

Area of polygons word problem solving Study Guide

Area of Polygons Word Problem Solving

Understanding how to solve word problems involving the area of polygons is a fundamental skill in geometry that combines both mathematical reasoning and real-world application. Word problems challenge students to interpret written descriptions, visualize geometric figures, and apply formulas accurately. Success in this area not only enhances geometric comprehension but also fosters critical thinking and problem-solving skills vital for academic and everyday contexts. This article provides an in-depth exploration of strategies, step-by-step approaches, and common pitfalls related to solving polygon area word problems.

Understanding the Basics of Polygon Area

What Is a Polygon?

A polygon is a two-dimensional geometric figure with:

- Sides that are straight line segments
- Angles where sides meet
- At least three sides (triangles being the simplest polygon)

Polygons can be regular (all sides and angles equal) or irregular.

Common Types of Polygons in Word Problems

- Triangles
- Squares
- Rectangles
- Parallelograms
- Rhombuses
- Trapezoids
- Irregular polygons

Basic Area Formulas for Common Polygons

- Square: $\text{Area} = s^2$ (where s is the side length)
- Rectangle: $\text{Area} = l \times w$ (length $\times$ width)
- Triangle: $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$
- Parallelogram: $\text{Area} = \text{base} \times \text{height}$
- Trapezoid: $\text{Area} = \frac{1}{2} \times (b_1 + b_2) \times h$ (sum of bases times height, divided by 2)

Knowing these formulas is crucial before tackling word problems.

Approach to Solving Polygon Area Word Problems

Step 1: Carefully Read and Understand the Problem

- Identify what shape is involved.
- Note all given measurements (lengths, bases, heights, angles).
- Determine what is being asked (area, missing side length, etc.).

Step 2: Visualize and Draw the Figure

- Sketch the polygon based on the description.
- Label all known sides, angles, and other measurements.
- Use assumptions if some parts are not explicitly given, but only if justified.

Step 3: Identify the Appropriate Formula or Method

- Match the shape to a known formula.
- For irregular polygons, consider dividing the shape into simpler figures like triangles or rectangles.
- For composite figures, find the areas of individual parts and sum or subtract as needed.

Step 4: Substitute Known Values and Calculate

- Plug in the measurements into the formula.
- Perform calculations carefully, paying attention to units.

Step 5: Check Your Work

- Verify that all measurements are correctly used.
- Confirm that the calculated area makes sense in context.
- Revisit the problem to ensure all parts are addressed.

Strategies for Dealing with Complex Polygon Word Problems

Dividing the Polygon into Simpler Shapes

- Break down irregular polygons into triangles, rectangles, or trapezoids.
- Calculate the area of each shape separately.
- Sum or subtract areas to find the total.

Using Coordinate Geometry

- Assign coordinates to vertices.
- Use the Shoelace Theorem or coordinate geometry formulas to find the area.
- This method is especially useful for irregular polygons.

Applying Algebra to Find Unknowns

- Set up equations based on the area formulas.
- Use algebraic manipulation to solve for unknown lengths or heights.

Common Challenges and How to Overcome Them

Misinterpreting the Problem

- Read the problem multiple times.
- Highlight key measurements and what is asked.
- Confirm understanding before drawing or calculating.

Incorrectly Applying Formulas

- Ensure the shape matches the formula used.
- Check units and conversions.
- Remember to use the correct dimensions (base, height, sides).

Ignoring Irregular or Composite Shapes

- Don't attempt to use a simple formula if the shape is irregular.
- Divide into manageable parts.
- Use appropriate methods like coordinate geometry if needed.

Sample Word Problem and Step-by-Step Solution

Problem:

A rectangular garden measures 20 meters in length and 15 meters in width. A triangular flower bed is located at one corner of the garden, with a base of 5 meters and a height of 4 meters. Find the total area of the garden excluding the flower bed.

Solution Steps:

- Identify the total area of the garden:
- Area of rectangle = length $\times$ width = 20 m $\times$ 15 m = 300 m².
- Calculate the area of the triangular flower bed:
- Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 5 \times 4 = 10$ m².
- Subtract the flower bed area from the total garden area:
- Total area = 300 m² - 10 m² = 290 m².
- Answer: The total garden area excluding the flower bed is 290 square meters.

Real-World Applications of Polygon Area Problem Solving

Landscaping and Gardening

- Calculating the area for planting or fencing.
- Dividing land into sections for different crops or features.

Architecture and Construction

- Estimating material requirements based on surface areas.
- Planning layouts for buildings and outdoor spaces.

Art and Design

- Designing patterns involving polygons.
- Calculating surface areas for murals or mosaics.

Practice Tips for Mastery

- Regularly practice a variety of problems involving different polygons.
- Use visual aids and sketches to better understand the problem.
- Check calculations with estimation techniques.
- Incorporate coordinate geometry for irregular shapes.
- Engage with real-world scenarios to contextualize learning.

Conclusion

Mastering the art of solving polygon area word problems requires a clear understanding of geometric principles, careful reading, visualization, and systematic problem-solving strategies. By breaking down complex shapes into simpler figures, applying appropriate formulas, and verifying calculations, students can confidently tackle various real-world and academic problems involving polygons. Developing these skills not only improves mathematical competence but also enhances spatial reasoning and analytical thinking, valuable across numerous fields and everyday situations.

Area of polygons word problem solving is a fundamental skill in geometry that combines understanding of polygon properties with practical application through word problems. Mastering this area not only enhances mathematical reasoning but also prepares students to tackle real-world problems involving spatial awareness and measurement. In this article, we will explore various strategies, key concepts, common challenges, and tips to excel in solving area-related word problems involving polygons.

Understanding the Basics of Polygon Area

Before diving into complex word problems, it is essential to establish a clear understanding of what polygons are and how their areas are calculated.

What Is a Polygon?

A polygon is a two-dimensional shape with straight sides that are closed in a plane. Common polygons include triangles, quadrilaterals, pentagons, hexagons, and so forth. Each polygon is characterized by its number of sides, angles, and specific properties.

Importance of Area in Polygons

The area of a polygon measures the amount of space enclosed within its sides. Calculating this area is fundamental in fields such as architecture, engineering, and design, where spatial measurements are crucial.

Basic Area Formulas

- Triangle: $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$
- Rectangle: $\text{Area} = \text{length} \times \text{width}$
- Square: $\text{Area} = \text{side}^2$
- Parallelogram: $\text{Area} = \text{base} \times \text{height}$
- Regular polygons: Area formulas often involve apothem and perimeter or side length, e.g., for a regular hexagon: $\text{Area} = \frac{3\sqrt{3}}{2} \times \text{side}^2$

Note: For irregular polygons, methods such as dividing into known shapes, coordinate geometry, or the shoelace formula are used.

Strategies for Solving Word Problems Involving Polygon Areas

Approaching word problems systematically is key to accurate and efficient solutions.

Step 1: Read the Problem Carefully

- Identify what is being asked.
- Note all given measurements and data.
- Visualize or sketch the polygon if not provided.

Step 2: Break Down the Problem

- Determine if the polygon can be divided into simpler shapes (triangles, rectangles, etc.).
- Recognize if special formulas apply (e.g., regular polygons, composite figures).

Step 3: Identify Known and Unknown Variables

- Assign variables to unknowns.
- List given measurements and determine what calculations are needed.

Step 4: Select Appropriate Formulas and Methods

- Use basic area formulas for known shapes.
- For irregular polygons, consider coordinate geometry or decomposition methods.

Step 5: Carry Out Calculations Carefully

- Maintain units consistency.
- Check calculations at each step.

Step 6: Verify and Interpret the Result

- Ensure the answer makes sense in context.
- Cross-verify with alternative methods if possible.

Common Types of Polygon Word Problems and How to Solve Them

Different types of problems require tailored approaches. Below are some common scenarios.

1. Calculating the Area of a Polygon with Given Dimensions

Example: Find the area of a regular hexagon with side length 10 units.

Solution Approach:

- Use the formula for a regular hexagon:

$$\text{Area} = \frac{3\sqrt{3}}{2} \times \text{side}^2$$

- Substitute:

$$\text{Area} = \frac{3 \sqrt{3}}{2} \times 10^2 = \frac{3 \sqrt{3}}{2} \times 100$$

- Simplify:

$$\text{Area} = 150 \sqrt{3} \approx 150 \times 1.732 = 259.8 \text{ units}^2$$

Key Point: Recognize the polygon is regular and use the specific formula.

2. Dividing Complex Figures into Simpler Shapes

Example: Find the area of an irregular polygon by dividing it into triangles and rectangles.

Solution Approach:

- Sketch the figure.
- Draw lines to partition the polygon into known shapes.
- Calculate each shape's area individually.
- Sum the areas for the total.

Tips:

- Use coordinate geometry if vertices are known.
- Be attentive to the orientation and ensure all parts are included.

3. Using Coordinate Geometry for Irregular Polygons

Example: Find the area of a polygon with vertices at given coordinates.

Approach:

- List all vertices in order.
- Apply the shoelace formula:

$$\text{Area} = \frac{1}{2} \left| x_1 y_2 + x_2 y_3 + \dots + x_{n-1} y_n + x_n y_1 - (y_1 x_2 + y_2 x_3 + \dots + y_{n-1} x_n + y_n x_1) \right|$$

Advantages:

- Effective for any polygon with known coordinates.
- Eliminates guesswork in irregular shapes.

Features and Challenges in Area Polygon Word Problem Solving

Understanding the features and potential pitfalls can help learners improve their problem-solving skills.

Features

- Versatility: Applicable to regular and irregular polygons.
- Multiple methods: Decomposition, formulas, coordinate geometry.
- Real-world relevance: Useful in architecture, land measurement, and design.

Common Challenges

- Visualizing complex shapes.
- Correctly dividing polygons without overlaps or omissions.
- Applying formulas accurately.
- Managing units and conversions.
- Handling missing or indirect measurements.

Tips to Overcome Challenges:

- Practice sketching and labeling diagrams.
- Learn to decompose shapes into known figures.
- Familiarize with coordinate geometry techniques.
- Double-check calculations and units.

Pros and Cons of Different Approaches

Approach	Pros	Cons
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Direct formula application	Quick for regular polygons	Not applicable to irregular shapes

| Decomposition into simpler shapes | Flexible, applicable to irregular polygons | Can be time-consuming and prone to errors |

| Coordinate geometry | Precise for complex and irregular polygons | Requires knowledge of algebra and coordinates |

Tips for Effective Practice

- Practice a variety of problems with different polygons.
- Draw clear diagrams with labeled measurements.
- Memorize key formulas for regular polygons.
- Learn to decompose complex figures systematically.
- Use technology (graphing tools, geometry software) for visualization.
- Review mistakes to understand common errors.

Conclusion

Solving area of polygons word problems is a crucial aspect of geometry that enhances spatial reasoning and problem-solving skills. A structured approach?understanding basic properties, selecting suitable methods, and practicing diverse problems?can significantly improve proficiency. Whether dealing with simple rectangles or complex irregular polygons, mastery in this area empowers learners to approach real-world spatial challenges confidently. Remember, the key lies in visualization, decomposition, and precise calculations, supported by a solid grasp of the foundational formulas and concepts.

By continuously practicing and applying these strategies, students can develop a deeper understanding of polygon areas and become adept at solving a wide range of word problems efficiently and accurately.

Question How do you find the area of a regular hexagon using its side length? To find the area of a regular hexagon, use the formula: $(3\sqrt{3} / 2) \times \text{side length squared}$. Simply plug in the length of one side into the formula to calculate the area. **What is the process for solving a word problem involving the area of a triangle?** Identify the base and height from the problem, then apply the formula: $(1/2) \times \text{base} \times \text{height}$. Substitute the given measurements to find the area. **How can I find the area of a polygon when only given the lengths of its sides and interior angles?** Use the polygon decomposition method by dividing the polygon into triangles, then find the area of each triangle using relevant formulas (like Heron's formula) and add them up for the total area. **What steps should I follow to solve a word problem involving irregular polygons?** Break down the irregular polygon into regular shapes like triangles or rectangles, find each shape's area, then sum these areas to get the total polygon area. **How do I determine the area of a composite figure made of**

different polygons? Calculate the area of each individual polygon separately using appropriate formulas, then add all the areas together for the total. What is the key to solving area word problems involving polygons in real-world contexts? Identify the shape components, gather accurate measurements, choose the correct formulas, and carefully organize your calculations to find the total area. How can I use coordinate geometry to find the area of a polygon in a word problem? Plot the vertices of the polygon on a coordinate plane, then apply the shoelace formula (polygon area formula) to calculate its area based on the coordinates.

Related keywords: polygon area, perimeter, shape calculation, geometric formulas, triangulation, coordinate plane, irregular polygons, formula application, problem-solving strategies, math word problems

word problems area of rectangle square parallelogram

Word problems area of rectangle square parallelogram

Understanding the area of various geometric shapes is fundamental in mathematics, especially when solving real-world problems. Among these shapes, rectangles, squares, and parallelograms are common, and their area calculations form the basis for many word problems encountered in academic and practical settings. Mastering how to approach, interpret, and solve word problems involving these shapes' areas enhances problem-solving skills and mathematical reasoning. This comprehensive guide aims to explore the area concepts for rectangles, squares, and parallelograms through detailed explanations, strategies for solving word problems, and practical examples.

Understanding Basic Concepts of Area

What is Area?

Area refers to the amount of surface covered by a two-dimensional shape. It is measured in square units such as square centimeters (cm^2), square meters (m^2), or square inches (in^2). Calculating the area allows us to determine how much space a shape occupies.

Importance of Area in Real Life

Understanding area calculations helps in various fields such as:

- Architecture and construction (flooring, wall painting)

- Agriculture (farming land measurement)
- Interior design (carpet or tile coverage)
- Art and design (canvas or paper sizes)

Area of Basic Shapes: Rectangles, Squares, and Parallelograms

Rectangle

- Formula: $\text{Area} = \text{length} \times \text{width}$
- Properties: Opposite sides are equal, and angles are right angles.
- Notation: If length = L and width = W , then $\text{Area} = L \times W$.

Square

- Formula: $\text{Area} = \text{side} \times \text{side} = \text{side}^2$
- Properties: All sides are equal, and angles are right angles.
- Note: The square is a special case of a rectangle.

Parallelogram

- Formula: $\text{Area} = \text{base} \times \text{height}$
- Properties: Opposite sides are equal and parallel; angles are not necessarily right angles.
- Note: The height is the perpendicular distance between the bases.

Approach to Solving Word Problems on Area

Solving word problems involving areas requires a systematic approach:

- Read the problem carefully to understand what is given and what is asked.
- Identify the shape involved and recall the relevant formula.
- Extract numerical data and assign variables if needed.
- Determine the missing dimensions (length, width, height, base, etc.).
- Apply the area formula correctly.
- Perform calculations step-by-step.
- Check your answer in the context of the problem.

Strategies for Solving Word Problems

Step-by-Step Problem-Solving Techniques

- Visualize the problem: Draw diagrams or sketches to understand the shape and dimensions.
- Label all given data: Mark known measurements and unknowns clearly.
- Translate words into mathematical expressions: Convert phrases into equations using the formulas.
- Use units consistently: Convert all measurements to the same unit before calculations.
- Estimate before exact calculation: For complex problems, rough estimates can guide your approach.
- Verify the answer: Ensure the solution makes sense logically and contextually.

Common Pitfalls to Avoid

- Confusing perimeter with area.
- Using incorrect formulas for the shape.
- Forgetting to convert units.
- Misreading the problem's data.
- Ignoring the need for perpendicular height in parallelogram problems.

Sample Word Problems and Solutions

Problem 1: Area of a Rectangle

Question: A rectangle has a length of 12 meters and a width of 5 meters. Find its area.

Solution:

- Step 1: Identify given data: Length = 12 m, Width = 5 m.
- Step 2: Recall formula: Area = length $\times$ width.
- Step 3: Calculate: Area = $12 \times 5 = 60 \text{ m}^2$.
- Answer: The rectangle's area is 60 square meters.

Problem 2: Area of a Square

Question: A square garden has a side length of 8 meters. What is the area?

Solution:

- Step 1: Given: Side = 8 m.
- Step 2: Formula: Area = side².
- Step 3: Calculation: $8^2 = 64 \text{ m}^2$.
- Answer: The garden covers 64 square meters.

Problem 3: Area of a Parallelogram

Question: A parallelogram has a base of 15 meters and a height of 6 meters. Find its area.

Solution:

- Step 1: Given: Base = 15 m, Height = 6 m.
- Step 2: Formula: Area = base $\times$ height.
- Step 3: Calculation: $15 \times 6 = 90 \text{ m}^2$.
- Answer: The parallelogram's area is 90 square meters.

Problem 4: Word Problem Combining Shapes

Question: A rectangular park measures 200 meters in length and 150 meters in width. A square playground of side length 30 meters is within the park. Find the area of the remaining part of the park after excluding the playground.

Solution:

- Step 1: Calculate park area: $200 \times 150 = 30,000 \text{ m}^2$.
- Step 2: Calculate playground area: $30^2 = 900 \text{ m}^2$.
- Step 3: Subtract playground area from park area: $30,000 - 900 = 29,100 \text{ m}^2$.
- Answer: The remaining area of the park is 29,100 square meters.

Advanced Word Problems and Applications

Problem 5: Multiple Shapes in a Real-World Context

A farmer has a rectangular field measuring 500 meters by 300 meters. Within it, there is a parallelogram-shaped pond with a base of 100 meters and a height of 40 meters. Find the area of the field that is not occupied by the pond.

Solution:

- Step 1: Calculate total field area: $500 \times 300 = 150,000 \text{ m}^2$.
- Step 2: Calculate pond area: $100 \times 40 = 4,000 \text{ m}^2$.
- Step 3: Subtract pond area from total field: $150,000 - 4,000 = 146,000 \text{ m}^2$.
- Answer: The area of the field excluding the pond is 146,000 square meters.

Problem 6: Applying Area in Construction

A construction company needs to lay tiles on a square kitchen floor of side length 9 meters. If each tile covers 0.25 m^2 , how many tiles are needed to cover the entire floor?

Solution:

- Step 1: Calculate floor area: $9^2 = 81 \text{ m}^2$.
- Step 2: Determine number of tiles: $81 \div 0.25 = 324$ tiles.
- Answer: 324 tiles are required to cover the floor.

Additional Tips for Mastering Word Problems on Area

- Practice regularly: The more problems you solve, the better you understand different scenarios.
- Use diagrams: Visual representation helps in understanding complex problems.
- Understand the context: Real-world problems often contain clues that guide your calculations.
- Check units and conversions: Mistakes often occur due to incorrect units.
- Review formulas: Be sure about the formulas for different shapes and their conditions.

Conclusion

Mastering the area of rectangles, squares, and parallelograms through word problems enhances your mathematical skills and prepares you for tackling real-life situations involving space and measurements. Remember to approach each problem methodically, visualize the shapes involved, and apply the correct formulas. With consistent practice and attention to detail, solving word problems related to the area of these shapes becomes intuitive and rewarding. By understanding these fundamental concepts, you develop a strong foundation for more advanced geometry and problem-solving tasks.

Word Problems in Area of Rectangle, Square, and Parallelogram: A Comprehensive Guide

Understanding how to solve word problems related to the area of rectangles, squares, and parallelograms is a fundamental skill in geometry that combines conceptual understanding with practical problem-solving. These problems are often encountered in academic assessments and

real-life scenarios, making mastery in this area essential for students and enthusiasts alike. This comprehensive guide delves into the various aspects of word problems involving the areas of these quadrilaterals, offering detailed explanations, strategies, and examples to enhance your problem-solving toolkit.

Introduction to Area in Quadrilaterals

Before diving into specific word problems, it's crucial to understand what area signifies in the context of rectangles, squares, and parallelograms.

What is Area?

- Definition: Area refers to the amount of surface covered by a two-dimensional shape. It is measured in square units (e.g., square meters, square centimeters).
- Significance: Knowing the area helps in tasks such as flooring, painting, land measurement, and design.

General Formulas

- Rectangle: $\text{Area} = \text{length} \times \text{breadth}$
- Square: $\text{Area} = \text{side}^2$
- Parallelogram: $\text{Area} = \text{base} \times \text{height}$

Note: For parallelograms, the height is perpendicular to the base, which is a key aspect in solving problems.

Understanding Word Problems: Key Concepts and Strategies

Word problems require translating real-world language into mathematical expressions. Here's a structured approach:

Step-by-Step Problem-Solving Strategy

- Read Carefully: Understand what is being asked. Identify the given data and what you need to find.
- Identify the Shape: Recognize whether the problem involves a rectangle, square, or parallelogram.
- Highlight Known Values: Mark the given dimensions, areas, or other relevant information.

- Determine Unknowns: Decide which dimensions or measurements need to be calculated.
- Choose the Correct Formula: Select the appropriate area formula based on the shape.
- Set Up Equations: Translate the problem into mathematical equations.
- Solve the Equations: Perform calculations step-by-step.
- Check Units and Reasonableness: Make sure the units are consistent and the answer makes sense in context.
- Answer in Context: Write the final answer with appropriate units and interpret it if necessary.

Word Problems Involving Rectangles

Rectangles are the most straightforward among these shapes, and their word problems often involve calculating area based on given dimensions or vice versa.

Common Types of Rectangular Area Problems

- Finding the area given length and breadth
- Finding missing dimensions when the area and one dimension are known
- Determining the length or breadth when the area and other dimension are known

Sample Problems and Solutions

Problem 1: A rectangle has a length of 12 meters and a breadth of 5 meters. Find its area.

Solution:

- Use the formula: $\text{Area} = \text{length} \times \text{breadth}$
- $\text{Area} = 12 \times 5 = 60$ square meters

Problem 2: The area of a rectangle is 84 square meters, and its length is 12 meters. Find its breadth.

Solution:

- Rearrange the formula: $\text{breadth} = \frac{\text{Area}}{\text{length}}$
- $\text{breadth} = \frac{84}{12} = 7$ meters

Real-Life Application

- Calculating the area of a garden with given dimensions.
- Determining the amount of material needed for a rectangular tablecloth.

Word Problems Involving Squares

Squares are special rectangles with all sides equal. Their word problems often involve the side length or the area, with the relationship $(\text{Area} = \text{side}^2)$.

Common Types of Square Area Problems

- Finding area when side length is known
- Finding side length when area is given
- Application in tiling, fencing, and design

Sample Problems and Solutions

Problem 3: The side of a square playground is 20 meters. Find its area.

Solution:

- Use $(\text{Area} = \text{side}^2)$
- $(\text{Area} = 20^2 = 400)$ square meters

Problem 4: A square piece of land has an area of 256 square meters. Find the length of one side.

Solution:

- $(\text{side} = \sqrt{\text{area}})$
- $(\text{side} = \sqrt{256} = 16)$ meters

Practical Applications

- Calculating the amount of paint needed to cover a square wall.
- Determining the size of tiles required for a square floor.

Word Problems Involving Parallelograms

Parallelograms have a more complex area formula involving base and height. Their word problems often include scenarios where height is not directly given, requiring the use of auxiliary data or geometric reasoning.

Common Types of Parallelogram Area Problems

- Calculating area when base and height are known
- Finding missing height or base when the area and other dimensions are given
- Using diagonal and side lengths to find area

Key Concepts for Parallelogram Problems

- The height is perpendicular to the base, not necessarily the side length.
- Sometimes, the problem involves the use of other properties, such as diagonals or angles.

Sample Problems and Solutions

Problem 5: A parallelogram has a base of 15 meters and a height of 8 meters. Find its area.

Solution:

- $\text{Area} = \text{base} \times \text{height}$
- $\text{Area} = 15 \times 8 = 120$ square meters

Problem 6: The area of a parallelogram is 180 square meters, and the base length is 12 meters. Find the height.

Solution:

- $\text{height} = \frac{\text{Area}}{\text{base}}$
- $\text{height} = \frac{180}{12} = 15$ meters

Problem 7: In a parallelogram, if the side length is 10 meters and the height is 6 meters, what is the area? (Assume the side length is the base.)

Solution:

- $(\text{Area} = \text{base} \times \text{height} = 10 \times 6 = 60)$ square meters

Complex Application Problems

- Using diagonals to find the area when height is unknown.
- Estimating land area from irregular measurements involving parallelogram-shaped plots.

Advanced Word Problems and Real-World Applications

Real-life scenarios often involve combining multiple shapes and dimensions, requiring critical thinking and multi-step calculations.

Examples of Complex Word Problems

Example 1: A rectangular garden measures 50 meters in length and 30 meters in width. A path of uniform width surrounds the garden, increasing its total area to 2,500 square meters. Find the width of the path.

Solution Approach:

- Let (w) be the width of the path.
- Total dimensions including the path: $(50 + 2w)$ and $(30 + 2w)$.
- Set up the equation: $(50 + 2w)(30 + 2w) = 2500$.
- Expand and solve the quadratic:

[

$$(50 + 2w)(30 + 2w) = 2500$$

]

[

$$1500 + 100w + 60w + 4w^2 = 2500$$

]

[

$$4w^2 + 160w + 1500 = 2500$$

\]

\[

$$4w^2 + 160w - 1000 = 0$$

\]

- Divide through by 4:

\[

$$w^2 + 40w - 250 = 0$$

\]

- Use quadratic formula:

\[

$$w = \frac{-40 \pm \sqrt{40^2 - 4 \times 1 \times (-250)}}{2}$$

\]

\[

$$w = \frac{-40 \pm \sqrt{1600 + 1000}}{2} = \frac{-40 \pm \sqrt{2600}}{2}$$

\]

- Approximate:

\[

$$\sqrt{2600} \approx 50.99$$

\]

- Possible solutions:

\[

$$w = \frac{-40 + 50.99}{2} \approx \frac{10.99}{2} \approx 5.495$$

\]

\[

$$w = \frac{-40 - 50.99}{2} \approx \frac{-90.99}{2}$$

Question How do you find the area of a rectangle with length 8 meters and width 5 meters? Multiply the length by the width: $8 \times 5 = 40$ square meters. A square has a perimeter of 36 meters. What is its area? First, find the side length: $36 \div 4 = 9$ meters. Then, area = $9 \times 9 = 81$ square meters. If the base of a parallelogram is 10 cm and the height is 7 cm, what is its area? Area = base $\times$ height = $10 \times 7 = 70$ square centimeters. A rectangle's length is twice its width. If the area is 48 square meters, what are the dimensions? Let width = w , then length = $2w$. Area = $w \times 2w = 2w^2 = 48$. So, $w^2 = 24$, $w \approx 4.9$ meters. Length ≈ 9.8 meters. How do you determine the area of a parallelogram given the diagonals and the angle between them? Use the formula: Area = $\frac{1}{2} \times d_1 \times d_2 \times \sin(\text{angle between diagonals})$. What is the area of a square with a diagonal length of $10\sqrt{2}$ cm? Diagonal = $s\sqrt{2}$, so $s = \text{diagonal} / \sqrt{2} = 10\sqrt{2} / \sqrt{2} = 10$ cm. Area = $s^2 = 10 \times 10 = 100$ square centimeters. A rectangle has a length of 15 meters and an area of 150 square meters. What is its width? Width = area $\div$ length = $150 \div 15 = 10$ meters. How do you find the area of a rhombus if you know the lengths of its diagonals? Area = $\frac{1}{2} \times d_1 \times d_2$, where d_1 and d_2 are the diagonals. In a parallelogram, if the base is 12 cm and the height is 9 cm, what is its area? Area = base $\times$ height = $12 \times 9 = 108$ square centimeters.

Related keywords: area calculation, perimeter, geometry, shape problems, algebra, rectangles, squares, parallelograms, formulas, math exercises

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