

The Perimeter Of A Rectangular Swimming Pool Is 154 M. Its Length Is 2 M More Than Twice Its Breadth.

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Introduction

Understanding the dimensions of a swimming pool is essential for various reasons, including construction, maintenance, and ensuring it fits well within a designated space. In this article, we explore a mathematical problem involving a rectangular swimming pool with a given perimeter and a relationship between its length and breadth. Such problems not only sharpen our algebraic skills but also have practical applications in real-world scenarios like designing swimming pools and other rectangular structures.

The problem states: The perimeter of a rectangular swimming pool is 154 meters. Its length is 2 meters more than twice its breadth. Using this information, we aim to determine the exact dimensions of the pool—specifically its length and breadth. To do so, we will delve into the algebraic methods of solving linear equations and apply them step-by-step to arrive at the solution.

Understanding the Problem

Before jumping into calculations, it is crucial to understand what the problem is asking and the relevant information provided:

- Perimeter of the pool: 154 meters
- Relationship between length and breadth: Length is 2 meters more than twice the breadth

This information implies that there are two key variables:

- L: Length of the pool
- B: Breadth of the pool

Our goal is to find the numerical values of L and B that satisfy the given conditions.

Mathematical Formulation of the Problem

Step 1: Express the relationship between length and breadth

Given that:

> The length (L) is 2 meters more than twice its breadth (B).

Mathematically, this can be expressed as:

$$\begin{aligned} & \backslash[\\ & L = 2B + 2 \\ & \backslash] \end{aligned}$$

Step 2: Write the perimeter formula for a rectangle

The perimeter (P) of a rectangle is given by:

$$\begin{aligned} & \backslash[\\ & P = 2 \times (L + B) \\ & \backslash] \end{aligned}$$

Given that the perimeter is 154 meters, we have:

$$\begin{aligned} & \backslash[\\ & 2 \times (L + B) = 154 \\ & \backslash] \end{aligned}$$

which simplifies to:

$$\begin{aligned} & \backslash[\\ & L + B = 77 \\ & \backslash] \end{aligned}$$

Solving for the Dimensions

Step 3: Substitute the expression for L into the perimeter equation

From the relationship $(L = 2B + 2)$, substitute into $(L + B = 77)$:

$$\backslash[$$

$$(2B + 2) + B = 77$$

\]

Combine like terms:

\[

$$3B + 2 = 77$$

\]

Step 4: Solve for B

Subtract 2 from both sides:

\[

$$3B = 75$$

\]

Divide both sides by 3:

\[

$$B = 25$$

\]

So, the breadth of the pool is 25 meters.

Step 5: Find L using the value of B

Recall $(L = 2B + 2)$:

\[

$$L = 2 \times 25 + 2 = 50 + 2 = 52$$

\]

Therefore, the length of the pool is 52 meters.

Final Dimensions of the Swimming Pool

Dimension	Value (meters)
Breadth (B)	25
Length (L)	52

|-----|-----|

| Breadth (B) | 25 |

| Length (L) | 52 |

Verification

To ensure the calculations are correct, verify the perimeter:

$$\begin{aligned} P &= 2 \times (L + B) = 2 \times (52 + 25) = 2 \times 77 = 154 \end{aligned}$$

which matches the given perimeter, confirming the solution's correctness.

Practical Applications of the Solution

Understanding how to determine the dimensions of a rectangular pool using algebraic methods is valuable in various real-life contexts:

- **Pool Design and Construction:** Architects and engineers can use similar calculations to design pools that fit specific space and size requirements.
- **Space Planning:** Ensuring that the pool fits within a designated area while meeting size specifications.
- **Cost Estimation:** Knowing the dimensions helps in estimating the amount of materials needed for construction and maintenance.
- **Educational Purposes:** Such problems serve as excellent exercises for students learning algebra and problem-solving skills.

Additional Related Problems

To deepen understanding, here are some variations of similar problems:

1. If the perimeter of a rectangular swimming pool is 200 meters and its length is 3 meters more than its breadth, find the dimensions of the pool.
2. A rectangular garden has a perimeter of 120 meters. Its length is 5 meters less than twice its breadth. Find the length and breadth.
3. A swimming pool has a length of 10 meters more than its breadth, and the perimeter is 100 meters. Find its dimensions.

These types of problems reinforce the application of algebra in real-world scenarios.

Tips for Solving Similar Problems

- Identify the variables: Clearly define what each variable represents.
- Translate words into equations: Use algebraic expressions based on the given relationships.
- Use known formulas: Recall formulas like perimeter, area, etc.
- Substitute and solve step-by-step: Simplify equations systematically.
- Verify your solutions: Always plug back into original conditions to ensure accuracy.

Conclusion

Understanding the relationship between the perimeter, length, and breadth of a rectangle is fundamental in geometry and practical design tasks. In this case, by translating the problem into algebraic equations and solving systematically, we determined that the swimming pool's dimensions are 52 meters in length and 25 meters in breadth. This approach exemplifies how mathematical reasoning can be applied to solve real-world problems efficiently.

By mastering such problem-solving techniques, students and professionals alike can enhance their analytical skills, enabling them to tackle various challenges involving geometric dimensions with confidence and precision.

Frequently Asked Questions

What is the formula for the perimeter of a rectangular swimming pool?

The perimeter of a rectangle is given by 2 times the sum of its length and breadth, i.e., $P = 2(l + b)$.

Given the perimeter of the pool is 154 meters, how can we express the relationship between length and breadth?

Let the breadth be b meters. Since the length is 2 meters more than twice the breadth, the length $l = 2b + 2$. The perimeter equation becomes $2(l + b) = 154$.

How do we set up an equation to find the dimensions of the pool?

Substitute $l = 2b + 2$ into the perimeter formula: $2((2b + 2) + b) = 154$. Simplify to $2(3b + 2) = 154$, then solve for b .

What is the value of the breadth of the pool?

Solving $2(3b + 2) = 154$ gives $6b + 4 = 77$, so $6b = 73$, thus $b = 73/6 \approx 12.17$ meters.

What is the length of the pool based on the calculated breadth?

Using $l = 2b + 2$, substitute $b \approx 12.17$: $l \approx 2(12.17) + 2 \approx 24.34 + 2 = 26.34$ meters.

What are the approximate dimensions of the swimming pool?

The approximate dimensions are a breadth of 12.17 meters and a length of 26.34 meters.

How can these dimensions be used to calculate the area of the swimming pool?

The area $A = \text{length} \times \text{breadth} \approx 26.34 \times 12.17 \approx 320.8$ square meters.

Additional Resources

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Introduction

When designing or analyzing a rectangular swimming pool, understanding its dimensions is crucial for construction, maintenance, and space planning. In particular, knowing the relationship between the length and breadth allows for precise calculations of area, volume, and fencing requirements. Consider the scenario where the perimeter of the pool is 154 meters, and the length exceeds twice its breadth by 2 meters. Such a problem combines fundamental algebra with geometric principles, providing an engaging example of how mathematics applies to real-world structures.

In this article, we will explore the problem in depth, breaking down the steps involved in determining the exact dimensions of the pool. We will analyze the relationships, formulate equations, and solve for the unknowns, all while maintaining a reader-friendly approach. This case exemplifies how algebraic reasoning can solve practical problems, shedding light on the importance of mathematical literacy in everyday contexts.

Understanding the Problem

Before diving into calculations, it's essential to clarify what information is given and what is being asked.

- Given Data:

- Perimeter of the rectangular pool = 154 meters.

- The length (L) is 2 meters more than twice the breadth (B). Mathematically, $L = 2B + 2$.

- Goals:

- Find the actual dimensions—length and breadth—of the pool.

- Understand how these dimensions relate to the perimeter.

This problem involves two primary variables: the length (L) and the breadth (B). The key challenge is to find their specific values based on the given relationships.

Mathematical Foundations

To solve the problem, we need to recall some fundamental formulas and concepts from geometry and algebra.

Perimeter of a Rectangle

For a rectangle with length L and breadth B:

$$\text{Perimeter, } P = 2(L + B)$$

Given $P = 154$ meters, we have:

$$2(L + B) = 154$$

Dividing both sides by 2:

$$L + B = 77$$

This is our first key equation: the sum of length and breadth is 77 meters.

Relationship Between Length and Breadth

The problem states:

$$L = 2B + 2$$

This provides a second equation linking L and B.

Formulating the Equations

Using the two pieces of information, we can set up a system of equations:

1. $L + B = 77$

2. $L = 2B + 2$

Substituting the second equation into the first:

$$(2B + 2) + B = 77$$

Simplify:

$$2B + 2 + B = 77$$

Combine like terms:

$$3B + 2 = 77$$

Subtract 2 from both sides:

$$3B = 75$$

Divide both sides by 3:

$$B = 25$$

Now that we know B (breadth), we can find L (length):

$$L = 2B + 2 = 2(25) + 2 = 50 + 2 = 52$$

Validating the Solution

To ensure these dimensions are consistent with the given perimeter:

Calculate perimeter:

$$P = 2(L + B) = 2(52 + 25) = 2(77) = 154 \text{ meters}$$

This matches the given perimeter, confirming our solution.

Final Dimensions

- Breadth (B): 25 meters
- Length (L): 52 meters

Practical Implications of the Dimensions

Knowing the precise dimensions of the pool has several practical benefits:

- Construction Planning: Builders can accurately determine the amount of materials needed, such as tiles, concrete, and fencing.
- Safety Measures: Adequate fencing and safety barriers can be planned to match the pool's perimeter.
- Maintenance: Pool cleaning and chemical treatment routines can be tailored based on the surface area and volume, which depend on the dimensions.
- Space Optimization: The dimensions inform landscape design, ensuring the pool fits well within the available space.

Calculating Additional Parameters

Beyond the perimeter, other parameters are often useful:

Area of the Pool

$$\text{Area (A)} = L \times B = 52 \times 25 = 1300 \text{ square meters}$$

This helps estimate the volume if the depth is known, or plan for water requirements.

Volume Estimation (If Depth is Known)

Suppose the pool has an average depth of D meters. Then:

$$\text{Volume (V)} = \text{Area} \times \text{Depth} = 1300 \times D \text{ cubic meters}$$

This helps in water management and chemical dosing.

Broader Context and Applications

Understanding such problems extends beyond swimming pools to various fields:

- Architecture: Designing rooms or structures with specific perimeter and dimension relationships.
- Landscaping: Planning gardens or parks with given boundary constraints.
- Manufacturing: Cutting materials to specific dimensions based on perimeter and length-breadth relationships.
- Education: Enhancing problem-solving skills by applying algebra to real-world scenarios.

This problem exemplifies how mathematical modeling simplifies complex real-world tasks, ensuring precision and efficiency.

Conclusion

Determining the dimensions of a rectangular swimming pool based on its perimeter and the relationship between length and breadth demonstrates the power of algebraic reasoning. By translating the problem into equations and systematically solving them, we find that the pool measures 52 meters in length and 25 meters in breadth, with a perimeter of 154 meters. Such calculations are essential in practical fields, ensuring structures are built to specifications, safely, and efficiently. This case underscores the importance of mathematical literacy in everyday problem-solving, bridging abstract concepts with tangible outcomes.

Final Thoughts

Whether you're a student, an engineer, or a homeowner, understanding how to approach and solve such geometric problems enhances your analytical skills. It also highlights the relevance of mathematics in everyday life—be it planning a backyard pool, designing a room, or even navigating complex engineering projects. Mastery of these foundational principles empowers you to tackle diverse challenges with confidence and precision.

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