

List Of All Geometry Formulas

list of all geometry formulas Geometry forms the backbone of many mathematical concepts, involving the study of shapes, sizes, positions, and dimensions of objects. Whether you're a student preparing for exams, a teacher designing curriculum, or a math enthusiast eager to deepen your understanding, having a comprehensive list of all geometry formulas is invaluable. This article provides an extensive, well-organized collection of formulas across various branches of geometry, including plane geometry, solid geometry, coordinate geometry, and more. With clear categorizations and explanations, you'll find this guide to be an essential reference for mastering geometric concepts.

Basic Geometry Formulas

Basic formulas form the foundation for understanding more complex geometric principles.

Perimeter Formulas

- Rectangle: $P = 2(l + w)$ - Square: $P = 4a$ - Triangle: $P = a + b + c$ - Circle (Circumference): $C = 2\pi r$ - Regular Polygon: $P = n \times s$, where n is the number of sides, s is the length of one side

Area Formulas

- Rectangle: $A = l \times w$ - Square: $A = a^2$ - Triangle: $A = \frac{1}{2} \times b \times h$ - Circle: $A = \pi r^2$ - Parallelogram: $A = b \times h$ - Trapezium (Trapezoid): $A = \frac{1}{2}(a + b) \times h$ - Regular Polygon: $A = \frac{1}{2} \times P \times a$ (where a is apothem)

Formulas for Triangles

Triangles are fundamental shapes with numerous properties and formulas associated with them.

Side and Angle Relations

- Pythagorean Theorem: For right-angled triangle: $a^2 + b^2 = c^2$ - Law of Sines: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ - Law of Cosines: $c^2 = a^2 + b^2 - 2ab \cos C$

Area and Perimeter

- Heron's Formula: $A = \sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$ (semi-perimeter) - Median length: $m_a = \frac{1}{2} \sqrt{2b^2 + 2c^2 - a^2}$ - Altitude (height): $h = \frac{2A}{b}$

Special Triangle Formulas

- Equilateral Triangle: - Side length: a - Area: $A = \frac{\sqrt{3}}{4} a^2$ - Height: $h = \frac{\sqrt{3}}{2} a$ - Isosceles Triangle: - Height: $h = \sqrt{a^2 - \left(\frac{b}{2}\right)^2}$

Formulas for Quadrilaterals

Quadrilaterals include squares, rectangles, parallelograms, rhombuses, trapeziums, and kites.

Rectangle and Square

- Rectangle: - Perimeter: $P = 2(l + w)$ - Area: $A = l \times w$ - Square: - Perimeter: $P = 4a$ - Area: $A = a^2$

Parallelogram and Rhombus

- Parallelogram: - Perimeter: $(P = 2(a + b))$ - Area: $(A = b \times h)$ - Rhombus: - Perimeter: $(P = 4a)$ - Area (diagonals): $(A = \frac{1}{2} d_1 d_2)$ - Area (side and height): $(A = a \times h)$

Trapezium (Trapezoid)

- Perimeter: $(P = a + b + c + d)$ - Area: $(A = \frac{1}{2}(a + b) \times h)$

Kite

- Area: $(A = \frac{1}{2} d_1 d_2)$ - Perimeter: sum of all sides

Circles and Circular Geometry

Circles are key in geometry, with formulas relating to their radius, diameter, circumference, and area.

Key Circle Formulas

- Diameter: $(d = 2r)$ - Circumference: $(C = 2\pi r)$ - Area: $(A = \pi r^2)$ - Sector Area: $(A_{\text{sector}} = \frac{\theta}{360^\circ} \times \pi r^2)$ - Segment Area: $(A_{\text{segment}} = A_{\text{sector}} - \frac{1}{2} r^2 \sin \theta)$

Arc Length

- $(L = \frac{\theta}{360^\circ} \times 2\pi r)$

Solid Geometry Formulas

Solid geometry extends plane concepts into three dimensions, involving volume and surface area calculations for various 3D shapes.

Prisms

- Volume: $V = \text{Base Area} \times \text{height}$ - Surface Area: $SA = 2 \times \text{Base Area} + \text{Perimeter of base} \times \text{height}$

Cylinders

- Volume: $V = \pi r^2 h$ - Surface Area: $SA = 2 \pi r (r + h)$

Spheres

- Volume: $V = \frac{4}{3} \pi r^3$ - Surface Area: $SA = 4 \pi r^2$

Cones

- Volume: $V = \frac{1}{3} \pi r^2 h$ - Surface Area: $SA = \pi r (r + l)$, where l is the slant height

Rectangular and Triangular Pyramids

- Volume: $V = \frac{1}{3} \times \text{Base Area} \times h$ - Surface Area: Sum of base area and lateral faces

Coordinate Geometry Formulas

Coordinate geometry allows the calculation of distances, midpoints, slopes, and areas using coordinate points.

Distance Formula

- Between points (x_1, y_1) and (x_2, y_2) : $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula

- Between points (x_1, y_1) and (x_2, y_2) : $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Slope Formula

- Slope of line through (x_1, y_1) and (x_2, y_2) : $m = \frac{y_2 - y_1}{x_2 - x_1}$

Area of Triangle with Coordinates

$A = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

Advanced Geometry Formulas and Theorems

This section includes formulas from advanced topics and key theorems essential for higher-level geometry.

Heron's Formula

- Used to find the area of any triangle given side lengths: $A = \sqrt{s(s - a)(s - b)(s - c)}$ where $s = \frac{a + b + c}{2}$

Geometry Formulas: The Ultimate Guide to Essential Mathematical Tools When it comes to understanding the fundamental principles that shape our physical world and solve complex mathematical problems, geometry stands as a cornerstone. Whether you're a student preparing for exams, an educator designing curricula, or a professional in fields like architecture, engineering, or computer graphics, having a comprehensive grasp of geometry formulas is invaluable. In this detailed review, we explore all the essential geometry formulas, organizing them systematically to serve as your definitive reference.

Introduction to Geometry Formulas

Geometry is the branch of mathematics concerned with shapes, sizes, positions, and dimensions of objects. Its formulas encapsulate the relationships between these properties, allowing us to calculate areas, volumes, angles, and other critical measurements. This guide aims to present these formulas in an organized manner, explaining their significance, applications, and derivations where appropriate.

Basic Geometric Concepts and Formulas

Before diving into specific shapes and their formulas, it's important to understand some foundational concepts.

Angles and Their Properties

- Complementary Angles: Two angles whose sum is 90° ($\angle A + \angle B = 90^\circ$) - Supplementary Angles: Two angles whose sum is 180° ($\angle A + \angle B = 180^\circ$) - Vertical Angles: When two lines intersect, opposite angles are equal. ($\angle 1 = \angle 2$) - Angles in a Triangle: The sum of interior angles is always 180° ($\angle A + \angle B + \angle C = 180^\circ$)

Line and Angle Formulas

Understanding the relationships between lines, angles, and their intersections forms the basis for most geometric calculations.

Parallel Lines and Transversals

- Corresponding angles are equal ($\text{Corresponding angles} = \text{equal}$) - Alternate interior angles are equal ($\text{Alternate interior angles} = \text{equal}$) - Consecutive interior angles are supplementary ($\text{Consecutive interior angles} = 180^\circ$)

Angles in Geometric Figures

- Sum of interior angles of an n-sided polygon: $[(n - 2) \times 180^\circ]$ For example, the sum of interior angles of a pentagon ($n=5$): $[(5 - 2) \times 180^\circ = 540^\circ]$

Lines, Segments, and Their Lengths

Accurately measuring distances and understanding their relationships is crucial across all geometric

applications.

Distance Formula

- Between two points $((x_1, y_1))$ and $((x_2, y_2))$: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ - In 3D space between points $((x_1, y_1, z_1))$ and $((x_2, y_2, z_2))$: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$

Midpoint Formula

- Between two points: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ This formula finds the exact middle point on a segment, useful in various constructions.

Triangles: Core Formulas and Theorems

Triangles are the building blocks of polygonal geometry, and their properties are governed by specific, powerful formulas.

Area Formulas

- Basic formula (base $\times$ height): $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$ - Heron's Formula: For a triangle with sides (a, b, c) , semi-perimeter $(s = \frac{a + b + c}{2})$, $\text{Area} = \sqrt{s(s - a)(s - b)(s - c)}$ - Using two sides and included angle: $\text{Area} = \frac{1}{2}ab \sin C$

Perimeter and Pythagorean Theorem

- Perimeter: $P = a + b + c$ - Pythagorean Theorem: For right-angled triangles, the relation between sides (a, b) (legs) and hypotenuse (c) : $c^2 = a^2 + b^2$

Special Triangle Properties

- Equilateral Triangle: All sides equal, each angle 60° , area: $\text{Area} = \frac{\sqrt{3}}{4} a^2$ -
Isosceles Triangle: Two sides equal, base angles equal.

Quadrilaterals and Their Formulas

Quadrilaterals include squares, rectangles, parallelograms, rhombuses, and trapezoids, each with specific formulas for area and perimeter.

Common Quadrilaterals

- Square: - Area: $(\text{side})^2$ - Perimeter: $4 \times \text{side}$ - Rectangle: - Area: $(\text{length} \times \text{breadth})$ - Perimeter: $2(\text{length} + \text{breadth})$ - Parallelogram: - Area: $(\text{base} \times \text{height})$ - Perimeter: $2(\text{side}_1 + \text{side}_2)$ - Rhombus: - Area: $\frac{1}{2} d_1 d_2$ (product of diagonals) - Perimeter: $4 \times \text{side}$ - Trapezium (Trapezoid): - Area: $\frac{1}{2} (a + b) h$, where (a, b) are parallel sides, and (h) is height - Perimeter: sum of all sides

Circles: Key Formulas

Circles are fundamental in geometry, with their formulas rooted in radii, diameters, and angles.

Basic Parameters

- Radius (r): Distance from the center to any point on the circle - Diameter (d): $(d = 2r)$ - Circumference (perimeter): $[C = 2 \pi r = \pi d]$ - Area: $[A = \pi r^2]$

Sector and Segment Areas

- Area of a sector (angle (θ) in radians): $[\text{Sector Area} = \frac{1}{2} r^2 \theta]$ - Area of a segment: $[\text{Segment Area} = \text{Sector Area} - \frac{1}{2} r^2 \sin \theta]$

Ellipses, Parabolas, and Hyperbolas

While more advanced, these conic sections have their own critical formulas.

Ellipse

- Area: $[A = \pi a b]$ where (a) and (b) are the semi-major and semi-minor axes.

Parabola and Hyperbola

- Standard equations and their properties involve focus, directrix, and eccentricity, key for advanced applications.

3D Geometric Formulas: Volume and Surface Area

Moving into three dimensions, the formulas for volume and surface area enable spatial calculations essential in engineering and design.

Cube

- Volume: $V = a^3$ - Surface Area: $SA = 6a^2$

Rectangular Prism (Cuboid)

- Volume: $V = l \times w \times h$ - Surface Area: $SA = 2(lw + lh + wh)$

Sphere

- Volume: $V = \frac{4}{3}\pi r^3$

Questions & Answers About list of all geometry formulas

No	Question	Answer
1	What is the formula for calculating the area of a circle?	The area of a circle is given by the formula $A = \pi r^2$, where r is the radius of the circle.
2	How do you find the volume of a sphere?	The volume of a sphere is calculated using $V = \frac{4}{3}\pi r^3$, where r is the radius.
3	What is the Pythagorean theorem formula?	The Pythagorean theorem states that in a right-angled triangle, $a^2 + b^2 = c^2$, where c is the hypotenuse.
4	How do you compute the surface area of a cylinder?	The surface area of a cylinder is $A = 2\pi r(h + r)$, where r is radius and h is height.
5	What is the formula for calculating the volume of a cone?	The volume of a cone is $V = \frac{1}{3}\pi r^2 h$, with r as radius and h as height.

6	How do you find the area of a triangle using Heron's formula?	Heron's formula states that the area is $\sqrt{s(s - a)(s - b)(s - c)}$, where a, b, c are the triangle's sides and s is the semi-perimeter ($s = (a + b + c)/2$).
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