Also, \( \Delta APS \cong \Delta PBT \) (AA Similarity)

So, \( \frac{AP}{PB} = \frac{AS}{PT} = \frac{PS}{PT} \)

or \( \frac{m_1}{m_2} = \frac{x - x_1}{x_2 - x} = \frac{y - y_1}{y_2 - y} \)

From \( \frac{m_1}{m_2} = \frac{x - x_1}{x_2 - x} \), we have

\[ m_1 x_2 - m_1 x = m_2 x - m_2 x_1 \]
or $x = \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$

Similarly, from $\frac{m_1}{m_2} = \frac{y-y_1}{y_2-y}$, we have

$y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$

Thus, the coordinates of the point $P (x, y)$, which divides the line segment $AB$ in the ratio of $m_1:m_2$ internally are

\[
\left( \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2} \right)
\]

This is called the section formula for internal division.

Let $m_1:m_2 = k:1$, then

\[
\frac{m_1}{m_2} = k
\]

Then coordinates of the point $P$ are

\[
\left( \frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1} \right)
\]

Special case: When $m_1 = m_2 = 1$, i.e., $P$ is the mid-point of $AB$.

Coordinates of the mid-point of line – segment $AB$ will be

\[
\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)
\]

Example 7: Find the coordinates of the point $P$ which divides the join of $A (2, 5)$ and $B (5,2)$ internally in the ratio $1:2$.

Solution: Using the section formula,

we have $x$ coordinates of $P = \frac{1 \times 5 + 2 \times 2}{1+2} = \frac{9}{3} = 3$

$y$ coordinate of $P = \frac{1 \times 2 + 2 \times 5}{1+2} = \frac{12}{3} = 4$

Thus, the coordinates of the point $P$ are $(3, 4)$.

Example 8: Determine the ratio in which the graph of the equation $3x + y = 9$ divides line segment joining the points $A (2, 7)$ and $B (1,3)$.
Solution: Let $P(x,y)$ be the point which lies on line representing $3x + y = 9$ and dividing $AB$ in the ratio $K : 1$

![Diagram showing point P on line 3x + y = 9]

So, $x = \frac{K \times 1 + 1 \times 2}{K + 1} = \frac{K + 2}{K + 1}$

And $y = \frac{K \times 3 + 1 \times 7}{K + 1} = \frac{3K + 7}{K + 1}$

Thus, point $P$ is $\left( \frac{K + 2}{K + 1}, \frac{3K + 7}{K + 1} \right)$

As $P$ lies on $3x + y = 9$,

so, $3 \left( \frac{K + 2}{K + 1} \right) + \left( \frac{3K + 7}{K + 1} \right) = 9$,

Or, $3K + 6 + 3K + 7 = 9K + 9$

Or, $3K = 4$

Or, $K = \frac{4}{3}$

Thus, the required ratio is $K : 1$, i.e., $4:3$

Example 9: If $A (1,2)$, $B (4, y)$, $C (x,6)$ and $D (3,5)$ are vertices of a parallelogram $ABCD$, find the values of $x$ and $y$.

Solution: Let $O$ be the point of intersection of the diagonals $AC$ and $BD$ (See Fig. 14)
We know that diagonals of a parallelogram bisect each other.

Now, coordinates of O as mid-point of BD are

\[
\left( \frac{4+3}{2}, \frac{y+5}{2} \right)
\]

(1)

Also, coordinates of O as mid-point of AC are

\[
\left( \frac{1+x}{2}, \frac{2+6}{2} \right)
\]

(2)

From (1) and (2), we have

\[
\frac{4+3}{2} = \frac{1+x}{2} \quad \text{which gives } x = 6
\]

And \[
\frac{y+5}{2} = \frac{2+6}{2} \quad \text{which gives } y = 3
\]

4. **Transformations**

In the earlier classes, you have studied the concept of line symmetry (reflection) and rotational symmetry (rotation). These are called geometric transformations. A geometric transformation is a process by which a plane geometric figure is transformed to a new position.

Here, we shall use the knowledge of coordinate geometry to understand this process.
Reflection

(i) Reflection in x-axis

Let P (x, y) be a point (See Fig 19).

If we consider x-axis as a plane mirror, then image P' of the point P will be at the same distance as P is from x-axis, i.e., PM = P'M.

So, the coordinates of P' (x', y') will be satisfying the conditions

\[ x' = x \]
\[ y' = -y \]

We say that P' (x', -y) is the reflection of the point P(x, y) in x-axis.

Thus, reflection of the point (3, 4) in x-axis will be (3, -4). Similarly, reflection of the point (-4, 3) in the axis will be (-4, -3) and reflection of the point (-2, -5) in x-axis will be (-2, -(-5)) i.e., (-2, 5) and so on.

(ii) Reflection in y-axis

If we consider y-axis as a plane mirror, then image P' of the point P will be at the same distance as P is from y-axis i.e., PM = MP'.

Fig. 16
So, the coordinates of \(P' (x', y')\) will given by

\[
\begin{align*}
x' &= -x \\
y' &= y
\end{align*}
\]

We say that \(P' (-x, y)\) is the reflection of the point \(P(x, y)\) in y-axis.

Thus, reflection of the point \((-3, -4)\) in y-axis will be \((-3, 4)\). Similarly, reflection of the point \((3, -4)\) in y-axis will be \((-3, -4)\) and reflection of the point \((-2, -5)\) in y-axis is \([-(-2), -5]\) i.e., \((2, -5)\) and so on.

(iii) Reflection in the line \(x = \text{constant}, \text{say} \ x = a\)

![Reflection in the line x = constant, say x = a](image)

Clearly \(x = a\) is a line parallel to y-axis. (See Fig. 21)

Let \(P(x, y)\) be any point.

If we consider line \(x = a\) as a plane mirror, the image \(P'\) of the point \(P\) will be at the same distance as \(P\) is from the line \(x = a\). i.e., \(PM = P'M\).

So, the coordinates of \(P' (x', y')\) will be given by

\[
\begin{align*}
x - a &= a - x' \text{ i.e., } x' &= 2a - x \\
y' &= y
\end{align*}
\]
We say that $P' (x', y') = P' (2a-x, y)$ is the **reflection** of the point $P (x, y)$ in $x = a$

Thus, reflection of the point $(3, 4)$ in the line $x=2$ is $(2x2 -3, 4)$ i.e., $(1, 4)$.

Similarly, reflection of the point $(-2, 3)$ in the line $x = -3$ is $(2(-3) - (-2), 3)$ i.e., $(-4, 3)$ and reflection of the point $(5, -9)$ in the line $x = 4$ is $(2 x 4 -5, -9)$ i.e., $(3, -9)$ and so on.

(iv) **Reflection in the line $y = constant$, say, $y = b$**

![Image of reflection](image)

Fig. 18

Clearly, $y = b$ is a line parallel to $x$ axis. (See Fig. 22).

Let $P(x, y)$ be any point. If we consider line $y = b$ as a plane mirror, the image $P'$ of the point $P$ will be at the same distance as $P$ is from the line $y = b$ i.e., $PM = P'M$.

So, the coordinates of $P'(x', y')$ will be given by

\[
x' = x
\]

\[
y - b = b - y', \text{ i.e., } y' = 2b - y
\]

We say that $P' (x, 2b -y)$ is the **reflection** of the point $P(x, y)$ in the line $y = b$.

Thus, reflection of the point $(3, 4)$ in the line $y = 2$ is $(3, 2 x 2 -4)$ i.e., $(3, 0)$. 
Similarly, reflection of the point (-2, 3) in the line \( y = -4 \) is \((-2, 2 \times (-4) - 3)\), i.e., \((-2, -11)\) and reflection of the point (1, -1) in the line \( y = -3 \) is \((1, 2 \times (-3) - (-1))\), i.e., \((1, -5)\)

**Example 10:** Find the reflection of \( \Delta ABC \) formed by the vertices \( A(5, 2), B(4, 7) \) and \( C(7, -4) \) in the

(i) \( x \)-axis,

(ii) \( y \)-axis,

(iii) Show that reflected triangle obtained in each case is congruent to the original triangle.

**Solution:**

(i) **Reflection in \( x \)-axis**

\[ A(5, 2) \rightarrow A'(5, -2) \]

\[ B(4, 7) \rightarrow B'(4, -7) \]

\[ C(7, -4) \rightarrow C'(7, 4) \]

\( \Delta A' B' C' \) is the reflection of \( \Delta ABC \) in \( x \)-axis

(ii) **Reflection in \( y \)-axis**

\[ A(5, 2) \rightarrow A''(-5, 2) \]

\[ B(4, 7) \rightarrow B''(-4, 7) \]

\[ C(7, -4) \rightarrow C''(-7, -4) \]

\( \Delta A'' B'' C'' \) is the reflection of \( \Delta ABC \) in \( y \)-axis

(iii) Here \( AB = \sqrt{(5 - 4)^2 + (2 - 7)^2} = \sqrt{26} \)

\[ A' B' = \sqrt{(5 - 4)^2 + (2 - 7)^2} = \sqrt{26} \]
Thus, $AB = A'B'$

Similarly, we can see that

$BC = B'C'$

and $CA = C'A'$

Thus, $\Delta ABC \cong \Delta A'B'C'$ (SSS)

again

$A''B'' = \sqrt{(-5 + 4)^2 + (2 - 7)^2} = \sqrt{26}$

Thus $A''B'' = AB = \sqrt{26}$

Similarly, we can see that

$C''A'' = CA$ and $B''C'' = BC$

Thus, $AB = A''B''$, $BC = B''C''$ and $CA = C''A''$

$\Delta ABC \cong \Delta A''B''C''$ [SSS]

A figure obtained by any reflection is always congruent to the original figure.

Translation

There is yet another geometric transformation known as translation.

A translation is a transformation that translates each point in the plane through a fixed distance in the fixed direction. Its effect on a particular figure in a plane is that it moves in a fixed direction without changing its shape and size.

Thus, here also, any figure obtained after the translation will be congruent to the original figure.
(i) Translation of a point P \((x, y)\) to \(P' \,(x + a, y + a)\)

\[
\begin{align*}
  x & \quad \longrightarrow \quad x + a \\
  y & \quad \longrightarrow \quad y + a
\end{align*}
\]

Thus, point \(P(x, y)\) \longrightarrow \(P'(x + a, y + a)\), where \(a\) is a constant.

So, if \(a = 2\), then the point \(P(4, 7)\) is translated to \(P' \,(4 + 2, 7 + 2)\) i.e., \(Q(6, 9)\)

Similarly, \(Q(-5, 9)\) is translated to \(Q' \,(-5 + 2, 9 +2)\) i.e., \(Q' \,(-3, 11)\)

\[
\begin{align*}
  PP' &= \sqrt{(6 - 4)^2 + (9 - 7)^2} = \sqrt{8} \\
  QQ' &= \sqrt{(-3 + 5)^2 + (11 - 9)^2} = \sqrt{8}
\end{align*}
\]

Thus, \(PP' = QQ'\)

From the above, we observe that:

Each point is translated to a distance of \(\sqrt{8}\) or \(2\sqrt{2}\) in the plane in a fixed direction.

In general, when \(x \quad \longrightarrow \quad x + a,\ \ y \quad \longrightarrow \quad y + a\)

i.e., \(P(x, y)\) \longrightarrow \(P(x + a, y + a)\), then distance translated \(= \sqrt{a^2 + a^2} = a\sqrt{2}\) in a fixed direction.

Here in this case, fixed direction is \(\frac{y_2 - y_1}{x_2 - x_1} = \frac{a}{a} = 1\) i.e. \(m = \tan 45^\circ\) or \(\tan 135^\circ\)

Thus, direction is at an angle of \(45^\circ\) or \(135^\circ\) with x-axis.
(i) Translation of a line segment PQ where \( P = P(x_1, y_1) \) and \( Q = Q(x_2, y_2) \).

Let each point \((x, y)\) of line segment PQ is translated to \((x + a, y + a)\).

So, \(P(x_1, y_1) \rightarrow P'(x_1 + a, y_1 + a)\)

\(Q(x_2, y_2) \rightarrow Q'(x_2 + a, y_2 + a)\)

Thus, line segment PQ is translated to line segment \(P' Q'\) through a distance of \(a\sqrt{2}\).

\[PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\]

\[P'Q' = \sqrt{(x_2 + a - x_1 - a)^2 + (y_2 + a - y_1 + a)^2}\]

\[= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\]

Hence, \(PQ = P'Q'\)

Thus, the length of line segment obtained by translating a given line segment through a given distance in a fixed direction always remains the same.

(ii) Translation of a \(\Delta ABC\) formed by the vertices \(A(x_1, y_1), B(x_2, y_2)\) and \(C(x_3, y_3)\).

Let each point \((x, y)\) is translation to \((x + a, y + a)\).

Thus,

\(A(x_1, y_1) \rightarrow A'(x_1+a, y_1+a)\)

\(B(x_2, y_2) \rightarrow B'(x_2+a, y_2+a)\)

\(C(x_3, y_3) \rightarrow C'(x_3+a, y_3+a)\)

Now \(AB = \sqrt{(x_2 - x_1)^2 + (y_1 - y_1)^2}\), \(A'B' = \sqrt{(x_2 + a - x_1 - a)^2 + (y_2 + a - y_1 + a)^2}\)

\[= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\]
So, \( AB = A'B' \)

Similarly, \( BC = B'C' \)

and \( CA = C'A' \)

Hence \( \triangle ABC \cong \triangle A'B'C' \) (SSS)

A figure obtained by the translation of any figure through a fixed distance in a fixed direction is always congruent to the original figure.

**Suggested Activity:** Take some geometric figures like, triangle, square, rectangle with given vertices and show that figures obtained under different transformations (reflection, rotation and transformation) are always congruent to the original figures.

In some cases, coordinates of each point \((x, y)\) of figure are transformed into the form

\[
\begin{align*}
x & \rightarrow kx \\
y & \rightarrow ky
\end{align*}
\]

i.e, \((x, y) \rightarrow (kx, ky)\)

where \(k\) is a positive number, called a **scale factor**.

If \(k>1\), say \(2\), then new figure so obtained under this transformation is called an **enlargement** of the original figure.

If \(k<1\), say \(\frac{3}{4}\), then new figure so obtained under this transformation is called a **reduction** of the original figure.

In both the cases a transformed figure is **similar** to the original figure.
STUDENT’S SUPPORT MATERIAL
STUDENT’S WORKSHEET 1

Warm up (W1) – (Planting Trees at Given Points)

Name of Student___________     Date________

In the given grid, plant a tree at the given point.

1. (2, 3)
2. (-2, -3)
3. (-2, 3)
4. (2, -3)
5. (0, 0)
6. (3, 0)
7. (0, 4)
8. (0, -5)
9. (-4, 0)
10. (4, 4)
SELF ASSESSMENT RUBRIC 1- WARM UP (W1)

<table>
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<tr>
<th>Parameters of assessment</th>
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<tbody>
<tr>
<td>Able to plot coordinates in quadrants</td>
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<tr>
<td>Able to plot coordinates on both axes</td>
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</tbody>
</table>

STUDENT’S WORKSHEET 2

Warm up (W2) – (Speak Aloud- Abscissa and Ordinate)

Name of Student___________     Date________

Speak the abscissa and ordinate of following points:

1. (-p, y)
2. (2, 8)
3. (-4, 9)
4. (3, -4)
5. (1/2, 4)
6. (4.5, 7.2)
7. (√2, 3)
8. (1+√3, 5.3)
SELF ASSESSMENT RUBRIC 2- WARM UP (W2)

Parameters of assessment

Able to tell the abscissa and ordinate of a given coordinate
Pre Content (P1) – (Making Shapes by Joining Points)

Name of Student___________     Date________

Take three points in the coordinate plane which make a scalene triangle.

Take three points in the coordinate plane which make an isosceles triangle.
Take three points in the coordinate plane which make an equilateral triangle.

Take four points in the coordinate plane which make a quadrilateral.
Take four points in the coordinate plane which make a square

Take four points in the coordinate plane which make a rhombus
Take four points in the coordinate plane which make a trapezium.
Take four points in the coordinate plane which make a parallelogram.

SELF ASSESSMENT RUBRIC 3- PRE CONTENT (P1)

<table>
<thead>
<tr>
<th>Parameters of assessment</th>
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<tr>
<td>Able to make geometrical shapes on a coordinate plane</td>
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<tr>
<td>Able to write the coordinates of vertices of a geometrical shape</td>
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</table>
1. Find the lengths of the hypotenuse of the right triangles drawn here.

2. Draw 5 right triangles and calculate the hypotenuse of each one of them.
# SELF ASSESSMENT RUBRIC 4- PRE CONTENT (P2)

- Able to apply Pythagoras theorem
- Able to calculate sides of a right triangle

<table>
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<tr>
<th>Parameters of assessment</th>
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<th>Understanding of concept, can apply but commit errors in calculation</th>
<th>Understanding of concept, can apply accurately</th>
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<tr>
<td>Able to apply Pythagoras theorem</td>
<td>![Progression Level 1]</td>
<td>![Progression Level 2]</td>
<td>![Progression Level 3]</td>
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<tr>
<td>Able to calculate sides of a right triangle</td>
<td>![Progression Level 1]</td>
<td>![Progression Level 2]</td>
<td>![Progression Level 3]</td>
</tr>
</tbody>
</table>
Name of Student____________ Date_______

   Watch Video on how to get distance formula using Pythagoras theorem.

2. Let A\((x_1, y_1)\) and C\((x_2, y_2)\) represent the location of two friends Mehul and Priya.
   Can you find the distance between them? Explain the method.
3. Find the distance between (5, 6) and (-5, -6).

Let A(5,6) and B(-5, -6)

\[ x_1 = \ldots, \ x_2 = \ldots \]

\[ y_1 = \ldots, \ y_2 = \ldots \]

Distance (AB) = \ldots

= \ldots

= \ldots \text{ units}

4. Find the distance between the points (-2, -3) and (-4, 4).

Let A(-2,-3) and B(-4,4)

\[ x_1 = \ldots, \ x_2 = \ldots \]

\[ y_1 = \ldots, \ y_2 = \ldots \]

Distance (AB) = \ldots

= \ldots

= \ldots \text{ Units}

5. Find the radius of a circle, given that the centre is at (2, -3) and the point (-1, -2) lies on the circle.

Let the radius of the circle be \( r \) units using distance formula we have

\[ x_1 = \ldots, \ x_2 = \ldots \]

\[ y_1 = \ldots, \ y_2 = \ldots \]

\[ OA = \ldots \]

\[ OA = \ldots = \ldots \text{ units} \]
SELF ASSESSMENT RUBRIC 5- CONTENT (CW1)

Parameters of assessment

- No Understanding
- Understanding of concept but not able to apply
- Understanding of concept, can apply but commit errors in calculation
- Understanding of concept, can apply accurately

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<tbody>
<tr>
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<tr>
<td>Able to calculate distance between two given points</td>
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</tbody>
</table>

STUDENT’S WORKSHEET 6

Content (CW2)–(Application of Distance Formula)

Name of Student___________     Date________

1. Do the points (1, 2), (2, 0) and (3, 5) form a triangle? Justify your answer.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

2. How will you show that the given three coordinates are coordinates of vertices of a scalene triangle?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
3. Plot three points in the coordinate plane forming a scalene triangle. Verify the answer using distance formula.

4. How will you show that the given three coordinates are coordinates of vertices of an isosceles triangle?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
5. Plot three points in the coordinate plane forming an isosceles triangle. Verify the answer using distance formula.

6. How will you show that the given three coordinates are coordinates of vertices of an equilateral triangle?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
7. Plot three points in the coordinate plane forming an equilateral triangle. Verify the answer using distance formula.

8. How will you show that the given three coordinates are coordinates of vertices of a right triangle?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
9. Plot three points in the coordinate plane forming a right triangle. Verify the answer using distance formula.

10. How will you show that the given four coordinates are coordinates of vertices of a square?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
11. Plot four points in the coordinate plane forming a square. Verify the answer using distance formula.

12. How will you show that the given four coordinates are coordinates of vertices of a parallelogram?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
13. Plot four points in the coordinate plane forming a parallelogram. Verify the answer using distance formula.

14. How will you show that the given four coordinates are coordinates of vertices of a rhombus?
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
15. Plot four points in the coordinate plane forming a rhombus. Verify the answer using distance formula.

16. How will you show that the given four coordinates are coordinates of vertices of a rectangle?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
17. Plot four points in the coordinate plane forming a rectangle. Verify the answer using distance formula.
## SELF ASSESSMENT RUBRIC 6- CONTENT (CW2)

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<tr>
<td>Able to tell whether three given coordinates will make a scalene triangle, an isosceles triangle or an equilateral triangle</td>
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<tr>
<td>Able to tell whether four given coordinates will make a square, a rectangle, a parallelogram or a rhombus</td>
<td></td>
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</table>

- **No Understanding**
- **Understanding of concept but not able to apply**
- **Understanding of concept, can apply but commit errors in calculation**
- **Understanding of concept, can apply accurately**
## STUDENT’S WORKSHEET 7

**Content (CW3) – (Section Formula)**

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<th>Name of Student</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

1. **What is Section formula?**

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

2. **When do you use section formula? Describe a situation.**

3. **A point P(x, y) divides a line segment joining A(x₁, y₁) and B(x₂, y₂) in the ratio m: n. How will you find the coordinates of point P?**
4. Find the coordinates of a point which divides internally the join of A (2, 5) and B(-3, 9) in the ratio 2 : 3.
1. Salma wants to draw a parallelogram. The three vertices of a parallelogram taken in order are (-1, 0), (3, 1) and (2, 2) respectively. Find the coordinates of the fourth vertex.

2. In what ratio does the point C (3/5, 11/5) divides the line segment joining the points A (3, 5) and B (-3,-2).
3. Find the ratio in which the x-axis divides the line segment joining the points (2, -3) and (5, 6). Also find the point of intersection.

4. Find the coordinates of the point which divides the line segment joining the points (6, 3) and (-4, 5) in the ratio 2:3 internally.
5. Rama is holding a rope, the end points of which lie at (2, -2) and (-7, 4). She wants to divide the rope into three equal parts. Find the coordinates of points of trisection.

SELF ASSESSMENT RUBRIC8- CONTENT (CW4)

Parameters of assessment

<table>
<thead>
<tr>
<th>Able to apply section formula in given situation</th>
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</thead>
<tbody>
<tr>
<td>Able to use section formula in geometrical problems</td>
<td></td>
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</table>
1. If the coordinates of the vertices of a triangle ABC are A(x₁, y₁), B(x₂, y₂) and C(x₃, y₃), then the area of triangle is given by

\[ \text{Area (A)} = \frac{1}{2} [x₁(y₂ - y₃) + x₂(y₃ - y₁) + x₃(y₁ - y₂)] \]

Madhav said “If we have to prove that the three given points are collinear then we can prove that the area of the triangle formed by these three vertices is zero”. Is he right? Justify your answer with example.
### SELF ASSESSMENT RUBRIC 9- CONTENT (CW5)

<table>
<thead>
<tr>
<th>Parameters of assessment</th>
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<th>Understanding of concept, can apply but commit errors in calculation</th>
<th>Understanding of concept, can apply accurately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can find the area of a triangle, given the coordinates of vertices of a triangle</td>
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<tr>
<td>Able to use the concept when area of triangle is zero</td>
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</tbody>
</table>
1. Reflect the triangle w.r.t. the x-axis. Write the coordinates of the new triangle obtained.

2. Reflect the triangle w.r.t. the y-axis. Write the coordinates of the new triangle obtained.
3. Draw any triangle ABC. Find the reflection of ΔABC in the
   (i) x-axis
   (ii) y-axis
   (iii) Show that reflected triangle obtained in each case is congruent to the original triangle.
4. A figure obtained any reflection is always congruent to the original figure. Justify.

5. Reflect the rectangle w. r. t. the x-axis. Write the coordinates of the new rectangle obtained.
6. The length of line segment obtained by translating a given line segment through a given distance in a fixed direction always remains the same. Justify.
7. Take some geometric figures like, triangle, square, rectangle with given vertices and show that figures obtained under different transformations (reflection and transformation) are always congruent to the original figures.
8. Translate the following as per given instruction and write the new coordinates.

| 2 steps right and 2 steps down | ![Diagram](image1)
| 1 step left and 4 steps down  | ![Diagram](image2)
| 5 steps down                  | ![Diagram](image3)
6 steps left and 2 steps up

3 steps down and 4 steps right

5 steps right and 7 steps down
SELF ASSESSMENT RUBRIC 9- CONTENT (CW5)

<table>
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<th>Parameters of assessment</th>
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<th>Understanding of concept but not able to apply</th>
<th>Understanding of concept, can apply but commit errors in calculation</th>
<th>Understanding of concept, can apply accurately</th>
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</thead>
<tbody>
<tr>
<td>Able to find the reflection of a geometrical shape w.r.t. the given line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Able to translate a geometrical shape as per the given scale.</td>
<td></td>
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</tbody>
</table>
1. Show that the points (1, 7), (4,2), (-1,-1) and (-4,4) are the vertices of a square.

2. Find the distance between the following pair of points
   - (2, 3), (4, 1)
   - (1, 3), (-5, 7)
   - (a, b), (-a, -b)

3. Do the following points (3, 2), (-2,-3) and (3, 2) form a triangle? If so, name the type of triangle.

4. Find a relation between x and y such that the points (x, y) is equidistant from the points (7, 10) and (3, 5).

5. Find a point on y-axis which is equidistant from the points A (6, 5) and B (-4, 3).

6. Find a point on x-axis which is equidistant from the points (2,-5) and (-2, 9).

7. Find the value of y for which the distance between the points P (2,-3) and Q (10, y).

8. If Q (0, 1) is equidistant from P(5,-3) and R(x,6). Find the value of x.
STUDENT’S WORKSHEET 11

Post Content (PCW2) – (MCQ’s)

Name of Student_____________     Date________

Mark the correct alternative in each of the following

1. The distance between the points \((\cos\theta, \sin\theta)\) and \((\sin\theta, -\cos\theta)\) is
   - \(\sqrt{3}\)
   - \(\sqrt{2}\)
   - 2
   - 1

2. If the distance between the points \((4, p)\) and \((1, 0)\) is 5, then \(p =\)
   - \(\pm 4\)
   - 4
   - -4
   - 0

3. The perimeter of the triangle formed by the points \((0, 0)\), \((1, 0)\) and \((0, 1)\) is
   - \(1 \pm \sqrt{2}\)
   - \(1 + \sqrt{2}\)
   - 3
   - \(2 + \sqrt{2}\)

4. If the points \((k, 2k)\), \((3k, 3k)\) and \((3, 1)\) are collinear, then \(k\) is equal to
   - \(1/3\)
   - \(-1/3\)
   - \(2/3\)
   - \(-2/3\)
5. If three points (0, 0), (3, \(\sqrt{3}\)) and (3, \(\lambda\)) form an equilateral triangle, then \(\lambda\) is equal to

- 2
- 3
- 4
- None of these

6. If (-1, 2), (2,-1) and (3, 1) are any three vertices of a parallelogram, then the fourth vertex is

- (2,0)
- (-2,0)
- (-2,6)
- (6,2)

7. If the points (1,2),(-5,6) and (a,-2) are collinear, then a =

- -3
- 7
- 2
- -2

8. The ratio in which (4,5) divides the line segment joining (2,3) and (7,8) is

- -2:3
- -3:2
- 3:2
- 2:3

9. The ratio in which the x-axis divides the line segment joining the points (3,6) and (12,-3) is

- 2:1
- 1:2
- 1:-2
- -2:1
STUDENT’S WORKSHEET 12

Post Content (PCW3) – (Framing questions)

Name of Student_____________     Date________

Use the clues given below and frame questions.

1. Finding distance of points from origin.
2. Ram and Shyam are standing at equal distances.
3. Three points are on the same line.
4. Two points are at equal distance from origin.
5. A line divides join of two points in the ratio x: y
6. A point divides the join of two points in a given ratio.

STUDENT’S WORKSHEET 13

Post Content (PCW4) – (Fill in the blanks)

Name of Student_____________     Date________

Read the paragraph below and fill in the missing words.

The coordinates of any point on x-axis is of the form ________. The abscissa of any point on y axis is ________. In order to prove that the given three points are collinear, we will show that the area of the triangle formed by these lines is ________. Mid- point divides a line segment in ________ ratios. The midpoint of the line segment joining the points (0,2) and (4,6) is ________. The distance between the points (2,1) and (1,2) is ________ units. The diagonals of a parallelogram __________ each other. Diagonals of a rhombus cut each other at ________ angles. Three points A, B, C are collinear if the three points lie on the same ________. 
Revise the following points and create a mind map

- In coordinate geometry, the tools of algebra are used in studying geometry by establishing 1-1 correspondence between the points in a plane and the ordered pairs of real numbers.

- If \( P(x_1,y_1) \) and \( Q(x_2,y_2) \) be any two points in the plane,

\[
PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}
\]

- If \( A(x_1,y_1) \), \( B(x_2,y_2) \) and \( C(x_3,y_3) \) be the vertices of a triangle, then area, \( D \), of triangle \( ABC \) is given by

\[
\Delta = \frac{1}{2} [(x_1y_2 - x_2y_1) + (x_2y_3 - x_3y_2) + (x_3y_1 - x_1y_3)]
\]

- The points \( A, B \) and \( C \) are collinear if and only if area of triangle \( ABC \) is zero.

- A point \( R \) is said to divide \( PQ \) internally in the ratio \( m : n \) if \( R \) is within \( PQ \) and \( \frac{PR}{RQ} = \frac{m}{n} \)

- If \( R(x,y) \) divides the join of \( P(x_1,y_1) \) and \( Q(x_2,y_2) \) internally in the ratio \( m : n \),

\[
x = \frac{mx_2 + nx_1}{m+n}, \quad y = \frac{my_2 + ny_1}{m+n}
\]

- If \( M(x,y) \) is the midpoint of the join of \( P(x_1,y_1) \) and \( Q(x_2,y_2) \),

\[
x = \frac{x_1 + x_2}{2}, \quad y = \frac{y_1 + y_2}{2}
\]
<table>
<thead>
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<th>Web link</th>
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<td>To show given four points are the coordinates of vertices of a rectangle</td>
<td><a href="http://mykhmsmathclass.blogspot.com/2011/10/application-of-distance-formula.html">http://mykhmsmathclass.blogspot.com/2011/10/application-of-distance-formula.html</a></td>
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