

Find The Two Ordered Pairs That Are 4.5 Units Apart. Then Write Those Ordered Pairs In The Second Row of

Find The Two Ordered Pairs That Are 4.5 Units Apart. Then Write Those Ordered Pairs In The Second Row of is a prompt that involves understanding the distance between points in a coordinate plane and applying that knowledge to identify specific ordered pairs. This task is common in algebra and coordinate geometry, where students learn to analyze the spatial relationships between points. In this comprehensive guide, we will explore how to find two ordered pairs that are exactly 4.5 units apart, the methods involved, and how to write those pairs in a specific format as instructed.

Understanding Ordered Pairs and Distance in the Coordinate Plane

What Are Ordered Pairs?

Ordered pairs are pairs of numbers written in the form (x, y) , representing a point's position on the Cartesian coordinate plane. The x-coordinate indicates the point's horizontal position, while the y-coordinate indicates its vertical position.

Example:

$(3, 5)$ is an ordered pair where 3 is the x-value and 5 is the y-value.

The Distance Between Two Points

The distance between two points in the plane, say (x_1, y_1) and (x_2, y_2) , is calculated using the distance formula derived from the Pythagorean theorem:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Where:

- d is the distance between the points.
- (x_1, y_1) and (x_2, y_2) are the coordinates of the two points.

How to Find Two Ordered Pairs 4.5 Units Apart

The core task is to find pairs of points such that their distance is exactly 4.5 units. This involves solving the distance formula for specific conditions.

Step-by-Step Approach

1. Set Up the Distance Equation:

Given the distance $(d = 4.5)$, and points (x_1, y_1) and (x_2, y_2) :

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = 4.5$$

2. Square Both Sides to Eliminate the Square Root:

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = (4.5)^2$$

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = 20.25$$

3. Identify Possible Coordinate Pairs:

Since the equation involves two variables, there are infinitely many solutions. To find specific pairs, choose values for one coordinate difference and solve for the other.

Finding Specific Ordered Pairs - Examples

Let's explore some specific instances where the distance between two points is 4.5 units.

Example 1: Horizontal Distance Only

Suppose the points differ only along the x-axis:

$$|x_2 - x_1| = 4.5, \quad y_2 - y_1 = 0$$

- Possible pairs:

- $((x_1, y_1) = (0, 0)), ((x_2, y_2) = (4.5, 0))$
- $((x_1, y_1) = (2, 3)), ((x_2, y_2) = (6.5, 3))$

Note: These pairs satisfy the distance formula:

$$\sqrt{(4.5)^2 + 0^2} = 4.5$$

Example 2: Vertical Distance Only

Suppose the points differ only along the y-axis:

$$|y_2 - y_1| = 4.5, \quad x_2 - x_1 = 0$$

- Possible pairs:

- $((x_1, y_1) = (1, 2)), ((x_2, y_2) = (1, 6.5))$
- $((x_1, y_1) = (-3, -1)), ((x_2, y_2) = (-3, 3.5))$

Example 3: Diagonal Distance

Suppose both x and y coordinates differ:

$$(x_2 - x_1) = a, \quad (y_2 - y_1) = b$$

such that $(a^2 + b^2 = 20.25)$

- For simplicity, pick $(a = 3)$:

$$3^2 + b^2 = 20.25 \rightarrow 9 + b^2 = 20.25 \rightarrow b^2 = 11.25$$

$$b = \pm \sqrt{11.25} \approx \pm 3.354$$

- Pairs:

- $((x_1, y_1) = (0, 0)), ((x_2, y_2) = (3, 3.354))$
- $((x_1, y_1) = (-2, -1)), ((x_2, y_2) = (1, 2.354))$

Systematic Methods to Find Multiple Pairs

Instead of randomly guessing, you can systematically generate pairs:

Method 1: Fix One Coordinate Difference and Solve for the Other

- Choose a value for (Δx) or (Δy) .
- Calculate the remaining difference using:

$$(\Delta y)^2 = 20.25 - (\Delta x)^2$$

- Find the corresponding (Δy) .

Method 2: Use Circle Equations

- The set of points at a distance 4.5 units from a fixed point (x_0, y_0) forms a circle:

$$(x - x_0)^2 + (y - y_0)^2 = 20.25$$

- To find pairs, pick points on this circle.

Writing the Pairs in the Second Row of

The instruction to "write those ordered pairs in the second row of" typically refers to formatting the solution in a tabular or specific layout. Here's a detailed guide on how to do this:

Organizing the Pairs

Suppose you are asked to list the pairs in a table:

Pair Number	Ordered Pair (Second Row)
1	(x_1, y_1)
2	(x_2, y_2)

- You can list the pairs in the second row as:

```
\[
\begin{bmatrix}
x_1 & y_1 \\
x_2 & y_2
\end{bmatrix}
\]
```

or in a simple list format:

- First Pair: (x_1, y_1)
- Second Pair: (x_2, y_2)

Example of Listing Pairs in a Table

Second Row	Ordered Pairs
1	$(0, 0)$ and $(4.5, 0)$
2	$(2, 3)$ and $(6.5, 3)$
3	$(1, 2)$ and $(1, 6.5)$
4	$(-3, -1)$ and $(-3, 3.5)$

The pairs are written in rows, making it clear and organized.

Practical Applications and Additional Tips

Applications of Finding Points at a Specific Distance

- Geometry Problems: Determining points at a certain distance for geometric constructions.
- Navigation and Mapping: Calculating locations that are a fixed distance from known points.
- Computer Graphics: Rendering points at specific distances for visual effects.
- Physics: Positioning objects at a certain separation.

Additional Tips for Students and Teachers

- Use Graph Paper: Plot points to visualize solutions.
- Check Solutions: Always verify that the distance between the pairs matches the target (4.5 units).
- Explore Symmetry: Many solutions are symmetric across axes.
- Use Technology: Graphing calculators or software like Desmos can help visualize and verify solutions.

Conclusion

Finding two ordered pairs that are 4.5 units apart involves understanding the distance formula and applying algebraic reasoning. By selecting specific differences in coordinates and solving the resulting equations, you can generate numerous pairs that satisfy the distance criterion. Once identified, these pairs can be organized and presented in a structured format

Frequently Asked Questions

What is the first step to find two ordered pairs that are 4.5 units apart?

The first step is to understand the distance formula between two points: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, and set it equal to 4.5.

How do I set up the equation to find the ordered pairs 4.5 units apart?

You set up the equation $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = 4.5$, then square both sides to get $(x_2 - x_1)^2 + (y_2 - y_1)^2 = 20.25$.

Can you give an example of two ordered pairs that are 4.5 units apart?

Yes, for example, (0, 0) and (3, 3) are approximately 4.24 units apart, so to get exactly 4.5 units, you might use (0, 0) and (4, 1.5).

How do I find the second ordered pair once I have one point?

Choose a point as the first pair, then solve the distance equation for the second point's coordinates, which can involve choosing a value for one coordinate and solving for the

other.

What should I write in the second row after finding the pairs?

You should write the two ordered pairs separated by a comma, each in parentheses, for example: $(x_1, y_1), (x_2, y_2)$.

Are there multiple solutions for pairs 4.5 units apart?

Yes, there are infinitely many solutions since multiple points can be 4.5 units away from a given point, forming a circle with radius 4.5 centered at the initial point.

Additional Resources

Find The Two Ordered Pairs That Are 4.5 Units Apart. Then Write Those Ordered Pairs In The Second Row Of — this prompt invites students and math enthusiasts to explore the fascinating world of coordinate geometry, focusing on the concept of distance between points and how to identify specific pairs based on a given distance. Understanding how to find two ordered pairs that are a specific distance apart is a fundamental skill that builds a solid foundation for more complex geometric and algebraic problems. In this guide, we'll delve into the process step-by-step, explore the mathematical principles involved, and provide practical strategies to solve such problems efficiently.

Understanding the Problem

Before diving into calculations, it's crucial to clarify what the problem entails:

- Find two ordered pairs: You are tasked with identifying two points in the coordinate plane, each represented as an ordered pair, such as (x, y) .
- That are 4.5 units apart: The distance between these two points must be exactly 4.5 units.
- Then write those ordered pairs in the second row: After determining the pair, you need to record them in a specific format or location, possibly within a table or worksheet.

This type of problem commonly appears in algebra and coordinate geometry, often as part of exercises focused on the distance formula, point plotting, or geometric reasoning.

The Mathematical Foundation: Distance Formula

The core concept here is the distance between two points in a plane, which is derived from the Pythagorean theorem. The distance d between points (x_1, y_1) and (x_2, y_2) is given by:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Given the distance $(d = 4.5)$, our goal is to find all pairs $((x_1, y_1))$ and $((x_2, y_2))$ satisfying:

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = 4.5$$

Squaring both sides simplifies the problem:

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = (4.5)^2 = 20.25$$

Step-by-Step Approach to Find the Pairs

1. Choose a Reference Point

To simplify calculations, you can select a specific point as a starting point, say $((x_1, y_1) = (0, 0))$. This is a common technique because the relative distances are what matter, not the absolute position.

2. Express Possible Second Points

Given $((x_1, y_1) = (0, 0))$, the second point $((x_2, y_2))$ must satisfy:

$$(x_2 - 0)^2 + (y_2 - 0)^2 = 20.25$$

which simplifies to:

$$x_2^2 + y_2^2 = 20.25$$

This is the equation of a circle centered at the origin with radius 4.5.

3. Find Solutions on the Circle

Any point $((x, y))$ on this circle is a potential candidate for the second ordered pair relative to the first. To find specific points, choose a value for (x) (or (y)) and solve for the other:

- For example, if $(x = 0)$:

$$0^2 + y^2 = 20.25 \rightarrow y^2 = 20.25 \rightarrow y = \pm \sqrt{20.25} \approx$$

$$\pm 4.5$$

\]

So, two points are:

\[

$$(0, 4.5) \quad \text{and} \quad (0, -4.5)$$

\]

- Similarly, if $(y = 0)$:

\[

$$x^2 + 0 = 20.25 \Rightarrow x = \pm 4.5$$

\]

Points:

\[

$$(4.5, 0) \quad \text{and} \quad (-4.5, 0)$$

\]

4. General Solution for Any Point

The general solution involves all points on the circle $(x^2 + y^2 = 20.25)$. By choosing various (x) values, you can find corresponding (y) values:

\[

$$y = \pm \sqrt{20.25 - x^2}$$

\]

This creates an infinite set of pairs, but for practical purposes, specific solutions are often sufficient.

Visualizing and Verifying the Pairs

Plotting these points can help verify their distances visually. On graph paper or a digital graphing tool:

- Plot the circle $(x^2 + y^2 = 20.25)$.
- Mark the points calculated.
- Use the distance formula to confirm the distance between pairs.

For example, the distance between $(0, 0)$ and $(4.5, 0)$:

\[

$$\sqrt{(4.5 - 0)^2 + (0 - 0)^2} = \sqrt{20.25 + 0} = 4.5$$

\]

Similarly, check between $(0, 0)$ and $(0, 4.5)$.

Creating Multiple Pairs

To find multiple pairs, vary your x value and compute the corresponding y . Here are some examples:

x	y	Notes
0	± 4.5	Points: (0, 4.5), (0, -4.5)
4.5	0	Points: (4.5, 0), (-4.5, 0)
3	$\pm \sqrt{20.25 - 9}$	Approximate y : ± 3.75
2	$\pm \sqrt{20.25 - 4}$	Approximate y : ± 4.2

Practical Applications and Extensions

Real-World Contexts

- Navigation and GPS: Calculating the positions of two points exactly 4.5 units apart.
- Design and Engineering: Ensuring components are placed at precise distances.
- Game Development: Plotting characters or objects at specific distances on a grid.

Advanced Exploration

- Varying the distance: Find pairs that are 3, 5, or any other unit apart.
- Multiple points at a fixed distance: Explore the circle's properties.
- Coordinate transformations: Shift or rotate points to understand their relative positions.

Final Step: Writing the Pairs in the Second Row

Once you have identified the pairs, the next step is to record them as instructed:

- Write two ordered pairs in the second row of your table or worksheet.
- Ensure they are formatted correctly, e.g., (x_1, y_1) and (x_2, y_2) .

For example, if your pairs are:

- (0, 4.5)
- (4.5, 0)

Then, in the second row, you might record:

(0, 4.5)	(4.5, 0)		
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Summary and Key Takeaways

- The problem involves using the distance formula to find pairs of points exactly 4.5 units apart.
- Simplify the problem by fixing one point and solving for the second on a circle of radius 4.5.
- Use the equation $(x^2 + y^2 = 20.25)$ to find all possible points.
- Pick specific (x) values to generate concrete solutions.
- Verify distances visually or computationally.
- Record the identified pairs as per the instructions.

By mastering these steps, you develop a strong understanding of how distance relates to coordinate pairs, which is essential for many areas of mathematics and its applications. Whether you're preparing for a test, working on a project, or simply exploring geometric concepts, this approach provides a clear, systematic way to solve such problems.

Happy solving!

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