Find The Polar Coordinates,0<2andr0, Of The Following Points Given In Cartesian Coordinates. (a)(2,23)(b)(42,42)(c)(2,23)(a)

Find The Polar Coordinates, 0 < r < 2, and r0, Of The Following Points Given In Cartesian Coordinates. (a)(2,23)(b)(42,42)(c)(2,23)(a)

Understanding how to convert Cartesian coordinates to polar coordinates is fundamental in various fields such as mathematics, physics, engineering, and computer graphics. When given points in the Cartesian plane, represented as (x, y), finding their polar coordinates involves determining the radius (r) and the angle (θ) that locate the point relative to the origin. This comprehensive guide aims to clarify the process of converting specific points—(2, 23), (42, 42), and (2, 23)—from Cartesian to polar coordinates, emphasizing the importance of the ranges 0 < r < 2 and r0, and how to interpret these in the context of the points provided.

Understanding Cartesian and Polar Coordinates

Cartesian Coordinates

Cartesian coordinates are expressed as (x, y), where:
- x represents the horizontal distance from the origin
- y represents the vertical distance from the origin

These coordinates are straightforward and familiar, especially in basic algebra and geometry.

Polar Coordinates

Polar coordinates express a point's position using:
- r: the distance from the origin to the point
- θ (theta): the angle between the positive x-axis and the line segment connecting the origin to the point

The conversion from Cartesian to polar coordinates involves the following relationships:
- $r = \sqrt{x^2 + y^2}$
- $\theta = \text{arctangent}(y / x)$ (adjusted based on the quadrant)

The polar coordinate system offers advantages in dealing with rotational symmetry and circular functions, making it essential for fields involving periodic phenomena.

Converting Cartesian Coordinates to Polar Coordinates

Step-by-Step Conversion Process

To convert a point (x, y) to polar coordinates (r, θ), follow these steps:
1. Calculate the radius:
- $r = \sqrt{(x^2 + y^2)}$
2. Calculate the angle:
- θ = arctangent(y / x)
3. Adjust the angle based on the quadrant:
- If $x < 0$ and $y \geq 0$, $\theta = \theta + \pi$
- If $x < 0$ and $y < 0$, $\theta = \theta - \pi$
- If $x > 0$ and $y < 0$, $\theta = \theta + 2\pi$
4. Ensure the radius r is within the specified range, considering the context of $0 < r < 2$ or r0.

Analyzing the Given Points

Let's explore each point and convert it to polar coordinates, considering the ranges and possible interpretations.

Point (2, 23)

- x = 2
- y = 23

Step 1: Calculate r
- $r = \sqrt{(2^2 + 23^2)} = \sqrt{(4 + 529)} = \sqrt{533} \approx 23.086$

Step 2: Calculate θ
- θ = arctangent(23 / 2) ≈ arctangent(11.5) ≈ 85.05°
- In radians: θ ≈ 1.484 radians

Step 3: Adjustments
- Since $x > 0$ and $y > 0$, θ remains approximately 1.484 radians
- The radius is approximately 23.086, which exceeds the specified range $0 < r < 2$, indicating that in the context of the question, either the range is symbolic or the specific value of r is beyond the scope.

Conclusion:
- Polar coordinates are approximately (r ≈ 23.086, θ ≈ 1.484 radians)

Point (42, 42)

- $x = 42$
- $y = 42$

Step 1: Calculate r
- $r = \sqrt{(42^2 + 42^2)} = \sqrt{(1764 + 1764)} = \sqrt{3528} \approx 59.44$

Step 2: Calculate θ
- $\theta = \text{arctangent}(42 / 42) = \text{arctangent}(1) = 45°$
- In radians: $\theta = \pi/4 \approx 0.785$ radians

Step 3: Adjustments
- Since both x and y are positive, θ remains 0.785 radians
- The radius is approximately 59.44, which again is outside the $0 < r < 2$ range, suggesting perhaps the question emphasizes the angles or the concept of r within a specific domain.

Conclusion:
- Polar coordinates are approximately ($r \approx 59.44$, $\theta \approx 0.785$ radians)

Point (2, 23) — Reiteration

- The same as the first point:
- $r \approx 23.086$
- $\theta \approx 1.484$ radians

Interpreting the Range Conditions (0 < r < 2, r0)

The mention of $0 < r < 2$ and r0 appears to be a reference to the domain or specific constraints within a problem, possibly related to a particular section or a typo. Typically:
- If the problem specifies $0 < r < 2$, then points with r greater than 2 are outside the scope unless considering multiple angles or branches.
- For points with large r, their primary polar representation is valid, but sometimes, multiple representations are sought, especially when considering negative angles or other branches.

Practical implication:
- When converting points with large Cartesian coordinates, the primary polar coordinate will generally have a large radius.
- To fit within a specific domain like $0 < r < 2$, one might consider the concept of angle periodicity or shifting to equivalent angles in different quadrants.

Special Considerations and Multiple Representations

Angles and Periodicity

- The angle θ in polar coordinates is periodic with a period of 2π.
- For any point (x, y), the polar coordinate can be expressed as $(r, \theta + 2\pi k)$, where k is an integer.

Negative and Zero Radius Values

- Typically, r is a non-negative value.
- Negative radius values are represented by adjusting the angle by π, effectively pointing in the opposite direction.

Multiple Representations for the Same Point

- For a given point, (r, θ) and $(-r, \theta + \pi)$ are equivalent representations, highlighting the importance of understanding the conventions used.

Application Examples

Graphing Points in Polar Coordinates

- When plotting points like (2, 23) and (42, 42), converting to polar coordinates helps visualize their position relative to the origin, especially in systems like radar, robotics, and navigation.

Using Polar Coordinates in Calculations

- Calculations involving circles and rotational symmetry are simplified when using polar coordinates.
- For example, the equation of a circle with radius r is simply $r = \text{constant}$, which is straightforward to interpret in polar form.

Summary and Final Thoughts

Converting Cartesian coordinates to polar coordinates involves calculating the radius and angle for each point, considering the correct quadrant and periodicity. For the points (2, 23) and (42, 42), the radius values are significantly larger than 2, which indicates that unless the problem context specifically restricts r to less than 2, these points are valid in their primary form. The angles—approximately 1.484 radians for (2, 23) and 0.785 radians for (42, 42)—are essential for understanding the points' positions in polar space.

Understanding these conversions is vital in multiple disciplines, enabling more efficient calculations and better visualization of data. When dealing with constraints like $0 < r < 2$, it may be necessary to interpret multiple representations or consider the problem's domain-specific context.

Conclusion

Converting Cartesian points to polar coordinates is an essential skill that enhances spatial understanding and mathematical flexibility. Whether dealing with large coordinates like (42, 42) or specific ranges like $0 < r < 2$, the core process remains consistent: calculating the radius and angle with attention to the point's quadrant and periodicity. Mastery of this conversion fosters better problem-solving skills, especially in fields that involve circular and rotational phenomena, making it a fundamental concept in mathematical education and practical applications alike.

Keywords for SEO Optimization:
Cartesian to polar coordinates, how to convert Cartesian to polar, polar coordinates of points, conversion formula Cartesian to polar, interpret points in polar coordinates, polar coordinate system, r and θ explanation, convert (x, y) to (r, θ), polar coordinate conversion examples, understanding polar coordinates in mathematics

Frequently Asked Questions

How do you convert the Cartesian coordinate (2, 23) to polar coordinates?

To convert (x, y) to polar coordinates (r, θ), calculate $r = \sqrt{x^2 + y^2}$ and θ = arctangent(y/x). For (2, 23), $r \approx 23.08$ and $\theta \approx 83.41°$.

What are the polar coordinates for the point (42, 42) in the given range 0 < θ < 2π?

For (42, 42), $r = \sqrt{42^2 + 42^2} \approx 59.39$, and θ = arctangent(42/42) = 45°, or π/4 radians, which is within $0 < \theta < 2\pi$.

Why is the point (2, 23) appearing twice in the list, and how does that affect the polar coordinate conversion?

The repetition likely indicates emphasis or a typo. In both cases, the polar coordinates are the same: $r \approx 23.08$ and $\theta \approx 83.41°$. The duplication does not affect the conversion process.

What is the significance of the angle range 0 < θ < 2π in finding polar coordinates?

The range $0 < \theta < 2\pi$ ensures that the angle θ is expressed in the principal value range for polar coordinates, covering all directions counterclockwise from the positive x-axis.

How do you handle points with negative x or y when converting to polar coordinates within 0 < θ < 2π?

For points with negative coordinates, compute $r = \sqrt{x^2 + y^2}$ and determine θ using arctangent(y/x). Adjust θ by adding π if necessary to ensure it falls within $0 < \theta < 2\pi$, accounting for the correct quadrant.

Additional Resources

Find The Polar Coordinates, 0 < r < 2 and r0, Of The Following Points Given In Cartesian Coordinates is a fundamental task in coordinate geometry that often confuses students and professionals alike. Understanding how to convert between Cartesian (x, y) coordinates and their polar counterparts (r, θ) is essential for analyzing points in a circular or radial context, such as in physics, engineering, and computer graphics. This guide aims to demystify the process, provide clear steps, and clarify common pitfalls when working with the given points.

Introduction to Polar Coordinates

Before diving into the specific points, it's important to grasp the basics of polar coordinates. Unlike Cartesian coordinates, which describe points based on their horizontal and vertical positions, polar coordinates describe a point based on its distance from the origin and the angle it makes with the positive x-axis.

What Are Polar Coordinates?

- Radius (r): The distance from the point to the origin (0,0). It is always non-negative.
- Angle (θ): The counterclockwise angle measured from the positive x-axis to the line segment connecting the origin to the point. It is usually measured in radians or degrees.

Conversion Formulas

Given a point in Cartesian coordinates (x, y), the conversion to polar coordinates (r, θ) is:

- $r = \sqrt{x^2 + y^2}$
- $\theta = \text{atan2}(y, x)$

Conversely, given (r, θ):

- $x = r \cos(\theta)$
- $y = r \sin(\theta)$

Understanding the Constraints: $0 < r < 2$ and r0

The problem specifies that the radius (r) should satisfy $0 < r < 2$, and the notation r0 suggests that the points are in a particular region or may involve multiple representations. The key here is to focus on points within the annular region between the origin and a circle of radius 2, excluding the origin itself.

Step-by-Step Guide for Finding Polar Coordinates

Step 1: Identify the Cartesian Coordinates

Given points are:

1. (2, 23)
2. (42, 42)
3. (2, 23) (repeated or possibly an error in the prompt—assumed to be the same point)

(Note: The original prompt may contain typographical issues; assuming the third point is the same as the first.)

Step 2: Calculate the Radius (r)

For each point, compute:

- $r = \sqrt{x^2 + y^2}$

Calculate the value and check if it satisfies $0 < r < 2$:

- If $r \geq 2$, then the point lies outside the specified region.
- If $r \leq 0$, then the point is at the origin, which is excluded as per the inequality.

Step 3: Determine the Angle (θ)

Calculate:

- $\theta = \operatorname{atan2}(y, x)$

Ensure that the angle is expressed in the correct quadrant:

- Use the `atan2` function (available in most programming languages and calculators) for correct quadrant determination.
- Convert θ to degrees if necessary, but typically radians are preferred.

Step 4: Verify the Region Conditions

After calculating r and θ, verify whether r satisfies $0 < r < 2$. Only include points that meet these criteria.

Applying the Process to the Given Points

Let's analyze each point step by step.

Point (2, 23)

Step 1: Coordinates: $x=2$, $y=23$

Step 2: Calculate r:

$r = \sqrt{(2^2 + 23^2)} = \sqrt{(4 + 529)} = \sqrt{533} \approx 23.086$

Step 3: Determine θ:

$\theta = \text{atan2}(23, 2) \approx \text{atan2}(23, 2) \approx 1.48$ radians (about 84.87°)

Step 4: Check if $0 < r < 2$:

- $r \approx 23.086$, which is greater than 2.

Conclusion: The point (2, 23) does not satisfy the condition $0 < r < 2$. It lies far outside the specified region.

Point (42, 42)

Step 1: Coordinates: $x=42$, $y=42$

Step 2: Calculate r:

$r = \sqrt{(42^2 + 42^2)} = \sqrt{(1764 + 1764)} = \sqrt{3528} \approx 59.44$

Step 3: Determine θ:

$\theta = \text{atan2}(42, 42) = \text{atan2}(1) = \pi/4 \approx 0.785$ radians (45°)

Step 4: Check if $0 < r < 2$:

- $r \approx 59.44$, which is much greater than 2.

Conclusion: The point (42, 42) is outside the desired region.

Point (2, 23) — Repetition

Repeating the previous calculation, it remains outside the specified region.

Handling Points Outside the Region

Since both points are outside the $0 < r < 2$ region, it’s important to clarify what this means practically:

- If the goal is to find the polar coordinates of points within the specified annular region, these particular points are not suitable.
- If the problem involves transforming these points regardless of the region, then their polar coordinates are as calculated, but they do not satisfy the given bounds.

Alternative Approach: Points Within the Region

Suppose you are given other points or need to find points that satisfy $0 < r < 2$. Here's how you could proceed:

Step 1: Select points with small x and y values

- For example, (1, 1):

$r = \sqrt{1^2 + 1^2} \approx 1.414$ (which satisfies $0 < r < 2$)

$\theta = \text{atan2}(1, 1) \approx 0.785$ radians (45°)

- Result: Polar coordinates: ($r \approx 1.414$, $\theta \approx 0.785$ radians)

Step 2: Check other points similarly

- (1.5, 0.5): $r \approx 1.58$, $\theta \approx 0.322$ radians
- (0.5, 1.5): $r \approx 1.58$, $\theta \approx 1.249$ radians

All satisfy the condition $0 < r < 2$.

Common Pitfalls and Tips

- Misinterpreting the notation: Ensure clarity whether points are given with commas, parentheses, or other formats.
- Incorrect use of atan2: Always use `atan2(y, x)` rather than `tan⁻¹(y/x)` to correctly determine the quadrant.
- Ignoring the bounds: Remember that the problem specifies $0 < r < 2$; points outside this range are invalid for the specific region.
- Angles in degrees vs radians: Confirm the units required; radians are standard in most mathematical contexts.

Summary and Final Remarks

Converting Cartesian coordinates to polar coordinates is straightforward once the formulas are understood. The key steps involve calculating the radius and angle while respecting the specified bounds. For the given points:

- Both points (2, 23) and (42, 42) have radii much larger than 2.
- Therefore, neither point satisfies the condition 0 < r < 2.
- To find points within that region, choose points with smaller x and y values, and perform the conversion steps.

This process is essential for tasks involving circular motion, wave analysis, and many engineering applications. Mastery of coordinate transformations enhances spatial understanding and problem-solving skills across various scientific disciplines.

Final Note

If the original question intended to include different points or had additional context, please clarify for a more specific analysis. The principles outlined here, however, will guide you in any similar conversion task involving Cartesian and polar coordinates within specified bounds.

Find The Polar Coordinates 0 Lt 2andr0 Of The Following Points Given In Cartesian Coordinates A 2 23 B 42 42 C 2 23 A

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