

The Diameter Of A Fountain Is 9 Meters. A Sidewalk That Is 0.7 Meters Will Be Built Around It. Find The

The Diameter Of A Fountain Is 9 Meters. A Sidewalk That Is 0.7 Meters Will Be Built Around It. Find The total area covered by the fountain and the sidewalk combined. This problem involves understanding geometric shapes, calculating areas, and applying formulas for circles and annular regions. Whether you're a student preparing for a math exam or a homeowner interested in landscaping measurements, understanding how to approach such problems can be quite useful. In this article, we will explore how to solve this problem step by step, diving into the concepts of circle geometry, area calculations, and real-world applications.

Understanding the Problem

Before jumping into calculations, it's essential to comprehend what the problem asks for and identify the key information provided.

Given Data:

- The diameter of the fountain: 9 meters
- The sidewalk width around the fountain: 0.7 meters

What needs to be found:

- The total area covered by the fountain and the sidewalk combined.

This essentially involves calculating the area of the larger circle (including the sidewalk) and subtracting the area of the fountain alone to find the area of the sidewalk, or directly calculating the total area.

Step 1: Find the Radius of the Fountain

The first step is to convert the given diameter into radius because the area formulas for circles depend on the radius.

Formula:

- Radius (r) = Diameter / 2

Calculation:

- For the fountain:
- Diameter = 9 meters
- Radius = $9 / 2 = 4.5$ meters

Now, we have the radius of the fountain as 4.5 meters.

Step 2: Determine the Outer Radius Including the Sidewalk

The sidewalk surrounds the fountain uniformly, extending outward by 0.7 meters.

Calculation:

- Outer radius (R) = Fountain's radius + sidewalk width
- $R = 4.5 + 0.7 = 5.2$ meters

This radius represents the total radius of the larger circle, which includes both the fountain and the sidewalk.

Step 3: Calculate the Area of the Fountain

The area of a circle is given by the formula:

$$[A = \pi r^2]$$

Calculation:

- Area of the fountain (A_{fountain}):
- $A_{\text{fountain}} = \pi (4.5)^2$
- $A_{\text{fountain}} \approx 3.1416 \times 20.25 \approx 63.62$ square meters

Step 4: Calculate the Area of the Larger Circle

(Fountain + Sidewalk)

- Area of the larger circle (A_{total}):
- $A_{\text{total}} = \pi (5.2)^2$
- $A_{\text{total}} \approx 3.1416 \cdot 27.04 \approx 84.82$ square meters

Step 5: Find the Area of the Sidewalk Alone

The sidewalk area is the difference between the total area and the fountain's area:

$$\text{Sidewalk Area} = A_{\text{total}} - A_{\text{fountain}}$$

- Sidewalk Area $\approx 84.82 - 63.62 \approx 21.2$ square meters

Alternatively, the total area covered by the fountain and sidewalk combined is approximately 84.82 square meters.

Step 6: Summary of Results

- Fountain Area: approximately 63.62 square meters
- Sidewalk Area: approximately 21.2 square meters
- Total Area (Fountain + Sidewalk): approximately 84.82 square meters

Additional Considerations and Applications

Understanding how to calculate areas of circles and annular regions (areas between two concentric circles) has practical applications in landscaping, urban planning, and construction projects.

Applications include:

- Designing decorative fountains and their surrounding features
- Estimating materials needed for paving or tiling around structures
- Planning drainage or irrigation systems for circular areas
- Determining space for seating, lighting, or landscaping around water features

Common Mistakes to Avoid

When solving problems like this, watch out for common errors:

1. Using diameter instead of radius in area calculations
2. Forgetting to square the radius in the area formula
3. Incorrectly adding the sidewalk width to the diameter instead of the radius
4. Assuming the sidewalk is a rectangle instead of a ring-shaped region

Ensuring clarity on these points will help you arrive at accurate solutions.

Conclusion

Calculating the area surrounding a circular fountain involves understanding basic circle geometry and applying the area formula accurately. Given the fountain's diameter and the sidewalk's width, we find the radii, compute individual areas, and then determine the total coverage. This method can be adapted for various sizes and shapes, making it a versatile approach for many real-world design and planning scenarios.

By mastering these calculations, you can confidently plan outdoor spaces, estimate material needs, and design aesthetically pleasing features with precision. Remember, always double-check your steps and units to ensure accuracy in your measurements and calculations.

Frequently Asked Questions

What is the total diameter of the fountain including the sidewalk?

The total diameter is 9 meters (fountain) + 2×0.7 meters (sidewalk on both sides) = $9 + 1.4 = 10.4$ meters.

What is the radius of the fountain?

The radius of the fountain is half of its diameter, so $9 \text{ meters} \div 2 = 4.5$ meters.

How do you calculate the area of the circular area including the sidewalk?

First, find the total radius: 4.5 meters (fountain) + 0.7 meters (sidewalk) = 5.2 meters. Then, use the formula $\text{area} = \pi \times \text{radius}^2$: $\text{area} = \pi \times (5.2)^2$.

What is the area of the fountain alone?

Area of the fountain = $\pi \times (4.5)^2 \approx 3.1416 \times 20.25 \approx 63.62$ square meters.

What is the area of the entire circle including the sidewalk?

Area = $\pi \times (5.2)^2 \approx 3.1416 \times 27.04 \approx 84.91$ square meters.

How much area does the sidewalk occupy around the fountain?

Subtract the fountain area from the total area: $84.91 - 63.62 \approx 21.29$ square meters.

What is the width of the sidewalk around the fountain?

The width of the sidewalk is given as 0.7 meters, which is the distance from the fountain's edge to the outer edge of the sidewalk.

How would the total diameter change if the sidewalk width increases to 1 meter?

Total diameter would be 9 meters (fountain) + 2×1 meter (sidewalk) = $9 + 2 = 11$ meters.

Why is understanding the diameter important for construction planning around the fountain?

Knowing the diameter helps in designing the surrounding area, ensuring enough space for the sidewalk, safety zones, and aesthetic layout, and helps in calculating materials needed.

Additional Resources

The Diameter Of A Fountain Is 9 Meters. A Sidewalk That Is 0.7 Meters Will Be Built Around It. Find The – this scenario presents a classic geometric problem that combines understanding of circles, diameters, radii, and the

calculation of additional areas. Whether you're a student tackling a math problem or a professional planning a public space, understanding how to approach such a problem is essential. In this comprehensive guide, we'll walk through the steps to find the total area occupied by the fountain and the surrounding sidewalk, providing clarity and detailed explanations along the way.

Understanding the Problem

Before diving into calculations, it's crucial to carefully interpret the problem statement:

- The diameter of the fountain is 9 meters.
- A sidewalk of width 0.7 meters will be built around the fountain.

The goal is to find a specific measurement, which, based on typical problem-solving patterns, is likely to be either:

- The area of the sidewalk alone, or
- The total area covered by the fountain and sidewalk together.

For clarity, we will assume the problem asks: "Find the total area of the fountain plus the sidewalk built around it."

Breaking Down the Problem

To solve this, we need to understand the dimensions involved:

1. Fountain's radius (r_{fountain}): Since the diameter is given, the radius is half of that.
2. Sidewalk's width (w): Given as 0.7 meters.
3. Outer radius (r_{total}): The radius from the center of the fountain to the outer edge of the sidewalk.

Step 1: Find the fountain's radius

Given:

- Diameter of fountain, $D_{\text{fountain}} = 9$ meters

Therefore:

- Radius of fountain, $r_{\text{fountain}} = D_{\text{fountain}} / 2 = 9 / 2 = 4.5$ meters

Step 2: Determine the total radius including the sidewalk

Since the sidewalk surrounds the fountain uniformly, its width adds to the

radius:

- Total radius, $r_{total} = r_{fountain} + sidewalk\ width = 4.5 + 0.7 = 5.2$ meters

Calculating Areas

Having established the radii, the next step is to calculate the relevant areas.

Step 3: Find the area of the fountain

The area of a circle is given by:

$A = \pi r^2$

So,

$A_{fountain} = \pi \times (4.5)^2 = \pi \times 20.25 \approx 63.62 \text{ square meters}$

(Using $\pi \approx 3.1416$)

Step 4: Find the area of the larger circle including the sidewalk

Similarly,

$A_{total} = \pi \times (r_{total})^2 = \pi \times (5.2)^2 = \pi \times 27.04 \approx 84.87 \text{ square meters}$

Step 5: Find the area of the sidewalk alone

The sidewalk area is the difference between the total area and the fountain area:

$A_{sidewalk} = A_{total} - A_{fountain} \approx 84.87 - 63.62 = 21.25 \text{ square meters}$

Summary of Results

Measure	Value	Description
Fountain Radius	4.5 meters	Half of the fountain's diameter
Total Radius (fountain + sidewalk)	5.2 meters	Fountain radius + sidewalk width
Fountain Area	approximately 63.62 m ²	Area of the fountain itself
Total Area (fountain + sidewalk)	approximately 84.87 m ²	Area including

the sidewalk |
| Sidewalk Area | approximately 21.25 m² | Area of the sidewalk alone |

Additional Considerations

Variations in Problem Assumptions

- If the problem is asking for just the area of the sidewalk, then the answer is approximately 21.25 square meters.
- If it asks for the total area covered by the fountain and sidewalk, then approximately 84.87 square meters is the answer.
- Always clarify what exactly the problem is requesting, especially in real-world applications where precise measurements are critical.

Practical Applications

- Urban Planning: Knowing how much space a fountain and its surrounding sidewalk occupy helps in designing public spaces.
- Construction: Accurate area calculations assist in material estimation.
- Landscape Design: Ensuring aesthetic proportions and functional walkways.

Visualizing the Geometry

Imagine a circle (the fountain) with a radius of 4.5 meters. Surrounding it is an annular region (the sidewalk) extending 0.7 meters outward in all directions, making the total radius 5.2 meters. The difference in areas between these two circles provides the precise surface area for the sidewalk.

Final Tips for Solving Similar Problems

1. Identify all given measurements clearly.
2. Convert all dimensions to consistent units.
3. Use the formula for the area of a circle whenever dealing with circular figures.
4. Break complex figures into simpler parts – often, subtracting areas gives you the region of interest.
5. Double-check your calculations for common errors, especially in arithmetic and unit conversions.
6. Visualize the problem with diagrams whenever possible to ensure understanding.

Conclusion

The problem involving the fountain with a 9-meter diameter and a 0.7-meter sidewalk around it demonstrates fundamental principles of geometry and area

calculation. By methodically breaking down the problem into steps—finding radii, calculating individual areas, and subtracting to find the sidewalk area—you develop a clear understanding of the spatial relationships involved. Whether applied in academic contexts or real-world scenarios like urban design, these skills are essential for precise planning and measurement.

In summary:

- The fountain's radius is 4.5 meters.
- The total radius including the sidewalk is 5.2 meters.
- The fountain's area is approximately 63.62 m².
- The total area (fountain + sidewalk) is approximately 84.87 m².
- The sidewalk alone covers about 21.25 m².

Mastering these calculations enables you to approach similar problems confidently, ensuring accuracy and clarity in your geometric and spatial analyses.

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