

If Point P(4,5) Lies On The Terminal Side Of Angle C, In Which Quadrant Does Angle C Lie? a.QIII b.QI c.QIV d.QII

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a. QIII b. QI c. QIV d. QII

Understanding the position of an angle in the coordinate plane is fundamental in trigonometry and analytic geometry. When given a point such as P(4,5), determining the quadrant where the terminal side of an angle lies involves analyzing the point's coordinates and their relation to the axes. This article explores the methods to identify the quadrant of an angle based on a point on its terminal side, focusing on the specific case of point P(4,5). We will discuss the coordinate plane, the quadrants, how to interpret points, and then apply this knowledge to find the exact quadrant where the angle C resides.

Understanding the Coordinate Plane and Its Quadrants

The Cartesian Coordinate System

The Cartesian coordinate system, also known as the xy-plane, is a two-dimensional plane divided into four sections called quadrants. It is formed by two perpendicular lines:

- The x-axis (horizontal axis)
- The y-axis (vertical axis)

The point of intersection of these axes is called the origin, denoted as (0,0).

The Four Quadrants

The coordinate plane is divided into four quadrants, numbered counterclockwise starting from the top right:

1. Quadrant I (Q I): Both x and y coordinates are positive.
- Example: (3, 4)
2. Quadrant II (Q II): x is negative, y is positive.
- Example: (-3, 4)
3. Quadrant III (Q III): Both x and y are negative.
- Example: (-3, -4)
4. Quadrant IV (Q IV): x is positive, y is negative.
- Example: (3, -4)

Understanding where a point lies is crucial in trigonometry, especially when dealing with angles and their terminal sides.

Determining the Quadrant of a Point

Analyzing Coordinates

To find the quadrant where a point $P(x, y)$ lies, examine the signs of x and y :

- If $x > 0$ and $y > 0$, P is in Quadrant I.
- If $x < 0$ and $y > 0$, P is in Quadrant II.
- If $x < 0$ and $y < 0$, P is in Quadrant III.
- If $x > 0$ and $y < 0$, P is in Quadrant IV.

Applying to Point $P(4,5)$

Given $P(4, 5)$:

- $x = 4$ (positive)
- $y = 5$ (positive)

Since both are positive, point $P(4,5)$ lies in Quadrant I.

Understanding Angles and Their Terminal Sides

Angles in Standard Position

An angle in standard position is formed by:

- The initial side along the positive x -axis.
- The terminal side, which rotates from the initial side.

The position of the terminal side relative to the axes determines the angle's quadrant.

Terminal Side and Point $P(4,5)$

If a point $P(4,5)$ lies on the terminal side of an angle C , then:

- The terminal side of angle C passes through P .
- The angle's measure is the angle between the initial side (positive x -axis) and the terminal side.

Since $P(4,5)$ is in Quadrant I, the terminal side of angle C is in Quadrant I.

Determining the Quadrant of Angle C

The Key Concept

The quadrant where the terminal side of an angle lies corresponds directly to the quadrant of any point on that terminal side (excluding points on the axes). Therefore:

- If $P(4,5)$ lies on the terminal side of angle C, then angle C's terminal side is in Quadrant I.

Implication for the Question

Given the options:

- QIII (Quadrant III)
- QI (Quadrant I)
- QIV (Quadrant IV)
- QII (Quadrant II)

Since $P(4,5)$ is in Quadrant I, the terminal side of angle C passes through a point in Quadrant I, meaning:

- Angle C lies in Quadrant I.

Additional Considerations

Angles Greater Than 90° , Less Than 180°

Angles with terminal sides in Quadrant I are between 0° and 90° . If the angle is larger, it could be in other quadrants, but the specific point $P(4,5)$ indicates a terminal side in Quadrant I.

Using Trigonometric Ratios

To further verify, one can:

- Calculate the radius $(r = \sqrt{x^2 + y^2})$.
- Determine the sine and cosine of the angle:
 - $(\sin \theta = y / r)$
 - $(\cos \theta = x / r)$

Since both x and y are positive, sine and cosine are positive, confirming the angle is in Quadrant I.

Summary and Conclusion

In summary:

- The point $P(4,5)$ lies in Quadrant I because both x and y are positive.
- An angle's terminal side passing through a point in a specific quadrant indicates the angle's own quadrant.
- Therefore, if point $P(4,5)$ lies on the terminal side of angle C , then angle C lies in Quadrant I.

This understanding is essential in solving problems involving angles, points, and their positions in the coordinate plane. Recognizing the quadrant based on coordinate signs simplifies the process of analyzing angles in trigonometry.

Final Answer

Based on the analysis above, the correct choice is:

- b. QI (Quadrant I)

This conclusion aligns with the fundamental principles of coordinate geometry and the behavior of angles in standard position.

Keywords for SEO Optimization:

- Point $P(4,5)$ lies on the terminal side of angle C
- Quadrant of an angle in coordinate geometry
- How to determine quadrant from point coordinates
- Trigonometry and coordinate plane
- Find the quadrant of a point
- Angle C in the coordinate plane
- Quadrant I, II, III, IV in trigonometry
- Analyzing points and angles in Cartesian plane

Understanding these concepts enhances your grasp of trigonometry, coordinate geometry, and their applications in mathematics.

Frequently Asked Questions

If Point $P(4,5)$ lies on the terminal side of angle C , in which quadrant does angle C lie?

The point $(4,5)$ is in the first quadrant, so angle C lies in Quadrant I.

Why does the position of point $P(4,5)$ determine the quadrant of angle C?

Because the terminal side of the angle passes through point P, which indicates the specific quadrant based on the sign of the coordinates.

What are the signs of coordinates in Quadrant I?

In Quadrant I, both x and y coordinates are positive.

If point P were $(-4, 5)$, in which quadrant would the terminal side of angle C lie?

It would lie in Quadrant II, where x is negative and y is positive.

How can we confirm the quadrant of an angle given a point on its terminal side?

By examining the signs of the x and y coordinates of the point; positive x and y indicate Quadrant I, negative x and positive y indicate Quadrant II, and so on.

What is the correct answer to the question: 'If Point $P(4,5)$ lies on the terminal side of angle C, in which quadrant does angle C lie?'

The correct answer is d. QI (Quadrant I).

Is the point $(4,5)$ on the positive x-axis, y-axis, or somewhere else?

The point $(4,5)$ is somewhere in the first quadrant, not on any axis.

Additional Resources

If Point $P(4,5)$ Lies On The Terminal Side Of Angle C, In Which Quadrant Does Angle C Lie? a. QIII b. QI c. QIV d. QII

Understanding the position of an angle in the coordinate plane is fundamental in trigonometry and analytical geometry. When given a point—here, $P(4,5)$ —that lies on the terminal side of an angle, determining which quadrant the angle resides in involves analyzing the coordinates of the point. This process is essential not only for solving geometric problems but also for applications across physics, engineering, and computer graphics. This article explores how to identify the quadrant of an angle given that its terminal side passes through a specific point in the plane, focusing particularly on the point $P(4,5)$.

Understanding the Coordinate Plane and Quadrants

Before delving into the specifics of the problem, it is important to review the fundamental layout of the coordinate plane and how quadrants are defined.

The Coordinate Plane Structure

The Cartesian coordinate system divides the plane into four regions called quadrants, based on the signs of the x and y coordinates:

- Quadrant I (Q I): Both x and y are positive ($x > 0, y > 0$).
- Quadrant II (Q II): x is negative, y is positive ($x < 0, y > 0$).
- Quadrant III (Q III): Both x and y are negative ($x < 0, y < 0$).
- Quadrant IV (Q IV): x is positive, y is negative ($x > 0, y < 0$).

This division helps locate points and interpret angles in the plane.

The Significance of the Terminal Side of an Angle

In standard position, an angle's initial side is aligned with the positive x-axis, and its terminal side rotates counterclockwise (or clockwise, in some cases). When a point lies on the terminal side, the coordinates of that point offer clues about the angle's position relative to the axes.

Determining the Quadrant of an Angle Given a Point

The process of identifying the quadrant involves examining the signs of the x and y coordinates of the given point.

Given Point P(4,5)

- x-coordinate: 4 (positive)
- y-coordinate: 5 (positive)

Since both coordinates are positive, the point P(4,5) is located in Quadrant I.

This immediate observation suggests that the terminal side of the angle passes through Quadrant I, where both x and y coordinates are positive.

The Relationship Between the Point and the Angle

Understanding how the point relates to the angle's position requires exploring the concepts of reference angles, the unit circle, and how angles are measured.

Angles in Standard Position

- An angle in standard position has its vertex at the origin.
- The initial side lies along the positive x-axis.
- The terminal side rotates from the initial side to the specified position.

Terminal Side Passing Through P(4,5)

- Since P(4,5) lies on the terminal side, the angle in question is the measure of the rotation from the positive x-axis to this line.
- The coordinates provide the direction of the terminal side relative to the origin.

The Significance of the Point's Coordinates

- The signs of x and y indicate the direction of the terminal side.
- For P(4,5), both positive, the terminal side points into Quadrant I, where both x and y are positive.

Calculating the Angle's Measure and Confirming Its Quadrant

While the coordinates directly indicate the quadrant, understanding the angle's measure adds depth to the analysis.

Using the Distance From the Origin

The distance from the origin to P(4,5) can be calculated using the Pythagorean theorem:

$$\begin{aligned} r &= \sqrt{x^2 + y^2} = \sqrt{4^2 + 5^2} = \sqrt{16 + 25} = \sqrt{41} \end{aligned}$$

This distance (r) is significant when working with the unit circle and trigonometric ratios.

Calculating the Reference Angle

The reference angle, θ , is the acute angle between the terminal side and the x-axis:

$$\theta = \arctan \left(\frac{y}{x} \right) = \arctan \left(\frac{5}{4} \right)$$

Using a calculator:

$$\theta \approx \arctan(1.25) \approx 51.34^\circ$$

Since both x and y are positive, the actual angle C measured from the positive x-axis is approximately 51.34° , placing it firmly in Quadrant I.

Summary of Quadrant Identification

Based on the coordinate analysis:

- The point P(4,5) has positive x and y coordinates.
- It lies in Quadrant I.
- The terminal side of angle C passing through this point also resides in Quadrant I.

Therefore, the correct answer choice is:

b. QI

Additional Considerations and Common Misconceptions

While the straightforward signs of the coordinates provide an immediate answer, it is essential to consider potential misconceptions that could arise.

Points on Axes vs. Points Inside Quadrants

- If a point lies exactly on an axis (e.g., (0,5) or (4,0)), the angle's position is considered to be on the boundary between quadrants or at the axes.
- In our case, P(4,5) is strictly inside Quadrant I, with both coordinates positive.

Angles Greater Than 90° or Less Than 0°

- The signs of coordinates determine the quadrant, not the magnitude of the angle.
- An angle in Quadrant I can range from 0° to 90° .
- Angles greater than 90° but passing through Quadrant II or III would have different coordinate sign patterns.

Ensuring Accurate Interpretation

- Always examine the signs of x and y .
- Use the arctangent of y/x to find the reference angle.
- Remember that the quadrant is determined by the signs of the coordinates, not just the arctangent value.

Real-World Applications of Quadrant Identification

Why does identifying the quadrant matter beyond pure mathematics? Here are some practical scenarios:

- Navigation and GPS: Determining the direction of a vector relative to a fixed point.
- Physics: Calculating trajectory angles and forces in different quadrants.
- Engineering: Designing components that depend on angular orientation.
- Computer Graphics: Rendering objects with correct orientation based on coordinate data.

In all these applications, knowing precisely which quadrant an angle's terminal side lies in ensures accurate calculations and effective problem-solving.

Conclusion

In summary, when given a point such as $P(4,5)$ lying on the terminal side of an angle C , the key to determining its quadrant is analyzing the signs of the coordinates. Since both x and y are positive in this case, the point—and consequently, the terminal side of the angle—resides in Quadrant I. This knowledge not only aids in solving geometric problems but also has broad applications across various scientific and engineering fields.

Therefore, the correct answer to the question is:

b. QI

Understanding how to interpret coordinate positions in the plane is an essential skill in trigonometry, enabling us to accurately classify angles and their positions relative to the axes. The case of $P(4,5)$ offers a clear illustration of these principles in action.

If Point P 4 5 Lies On The Terminal Side Of Angle C In Which Quadrant Does Angle C Lies A Qiiib Qic Qivd Qii

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