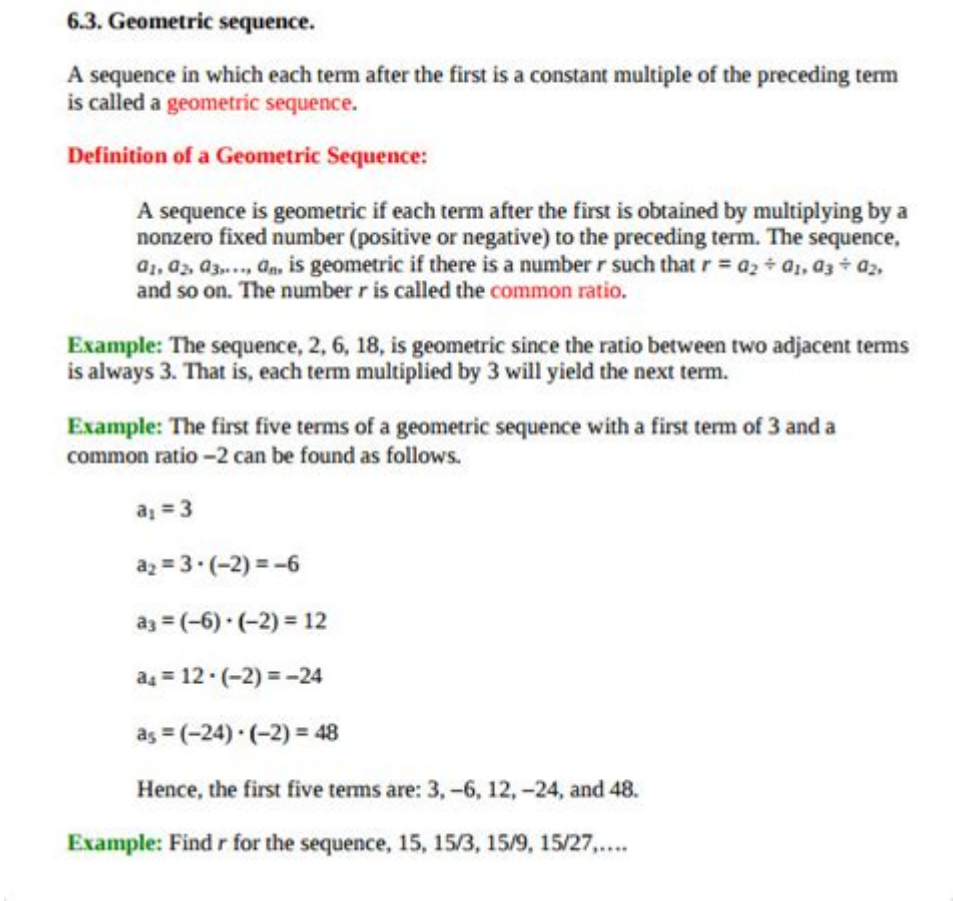
Example Of Geometric Problem With Solution



6.3. Geometric sequence.

A sequence in which each term after the first is a constant multiple of the preceding term is called a geometric sequence.

Definition of a Geometric Sequence:

A sequence is geometric if each term after the first is obtained by multiplying by a nonzero fixed number (positive or negative) to the preceding term. The sequence, $a_1, a_2, a_3, \ldots, a_n$, is geometric if there is a number r such that $r = a_2 \div a_1$, $a_3 \div a_2$, and so on. The number r is called the common ratio.

Example: The sequence, 2, 6, 18, is geometric since the ratio between two adjacent terms is always 3. That is, each term multiplied by 3 will yield the next term.

Example: The first five terms of a geometric sequence with a first term of 3 and a common ratio −2 can be found as follows.

$a_1 = 3$

$a_2 = 3 \cdot (-2) = -6$

$a_3 = (-6) \cdot (-2) = 12$

$a_4 = 12 \cdot (-2) = -24$

$a_5 = (-24) \cdot (-2) = 48$

Hence, the first five terms are: 3, −6, 12, −24, and 48.

Example: Find r for the sequence, 15, 15/3, 15/9, 15/27,….

Example of geometric problem with solution can serve as an enlightening exploration into the world of mathematics, helping students and enthusiasts alike understand the intricacies of geometry. Geometry is a branch of mathematics that deals with shapes, sizes, and the properties of space. It is not only essential in theoretical math but also plays a significant role in real-world applications, from architecture to engineering. In this article, we will delve into a specific geometric problem, explore its concepts, and provide a step-by-step solution.

Understanding the Problem

Let’s consider a classic geometric problem involving a right triangle. The problem is as follows:

Problem Statement:

A right triangle has one leg measuring 6 cm and the other leg measuring 8 cm. Calculate the length of the hypotenuse and the area of the triangle.

This problem allows us to utilize the Pythagorean theorem and area formulas, which are

fundamental in geometry.

Concepts Involved

To solve this problem, we will need to focus on two main concepts:

Pythagorean Theorem

The Pythagorean theorem states that in a right triangle, the square of the length of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the lengths of the other two sides. The theorem can be expressed mathematically as:

$$ c^2 = a^2 + b^2 $$

Where:
- $ c $ is the hypotenuse,
- $ a $ and $ b $ are the lengths of the other two sides.

Area of a Triangle

The area $ A $ of a triangle can be calculated using the formula:

$$ A = \frac{1}{2} \times \text{base} \times \text{height} $$

In a right triangle, the two legs can be considered as the base and height.

Step-by-Step Solution

Now, let’s break down the solution into clear steps.

Step 1: Determine the Length of the Hypotenuse

Using the Pythagorean theorem, we can find the hypotenuse $ c $ of the triangle. We know the lengths of the two legs:

- $ a = 6 \, \text{cm} $
- $ b = 8 \, \text{cm} $

Plugging these values into the theorem:

$$

$$
c^2 = a^2 + b^2
$$

$$
c^2 = 6^2 + 8^2
$$

Calculating the squares:

$$
c^2 = 36 + 64
$$

$$
c^2 = 100
$$

Now, taking the square root of both sides to find c:

$$
c = \sqrt{100} = 10 \, \text{cm}
$$

Thus, the length of the hypotenuse is 10 cm.

Step 2: Calculate the Area of the Triangle

To find the area of the triangle, we apply the area formula mentioned earlier:

$$
A = \frac{1}{2} \times \text{base} \times \text{height}
$$

In this case, we can take the lengths of the two legs as the base and height:

$$
A = \frac{1}{2} \times 6 \times 8
$$

Calculating the area:

$$
A = \frac{1}{2} \times 48 = 24 \, \text{cm}^2
$$

Thus, the area of the triangle is 24 cm^2.

Conclusion

In this example of a geometric problem, we explored a right triangle with legs measuring 6 cm and 8 cm. Through the application of the Pythagorean theorem, we determined that the length of the hypotenuse is 10 cm. Additionally, we calculated the area of the triangle to be 24 cm^2.

This problem exemplifies the beauty and utility of geometry in solving practical problems. It demonstrates how mathematical principles can be applied to ascertain unknown values and analyze geometric figures effectively. Understanding such fundamental concepts is essential for students and professionals who wish to delve deeper into the field of mathematics.

Additional Examples and Applications

To reinforce the concepts discussed, let's explore a few more geometric problems that utilize similar principles.

Example 1: Isosceles Triangle

Problem Statement:

An isosceles triangle has a base of 10 cm and the legs measure 7 cm each. Find the height of the triangle and its area.

Solution Steps:

1. Height Calculation:
- Drop a perpendicular from the apex to the base, bisecting it into two equal segments (5 cm each).
- Using the Pythagorean theorem:
$$
h^2 + 5^2 = 7^2 \\
h^2 + 25 = 49 \\
h^2 = 24 \\
h = \sqrt{24} = 2\sqrt{6} \approx 4.9 \, \text{cm}
$$

2. Area Calculation:
$$
A = \frac{1}{2} \times \text{base} \times \text{height} \\
A = \frac{1}{2} \times 10 \times 4.9 \approx 24.5 \, \text{cm}^2
$$

Example 2: Circle and Radius

Problem Statement:

A circle has a radius of 5 cm. Find the area and circumference of the circle.

Solution Steps:

1. Area Calculation:
$$
A = \pi r^2 \\
A = \pi (5^2) = 25\pi \approx 78.54 \, \text{cm}^2
$$

2. Circumference Calculation:
$$
C = 2\pi r \\
C = 2\pi (5) = 10\pi \approx 31.42 \, \text{cm}
$$

Final Thoughts

Geometry is a fascinating subject that provides tools for solving various problems in mathematics and real life. By understanding the principles and formulas associated with different geometric shapes, anyone can enhance their problem-solving skills. The examples presented in this article illustrate the importance of these concepts and how they can be applied in a variety of scenarios. Whether one is a student looking to improve their math skills or a professional in a related field, a solid grasp of geometric principles is invaluable.

Frequently Asked Questions

What is an example of a geometric problem involving the area of a triangle?

A common problem is to find the area of a triangle with a base of 8 cm and a height of 5 cm. The area can be calculated using the formula Area = 1/2 base height. Thus, Area = 1/2 8 5 = 20 cm².

How do you solve a geometric problem involving the circumference of a circle?

To find the circumference of a circle with a radius of 7 cm, use the formula Circumference = 2 π radius. Therefore, Circumference = 2 π 7 ≈ 43.98 cm.

Can you provide a geometric problem related to the Pythagorean theorem?

Yes! If a right triangle has legs of lengths 3 cm and 4 cm, find the length of the hypotenuse. Using the Pythagorean theorem: $a^2 + b^2 = c^2$, we have $3^2 + 4^2 = c^2$, which gives $9 + 16 = c^2$, so $c^2 = 25$ and $c = 5$ cm.

What is an example of a problem involving the volume of a cylinder?

To find the volume of a cylinder with a radius of 3 cm and a height of 10 cm, use the formula Volume = π radius² height. Thus, Volume = π 3^2 10 = 90π ≈ 282.74 cm^3.

How can you determine the perimeter of a rectangle?

To find the perimeter of a rectangle with length 10 cm and width 5 cm, use the formula Perimeter = 2 (length + width). Therefore, Perimeter = 2 (10 + 5) = 30 cm.

What geometric problem can illustrate the concept of similar triangles?

If two triangles have sides in the ratio 2:3 and the shorter triangle has a base of 4 cm, what is the base of the larger triangle? Since the triangles are similar, the base of the larger triangle would be 4 cm (3/2) = 6 cm.

Give an example of a geometric problem involving angles in a triangle.

In a triangle where two angles are 45° and 65°, find the third angle. Since the sum of angles in a triangle is 180°, the third angle is 180° - (45° + 65°) = 70°.

What is a geometric problem that involves finding the distance between two points?

To find the distance between points A(1, 2) and B(4, 6) on a Cartesian plane, use the distance formula: Distance = $\sqrt{(x2 - x1)^2 + (y2 - y1)^2}$. Thus, Distance = $\sqrt{(4 - 1)^2 + (6 - 2)^2}$ = $\sqrt{9 + 16}$ = $\sqrt{25}$ = 5 units.

Can you solve a problem involving the surface area of a sphere?

To find the surface area of a sphere with a radius of 5 cm, use the formula Surface Area = 4 π radius². Therefore, Surface Area = 4 π 5^2 = 100π ≈ 314.16 cm^2.

Example Of Geometric Problem With Solution

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