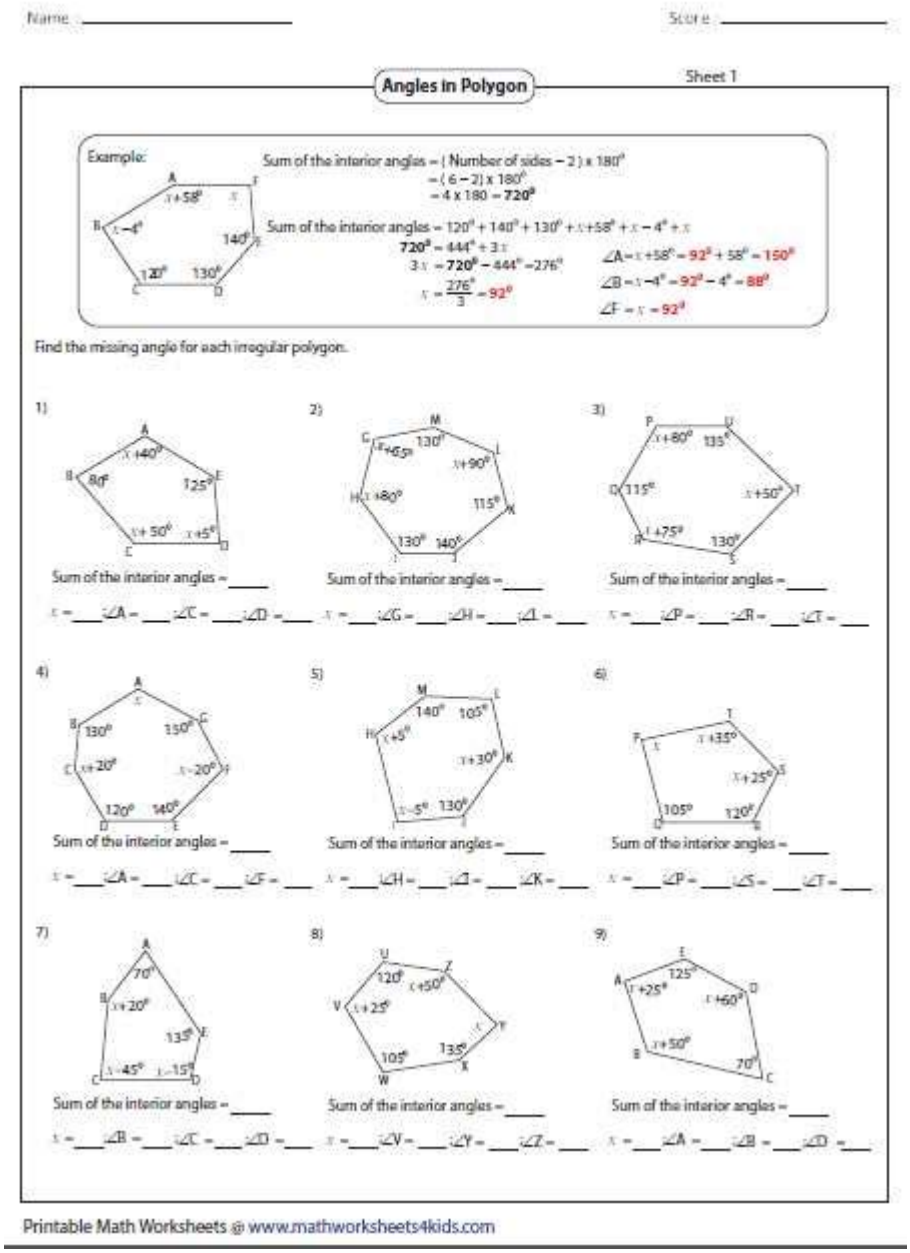
Area Of Regular Polygons Answer Key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Angles in Polygon — Sheet 1

Example:

Sum of the interior angles = (Number of sides − 2) x 180°
= (6 − 2) x 180°
= 4 x 180 = 720°

Sum of the interior angles = 120° + 140° + 130° + x + 58° + x − 4° + x
720° = 444° + 3x
3x = 720° − 444° = 276°
x = 276°/3 = 92°

∠A = x + 58° = 92° + 58° = 150°
∠B = x − 4° = 92° − 4° = 88°
∠F = x = 92°

Find the missing angle for each irregular polygon.

1) Sum of the interior angles = ____
x = ____ ∠A = ____ ∠C = ____ ∠D = ____

2) Sum of the interior angles = ____
x = ____ ∠G = ____ ∠H = ____ ∠I = ____

3) Sum of the interior angles = ____
x = ____ ∠P = ____ ∠R = ____ ∠T = ____

4) Sum of the interior angles = ____
x = ____ ∠A = ____ ∠C = ____ ∠F = ____

5) Sum of the interior angles = ____
x = ____ ∠H = ____ ∠I = ____ ∠K = ____

6) Sum of the interior angles = ____
x = ____ ∠P = ____ ∠S = ____ ∠T = ____

7) Sum of the interior angles = ____
x = ____ ∠B = ____ ∠C = ____ ∠D = ____

8) Sum of the interior angles = ____
x = ____ ∠V = ____ ∠Y = ____ ∠Z = ____

9) Sum of the interior angles = ____
x = ____ ∠A = ____ ∠B = ____ ∠D = ____

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Area of Regular Polygons Answer Key

Understanding the area of regular polygons is a fundamental concept in geometry that not only applies to mathematics but also to various real-life applications such as architecture, design, and nature. Regular polygons are defined as polygons that have all sides equal in length and all interior angles equal in measure. The most common regular polygons include the equilateral triangle, square, regular pentagon, hexagon, and octagon. In this article, we will explore the formulas for calculating the area of regular polygons, provide step-by-step examples, and offer an answer key for various problems related to the area of these shapes.

Understanding Regular Polygons

Before diving into the area calculations, it is essential to understand what constitutes a regular polygon. Regular polygons can be identified by the following characteristics:

- Equal Sides: All sides of the polygon are of equal length.
- Equal Angles: All interior angles are equal.
- Symmetry: Regular polygons are symmetrical about their center.

Some common examples of regular polygons include:

1. Triangle (3 sides)
2. Square (4 sides)
3. Pentagon (5 sides)
4. Hexagon (6 sides)
5. Heptagon (7 sides)
6. Octagon (8 sides)

Formulas for Calculating Area

The area of regular polygons can be calculated using specific formulas based on the number of sides and the length of the sides (s). Below are the formulas for calculating the area of some common regular polygons.

1. Area of an Equilateral Triangle

The formula for calculating the area (A) of an equilateral triangle is given by:

$$
A = \frac{\sqrt{3}}{4} s^2
$$

Where s is the length of a side.

2. Area of a Square

The formula for the area (A) of a square is straightforward:

$$
A = s^2
$$

Where s is the length of a side.

3. Area of a Regular Pentagon

The area (A) of a regular pentagon can be calculated using the formula:

$$
A = \frac{1}{4} \sqrt{5(5 + 2\sqrt{5})} s^2
$$

Where s is the length of a side.

4. Area of a Regular Hexagon

The area (A) of a regular hexagon can be derived from its relationship with equilateral triangles:

$$
A = \frac{3\sqrt{3}}{2} s^2
$$

Where s is the length of a side.

5. Area of a Regular Octagon

The area (A) of a regular octagon is given by:

$$
A = 2(1 + \sqrt{2}) s^2
$$

Where s is the length of a side.

Step-by-Step Examples

Below are step-by-step examples illustrating how to calculate the area of various regular polygons.

Example 1: Area of an Equilateral Triangle

Problem: Calculate the area of an equilateral triangle with a side length of 6 cm.

Solution:

1. Use the formula:
$$ A = \frac{\sqrt{3}}{4} s^2 $$

2. Substitute s = 6 cm:
$$ A = \frac{\sqrt{3}}{4} (6)^2 $$
$$ A = \frac{\sqrt{3}}{4} \cdot 36 $$
$$ A = 9\sqrt{3} \text{ cm}^2 \approx 15.59 \text{ cm}^2 $$

Example 2: Area of a Square

Problem: Find the area of a square with a side length of 5 m.

Solution:

1. Apply the formula:
$$ A = s^2 $$

2. Substitute s = 5 m:
$$ A = (5)^2 = 25 \text{ m}^2 $$

Example 3: Area of a Regular Pentagon

Problem: Determine the area of a regular pentagon with a side length of 4 cm.

Solution:

1. Use the formula:
$$ A = \frac{1}{4} \sqrt{5(5 + 2\sqrt{5})} s^2 $$

2. Substitute s = 4 cm:
$$ A = \frac{1}{4} \sqrt{5(5 + 2\sqrt{5})} (4)^2 $$
$$ A = \frac{1}{4} \sqrt{5(5 + 2\sqrt{5})} \cdot 16 $$
$$ A = 4 \sqrt{5(5 + 2\sqrt{5})} \text{ cm}^2 \approx 27.53 \text{ cm}^2 $$

Answer Key for Area Calculations

Below is an answer key for a series of problems related to the area of regular polygons.

1. Equilateral Triangle (s = 8 cm):
- Area = $16\sqrt{3} \approx 27.71 \text{ cm}^2$

2. Square (s = 10 m):
- Area = 100 m^2

3. Regular Pentagon (s = 6 cm):
- Area = $9\sqrt{5(5 + 2\sqrt{5})} \approx 61.93 \text{ cm}^2$

4. Regular Hexagon (s = 5 cm):
- Area = $\frac{15\sqrt{3}}{2} \approx 39.69 \text{ cm}^2$

5. Regular Octagon (s = 4 m):
- Area = $32(1 + \sqrt{2}) \approx 81.65 \text{ m}^2$

Conclusion

Calculating the area of regular polygons is a vital skill for students and professionals in various fields. By mastering the formulas and understanding how to apply them, one can accurately determine the area of different

geometric shapes. This knowledge is not only useful in academic settings but also in practical applications ranging from construction to art. With regular practice and application of these formulas, anyone can become proficient in calculating the areas of regular polygons. Remember to always refer back to the formulas provided for each type of polygon, and use the answer key for verification.

Frequently Asked Questions

What is the formula to calculate the area of a regular polygon?

The area A of a regular polygon with n sides of length s can be calculated using the formula: A = (n s^2) / (4 tan(π/n)).

How does the number of sides affect the area of a regular polygon?

As the number of sides (n) increases, the area of a regular polygon generally increases, approaching the area of a circle as n approaches infinity.

What is the area of a regular hexagon with a side length of 4?

The area A of a regular hexagon with side length s = 4 can be calculated as A = (6 4^2) / (4 tan(π/6)) = 16√3 ≈ 27.71.

How do you find the area of a regular pentagon?

The area A of a regular pentagon with side length s is calculated using A = (5 s^2) / (4 tan(π/5)).

What is the relationship between the radius of the circumcircle and the area of a regular polygon?

The area A of a regular polygon can also be expressed in terms of the circumradius R: A = (1/2) n R^2 sin(2π/n).

Can you determine the area of a regular polygon if you only know the apothem?

Yes, the area A can be calculated using the formula A = (perimeter apothem) / 2, where the perimeter can be calculated if the side length is known.

How do you calculate the area of a regular octagon?

The area A of a regular octagon with side length s is calculated using A = 2 (1 + √2) s^2.

What is the area of a regular dodecagon with a side length of 3?

The area A of a regular dodecagon with side length s = 3 can be calculated as

A = 3 s^2 (2 + √3) = 3 3^2 (2 + √3) ≈ 34.64.

Is there a simple way to visualize the area of regular polygons?

Yes, dividing the polygon into congruent triangles from the center can help visualize and calculate the area more easily.

What is the area of a regular triangle with a side length of 5?

The area A of a regular triangle (equilateral) with side length s = 5 is calculated as A = (√3 / 4) s^2 = (√3 / 4) 5^2 ≈ 10.83.

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