NCERT Solutions Class 11 Maths
Chapter 9: Straight Lines
EXERCISE 9.1

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 9 Exercise 9.1, students learn fundamental concepts of coordinate geometry including slope calculation, distance formula applications, and area determination using coordinate methods. This exercise covers essential coordinate geometry principles that form the foundation for straight line equations and are crucial for CBSE Class 11 board exams and competitive entrance tests.

Key Takeaways:

- Master the slope formula m = (y_2 - y_1)/(x_2 - x_1) for finding the gradient of a line passing through two points
- Apply the distance formula d = √(x_2-x_1)^2 + (y_2-y_1)^2 to solve problems involving equidistant points and geometric constructions
- Calculate areas of quadrilaterals and triangles using coordinate geometry methods by plotting points on the Cartesian plane
- Understand midpoint formula applications and how to find slopes of lines passing through origin and midpoints of line segments

Complete Solutions

Question 1

QUESTION

Draw a quadrilateral in the Cartesian plane, whose vertices are (-4,5), (0,7), (5,-5), (-4,-2). Also, find its area.

SOLUTION

This question requires us to plot the given points on the Cartesian plane to form a quadrilateral and then calculate its area.

Step 1: Plot the points

Plot the points A(-4, 5), B(0, 7), C(5, -5), and D(-4, -2) on the Cartesian plane. Connect the points in the order A-B-C-D-A to form the quadrilateral.

Step 2: Divide the quadrilateral into two triangles

Divide the quadrilateral ABCD into two triangles, say triangle ABC and triangle ADC, by drawing the diagonal AC.

Step 3: Calculate the area of triangle ABC

We use the formula for the area of a triangle given its vertices , , and :

For triangle ABC, the vertices are A(-4, 5), B(0, 7), and C(5, -5). Plugging in the coordinates:

Step 4: Calculate the area of triangle ADC

For triangle ADC, the vertices are A(-4, 5), D(-4, -2), and C(5, -5). Plugging in the coordinates:

Step 5: Calculate the area of the quadrilateral

The area of quadrilateral ABCD is the sum of the areas of triangles ABC and ADC:

Final Answer: The area of the quadrilateral is square units.

ANSWER

(121)/(2) square unit.

Question 2

QUESTION

The base of an equilateral triangle with side 2a lies along the y-axis such that the mid-point of the base is at the origin. Find vertices of the triangle.

SOLUTION

This question tests our understanding of coordinate geometry and properties of equilateral triangles. We need to find the coordinates of the vertices of the equilateral triangle given the position of its base.

Step 1: Visualize the problem

Imagine an equilateral triangle with its base on the y-axis and the midpoint of the base at the origin (0,0). Since it's equilateral, all sides are equal, and all angles are 60 degrees.

Step 2: Determine the coordinates of the base vertices

The base has length , and its midpoint is at the origin. Therefore, the vertices of the base are at a distance of from the origin along the y-axis. This gives us the coordinates (0, a) and (0, -a).

So, two vertices are: (0, a) and (0, -a)

Step 3: Find the coordinates of the third vertex

The third vertex lies on the x-axis because the triangle is equilateral and the base is symmetric about the x-axis. Let the third vertex be (x, 0).

Step 4: Use the distance formula

Since it's an equilateral triangle, the distance between (x, 0) and (0, a) must be equal to the side length . Using the distance formula:

Squaring both sides:

Step 5: State the possible coordinates of the third vertex

Therefore, the third vertex can be either or .

Step 6: Final Answer

The vertices of the equilateral triangle are (0, a), (0, -a) and or (0, a), (0, -a), and .

ANSWER

(0, a), (0, -a) and ($-\sqrt{3}$ a, 0) or (0, a), (0, -a), and ($\sqrt{3}$ a, 0)

Question 3

QUESTION

Find the distance between P (x_1, y_1) and Q (x_2, y_2) when (i) PQ is parallel to the y-axis, (ii) PQ is parallel to the x-axis.

SOLUTION

This question tests our understanding of the distance formula and how it simplifies when lines are parallel to the x or y axis.

(i) PQ is parallel to the y-axis

When PQ is parallel to the y-axis, the x-coordinates of points P and Q are the same. That is, . The distance between P and Q is the difference in their y-coordinates.

Step 1: Recall the distance formula

The distance between two points P and Q is given by:

Step 2: Apply the condition

Since PQ is parallel to the y-axis, . Substituting this into the distance formula:

Step 3: Simplify

Taking the square root, we get the absolute value:

Answer (i): The distance between P and Q when PQ is parallel to the y-axis is .

(ii) PQ is parallel to the x-axis

When PQ is parallel to the x-axis, the y-coordinates of points P and Q are the same. That is, . The distance between P and Q is the difference in their x-coordinates.

Step 1: Recall the distance formula

The distance between two points P and Q is given by:

Step 2: Apply the condition

Since PQ is parallel to the x-axis, . Substituting this into the distance formula:

Step 3: Simplify

Taking the square root, we get the absolute value:

Answer (ii): The distance between P and Q when PQ is parallel to the x-axis is .

ANSWER

(i) $|y_2 - y_1|$, (ii) $|x_2 - x_1|$

Question 4

QUESTION

Find a point on the x-axis which is equidistant from the points (7, 6) and (3, 4).

SOLUTION

This question asks us to find a point on the x-axis that is the same distance away from two given points. This involves using the distance formula.

Step 1: Define the point on the x-axis

Any point on the x-axis has a y-coordinate of 0. Let the point be .

Step 2: Calculate the distance from to

Using the distance formula, the distance is:

Step 3: Calculate the distance from to

Using the distance formula, the distance is:

Step 4: Set the distances equal to each other

Since the point is equidistant from and , we have . Therefore:

Step 5: Solve for x

Squaring both sides to eliminate the square roots:

Expanding the squares:

Simplifying:

Subtracting from both sides:

Adding to both sides and subtracting 25 from both sides:

Dividing both sides by 8:

Step 6: State the point

The point on the x-axis is .

Final Answer:

ANSWER

\left((15)/(2), 0\right)

Question 5

QUESTION

Find the slope of a line which passes through the origin, and the mid-point of the line segment joining the points P (0, −4) and B (8, 0).

SOLUTION

We need to find the slope of a line that passes through the origin and the midpoint of the line segment joining points P(0, -4) and B(8, 0).

Step 1: Find the midpoint of the line segment PB

The midpoint formula for two points and is given by:

Here, and . So, the midpoint M is:

Step 2: Find the slope of the line passing through the origin (0, 0) and the midpoint M (4, -2)

The slope of a line passing through two points and is given by:

Here, the two points are the origin (0, 0) and the midpoint M (4, -2). So, , , , and .

Therefore, the slope is:

Final Answer: The slope of the line is .

ANSWER

-(1)/(2)

Question 6

QUESTION

Without using the Pythagoras theorem, show that the points (4, 4), (3, 5) and (−1, −1) are the vertices of a right-angled triangle.

SOLUTION

We need to show that the points (4, 4), (3, 5), and (−1, −1) are vertices of a right-angled triangle without using the Pythagorean theorem. We will use the concept of slopes of lines.

Step 1: Define the points

Let A = (4, 4), B = (3, 5), and C = (−1, −1).

Step 2: Calculate the slopes of the lines AB, BC, and AC

The slope of a line joining two points and is given by:

Slope of AB ():

Slope of BC ():

Slope of AC ():

Step 3: Check for perpendicularity using slopes

Two lines are perpendicular if the product of their slopes is -1.

Check if AB is perpendicular to AC: . Since the product is -1, AB is perpendicular to AC.

Check if AB is perpendicular to BC: . Since the product is not -1, AB is not perpendicular to BC.

Check if AC is perpendicular to BC: . Since the product is not -1, AC is not perpendicular to BC.

Step 4: Conclude

Since the lines AB and AC are perpendicular, the angle between them is 90 degrees. Therefore, the points A(4, 4), B(3, 5), and C(−1, −1) are the vertices of a right-angled triangle.

Question 7

QUESTION

Find the slope of the line which makes an angle of 30^\circ with the positive direction of y-axis measured anticlockwise.

SOLUTION

This question tests our understanding of the relationship between the slope of a line and the angle it makes with the axes.

Step 1: Understand the problem

We are given the angle the line makes with the positive y-axis, and we need to find the slope of the line. The slope is related to the angle the line makes with the positive x-axis.

Step 2: Find the angle with the x-axis

The line makes an angle of with the positive y-axis. Since the angle between the positive x-axis and positive y-axis is , the angle that the line makes with the positive x-axis is .

Step 3: Calculate the slope

The slope of a line is given by the tangent of the angle it makes with the positive x-axis:

In this case, , so we need to find .

We can write as . Using the identity , we have:

We know that , so:

Step 4: State the final answer

The slope of the line is .

ANSWER

-√3

Question 8

QUESTION

Without using distance formula, show that points (−2, −1), (4, 0), (3, 3) and (−3, 2) are the vertices of a parallelogram.

SOLUTION

To show that the given points are vertices of a parallelogram without using the distance formula, we will demonstrate that the opposite sides have equal slopes. This implies that the opposite sides are parallel, which is a defining property of a parallelogram.

Step 1: Define the points

Let the points be A(-2, -1), B(4, 0), C(3, 3), and D(-3, 2).

Step 2: Calculate the slope of side AB

The slope of a line joining two points and is given by:

Slope of AB,

Step 3: Calculate the slope of side CD

Slope of CD,

Since , AB is parallel to CD.

Step 4: Calculate the slope of side BC

Slope of BC,

Step 5: Calculate the slope of side AD

Slope of AD,

Since , BC is parallel to AD.

Step 6: Conclusion

Since both pairs of opposite sides (AB || CD and BC || AD) are parallel, the points A(-2, -1), B(4, 0), C(3, 3), and D(-3, 2) are the vertices of a parallelogram.

Question 9

QUESTION

Find the angle between the x-axis and the line joining the points (3, −1) and (4, −2).

SOLUTION

We are asked to find the angle between the x-axis and the line joining the points (3, -1) and (4, -2). This involves finding the slope of the line and then using the arctangent function to find the angle.

Step 1: Find the slope of the line

The slope of a line passing through two points and is given by:

In our case, and . Therefore:

So, the slope of the line is -1.

Step 2: Find the angle using the arctangent function

The angle between the line and the x-axis is given by:

In our case, . Therefore:

We know that or . Therefore, .

Alternatively, , but since we are looking for the angle between the x-axis and the line, we usually consider the angle in the range of 0° to 180°.

Step 3: State the final answer

The angle between the x-axis and the line is 135°.

ANSWER

135°

Question 10

QUESTION

The slope of a line is double the slope of another line. If tangent of the angle between them is (1)/(3), find the slopes of the lines.

SOLUTION

This question tests our understanding of the relationship between slopes of lines and the angle between them. We'll use the formula for the tangent of the angle between two lines.

Step 1: Define the slopes

Let the slope of one line be and the slope of the other line be . We are given that one slope is double the other. So, let .

Step 2: Use the tangent formula

The tangent of the angle between two lines with slopes and is given by:

We are given that . Substituting into the formula, we get:

Step 3: Solve for

We have two cases to consider due to the absolute value:

Case 1:

Cross-multiplying gives:

Factoring the quadratic equation:

So, or .

Case 2:

Cross-multiplying gives:

Factoring the quadratic equation:

So, or .

Step 4: Find the corresponding values of

If , then .

If , then .

If , then .

If , then .

Final Answer: The slopes of the lines are 1 and 2, or and 1, or −1 and −2, or − and −1.

ANSWER

1 and 2, or (1)/(2) and 1, or −1 and −2, or −(1)/(2) and −1

Question 11

QUESTION

A line passes through (x_1, y_1) and (h, k). If slope of the line is m, show that $k - y_1 = m(h - x_1)$.

SOLUTION

This question tests our understanding of the slope of a line passing through two given points.

Step 1: Recall the formula for the slope of a line

The slope of a line passing through two points and is given by:

Step 2: Apply the formula to the given points

In our case, the line passes through and . Therefore, we can write the slope as:

Step 3: Rearrange the equation to match the desired form

We need to show that . To do this, we can multiply both sides of the slope equation by :

Assuming , we can cancel out the terms on the right side:

Step 4: Rewrite the equation

By simply rearranging the terms, we get:

This is the equation we were asked to show.

Final Answer:

Conclusion: We have shown that if a line passes through points and with slope , then the relationship holds true. This is a direct application of the slope formula.

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Key Formulas

Important Formulas for Exercise 9.1

Formula / Concept	Description
Slope of a Line (m)	The slope of a non-vertical line passing through the points (x_1, y_1) and (x_2, y_2) is given by the formula: $m = (y_2 - y_1)/(x_2 - x_1)$ It represents the "rise over run" or the rate of change in y with respect to x.
Slope as Tangent of an Angle	If a line makes an angle θ with the positive direction of the x-axis, its slope 'm' is given by: $m = \tan(\theta)$ where $\theta \neq 90^\circ$.
Slope of Horizontal and Vertical Lines	• The slope of a horizontal line is 0. • The slope of a vertical line is undefined.
Condition for Collinearity of Three Points	Three points A, B, and C are collinear if and only if the slope of line segment AB is equal to the slope of line segment BC. $\text{Slope of AB} = \text{Slope of BC}$
Point-Slope Form	The equation of a line passing through a point (x_1, y_1) with a slope 'm' is given by: $y - y_1 = m(x - x_1)$ This form is useful when one point on the line and the slope are known.
Slope-Intercept Form	The equation of a line with slope 'm' and y-intercept 'c' is: $y = mx + c$ The y-intercept is the point where the line crosses the y-axis, with coordinates (0, c).
Angle Between Two Lines	The acute angle θ between two lines with slopes m_1 and m_2 is given by: $\tan(\theta) = \left\| (m_2 - m_1)/(1 + m_1 m_2) \right\|$ where $1 + m_1 m_2 \neq 0$.
Condition for Parallel Lines	Two non-vertical lines are parallel if and only if their slopes are equal. $m_1 = m_2$
Condition for Perpendicular Lines	Two non-vertical lines are perpendicular if and only if the product of their slopes is -1. $m_1 m_2 = -1$

❓ Top FAQs

Q1. How many questions are included in NCERT Solutions for Class 11 Maths Chapter 9 Straight Lines Exercise 9.1?

Exercise 9.1 of NCERT Solutions for Class 11 Maths Chapter 9 Straight Lines contains exactly 11 questions. These questions focus on fundamental concepts of slope of a line, including slope-intercept form and point-slope form. All 11 questions come with detailed step by step solutions for CBSE board exam 2025-26 preparation.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 9 Straight Lines Exercise 9.1?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 9 Straight Lines Exercise 9.1 from official educational websites and trusted academic platforms. The free PDF download includes complete step by step solutions for all 11 questions aligned with CBSE syllabus 2025-26. These PDFs are available in easy-to-print format for offline study.

Q3. How many marks does Chapter 9 Straight Lines carry in CBSE Class 11 Maths board exam 2025-26?

Chapter 9 Straight Lines is part of Unit III - Coordinate Geometry and carries approximately 4 marks weightage in CBSE Class 11 Maths board exam 2025-26. The marks are shared with other topics in coordinate geometry. Exercise 9.1 concepts on slope of a line form the foundation for higher-scoring questions in this chapter.

Q4. Which is the most difficult question in NCERT Solutions Class 11 Maths Chapter 9 Straight Lines Exercise 9.1?

Questions 9, 10, and 11 in NCERT Solutions for Class 11 Maths Chapter 9 Straight Lines Exercise 9.1 are considered the most challenging as they involve application of slope-intercept form and point-slope form concepts. These questions require strong understanding of coordinate geometry principles. Step by step solutions help students master these difficult problems for CBSE board exam 2025-26.

Q5. What is the Slope-Intercept Form explained in NCERT Class 11 Maths Chapter 9 Straight Lines Exercise 9.1?

The Slope-Intercept Form in NCERT Class 11 Maths Chapter 9 Exercise 9.1 is represented as $y = mx + c$, where m is the slope and c is the y-intercept. This form is extensively covered in Exercise 9.1 with multiple practice questions. Understanding this concept is crucial for solving problems in CBSE Class 11 board exam 2025-26 and competitive exams.

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