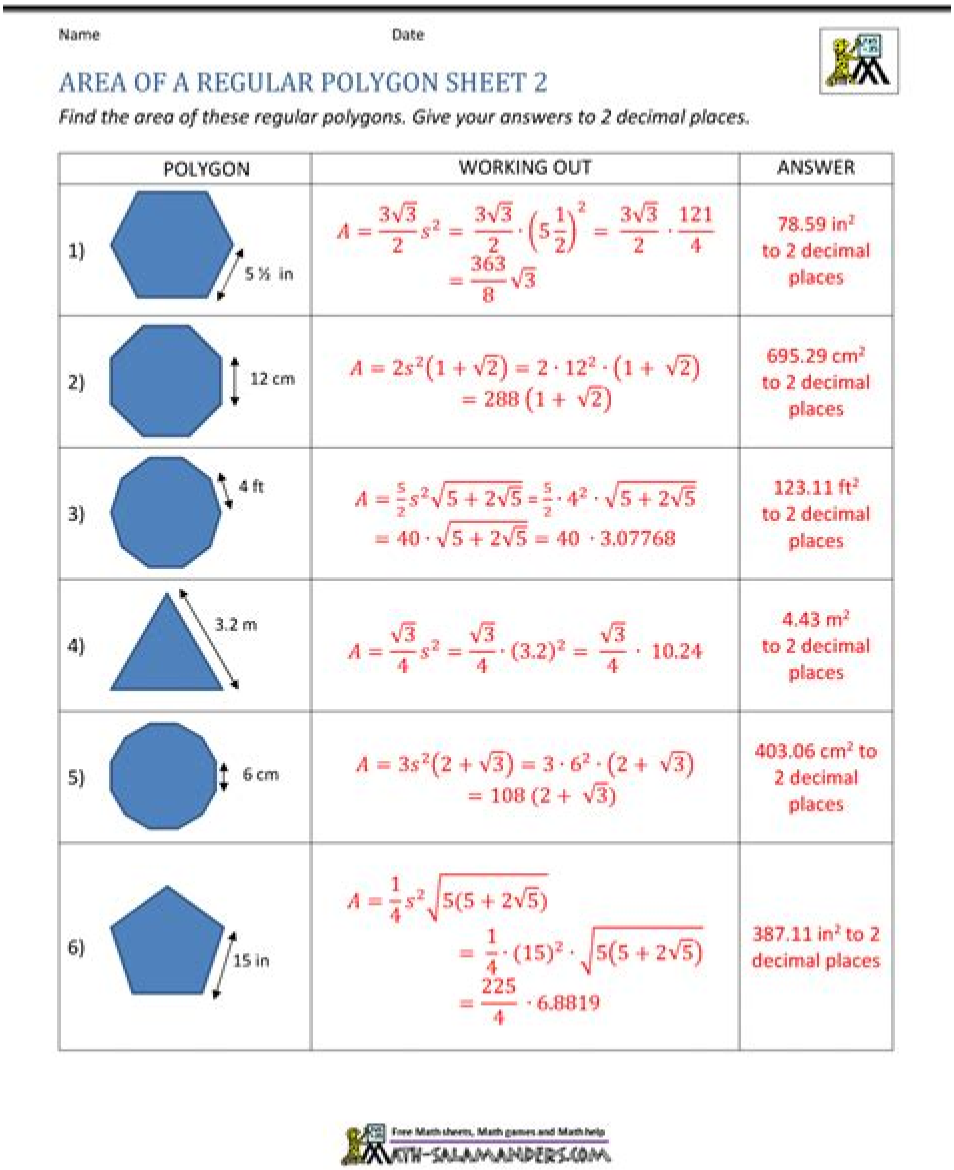
Areas Of Regular Polygons Hexagon Answers Key



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AREA OF A REGULAR POLYGON SHEET 2

Find the area of these regular polygons. Give your answers to 2 decimal places.

POLYGON	WORKING OUT	ANSWER
1) 5 ½ in	$A=\frac{3\sqrt{3}}{2}s^2=\frac{3\sqrt{3}}{2}\cdot\left(5\frac{1}{2}\right)^2=\frac{3\sqrt{3}}{2}\cdot\frac{121}{4}$ $=\frac{363}{8}\sqrt{3}$	78.59 in² to 2 decimal places
2) 12 cm	$A=2s^2(1+\sqrt{2})=2\cdot 12^2\cdot(1+\sqrt{2})$ $=288\,(1+\sqrt{2})$	695.29 cm² to 2 decimal places
3) 4 ft	$A=\frac{5}{2}s^2\sqrt{5+2\sqrt{5}}=\frac{5}{2}\cdot 4^2\cdot\sqrt{5+2\sqrt{5}}$ $=40\cdot\sqrt{5+2\sqrt{5}}=40\cdot 3.07768$	123.11 ft² to 2 decimal places
4) 3.2 m	$A=\frac{\sqrt{3}}{4}s^2=\frac{\sqrt{3}}{4}\cdot(3.2)^2=\frac{\sqrt{3}}{4}\cdot 10.24$	4.43 m² to 2 decimal places
5) 6 cm	$A=3s^2(2+\sqrt{3})=3\cdot 6^2\cdot(2+\sqrt{3})$ $=108\,(2+\sqrt{3})$	403.06 cm² to 2 decimal places
6) 15 in	$A=\frac{1}{4}s^2\sqrt{5(5+2\sqrt{5})}$ $=\frac{1}{4}\cdot(15)^2\cdot\sqrt{5(5+2\sqrt{5})}$ $=\frac{225}{4}\cdot 6.8819$	387.11 in² to 2 decimal places

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Areas of regular polygons hexagon answers key are essential for understanding the geometric properties of hexagons, which are six-sided polygons. This article will explore the area of regular hexagons, their properties, formulas for calculating their area, and practical applications. Understanding these concepts can greatly aid students and professionals in fields such as architecture, engineering, and mathematics.

Understanding Regular Hexagons

A regular hexagon is a polygon with six equal sides and six equal angles. The internal angles of a regular hexagon each measure 120 degrees. Regular hexagons are commonly found in nature and human-made structures, making them a topic of interest in various fields.

Properties of Regular Hexagons

Before diving into the area calculations, it is essential to understand the key properties of regular hexagons:

- Equal Sides and Angles: All six sides are of equal length, and all internal angles are the same.
- Symmetry: A regular hexagon exhibits rotational symmetry and reflectional symmetry. It can be rotated by 60 degrees and still appear the same.
- Diagonals: A regular hexagon has 9 diagonals.
- Circumcircle and Incircle: A regular hexagon can be inscribed in a circle (circumcircle), and it can also have a circle inscribed within it (incircle).

Calculating the Area of a Regular Hexagon

The area of a regular hexagon can be calculated using several different formulas depending on the information available. Below are the most common methods.

Formula for Area Using Side Length

The most straightforward formula for calculating the area \(A \) of a regular hexagon when the length of a side \(s \) is known is:

\[
A = \frac{3\sqrt{3}}{2} s^2
\]

This formula derives from dividing the hexagon into six equilateral triangles and calculating the total area.

Formula for Area Using Apothem

Another method to calculate the area involves the apothem \(a \). The apothem is the shortest distance from the center of the hexagon to the midpoint of one of its sides. The formula is:

\[
A = \frac{1}{2} \times Perimeter \times Apothem

\]

Where the perimeter \(P \) of the hexagon can be calculated as:

\[
P = 6s
\]

Thus, the area can also be expressed as:

\[
A = \frac{1}{2} \times 6s \times a = 3sa
\]

Example Calculations

To illustrate how to use the formulas, let’s consider a regular hexagon with a side length of 4 units.

1. Using Side Length:
- Apply the formula \(A = \frac{3\sqrt{3}}{2} s^2 \):
\[
A = \frac{3\sqrt{3}}{2} \times 4^2 = \frac{3\sqrt{3}}{2} \times 16 = 24\sqrt{3} \approx 41.57 \text{ square units}
\]

2. Using Apothem:
- First, we need to find the apothem. For a regular hexagon, the apothem can be calculated using:
\[
a = \frac{s\sqrt{3}}{2}
\]
- Thus:
\[
a = \frac{4\sqrt{3}}{2} = 2\sqrt{3}
\]
- Now calculatethe area:
\[
A = 3sa = 3 \times 4 \times 2\sqrt{3} = 24\sqrt{3} \approx 41.57 \text{ square units}
\]

Both methods yield the same result, confirming the area of the hexagon.

Applications of Hexagon Areas

Understanding the area of regular hexagons has practical implications in various fields:

1. Architecture and Design

In architecture, regular hexagons can be used in the design of floor plans, roofs, and other structural elements. Their efficient use of space and aesthetic appeal make them popular choices.

2. Nature and Biology

Hexagonal patterns are prevalent in nature, such as in honeycombs and certain crystalline structures. Understanding their geometric properties helps in studying biological forms and structures.

3. Urban Planning

Hexagonal grids are used in urban planning and geographical mapping to optimize space and improve accessibility. The area calculations of hexagonal plots are vital for effective land use planning.

Conclusion

In conclusion, the areas of regular polygons hexagon answers key is crucial for a comprehensive understanding of hexagons' geometrical properties and their applications. By utilizing the appropriate formulas, one can easily calculate the area of a regular hexagon based on the side length or apothem. Whether for academic purposes or practical applications in architecture, nature, or urban planning, knowledge of hexagonal areas is invaluable. With these insights, you can confidently tackle problems involving regular hexagons and appreciate their significance in various fields.

Frequently Asked Questions

What is the formula for the area of a regular hexagon?

The area of a regular hexagon can be calculated using the formula: Area = $(3\sqrt{3}/2) \times s^2$, where 's' is the length of a side.

How do you derive the area of a regular hexagon?

The area can be derived by dividing the hexagon into 6 equilateral triangles, each having an area of $(\sqrt{3}/4) \times s^2$, and then multiplying by 6.

If the side length of a regular hexagon is 4 cm, what is its area?

Using the formula, Area = $(3\sqrt{3}/2) \times (4)^2 = 24\sqrt{3}$ cm^2, which is approximately 41.57 cm^2.

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

The radius of the circumcircle (R) of a regular hexagon is equal to the length of a side (s), and the area can also be calculated as Area = $(3\sqrt{3}/2) \times R^2$.

Can you calculate the area of a regular hexagon with a perimeter of 30 cm?

First, find the side length: s = Perimeter/6 = 30/6 = 5 cm. Then, Area = $(3\sqrt{3}/2) \times (5)^2 = 37.5\sqrt{3}$ cm^2, approximately 64.95 cm^2.

What is the significance of the apothem in calculating the area of a regular hexagon?

The apothem (a) is the distance from the center to the midpoint of a side, and the area can also be calculated as Area = (Perimeter × Apothem) / 2.

How does the area of a regular hexagon compare to other regular polygons?

The area of a regular hexagon is larger than that of a regular pentagon or square with the same side length, due to its geometric properties.

Is it possible to calculate the area of a hexagon using the coordinates of its vertices?

Yes, you can use the shoelace formula to calculate the area of a hexagon if the coordinates of its vertices are known.

What happens to the area of a regular hexagon as the side length increases?

The area of a regular hexagon increases quadratically with the side length, meaning if the side length doubles, the area increases by a factor of four.

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