



Basic Geometric Shapes

Points, Lines, and Planes

Point	A location in space. Represented by a dot. Has no dimension.
Line	A straight, one-dimensional figure extending infinitely in both directions. Defined by two points.
Line Segment	A part of a line bounded by two distinct endpoints.
Ray	A part of a line that starts at one endpoint and extends infinitely in one direction.
Plane	A flat, two-dimensional surface that extends infinitely far. Defined by three non-collinear points.
Angle	Formed by two rays sharing a common endpoint (vertex). Measured in degrees or radians.

Triangles

Equilateral Triangle	All sides and angles are equal (60° each).
Isosceles Triangle	Two sides and two angles are equal.
Scalene Triangle	All sides and angles are different.
Right Triangle	One angle is 90° (right angle).
Acute Triangle	All angles are less than 90°.
Obtuse Triangle	One angle is greater than 90°.

Quadrilaterals

Square	Four equal sides and four right angles.
Rectangle	Opposite sides are equal and four right angles.
Parallelogram	Opposite sides are parallel and equal.
Rhombus	Four equal sides and opposite angles are equal.
Trapezoid	One pair of parallel sides.
Kite	Two pairs of adjacent sides are equal.

Angles and Lines

Angle Relationships

Complementary Angles	Two angles that add up to 90°.
Supplementary Angles	Two angles that add up to 180°.
Vertical Angles	Angles opposite each other when two lines intersect; they are equal.
Adjacent Angles	Angles that share a common vertex and side.
Alternate Interior Angles	Angles on opposite sides of the transversal and inside the parallel lines; they are equal.
Corresponding Angles	Angles in the same position relative to the transversal and parallel lines; they are equal.

Parallel and Perpendicular Lines

Parallel Lines	Lines in a plane that never intersect. They have the same slope.
Perpendicular Lines	Lines that intersect at a right angle (90°). Their slopes are negative reciprocals of each other.
Transversal	A line that intersects two or more other lines.
Angle Bisector	A line or ray that divides an angle into two equal angles.
Perpendicular Bisector	A line that is perpendicular to a line segment and passes through its midpoint.
Midpoint	The point that divides a line segment into two equal parts.

Area and Perimeter

Triangle Formulas

Area	$(1/2) * \text{base} * \text{height}$
Perimeter	$\text{side1} + \text{side2} + \text{side3}$
Heron's Formula (Area)	$\sqrt{s(s-a)(s-b)(s-c)}$, where $s = (a+b+c)/2$ (semi-perimeter)

Quadrilateral Formulas

Square Area	$\text{side} * \text{side}$ or side^2
Square Perimeter	$4 * \text{side}$
Rectangle Area	$\text{length} * \text{width}$
Rectangle Perimeter	$2 * (\text{length} + \text{width})$
Parallelogram Area	$\text{base} * \text{height}$
Parallelogram Perimeter	$2 * (\text{side1} + \text{side2})$
Trapezoid Area	$((\text{base1} + \text{base2}) / 2) * \text{height}$
Rhombus Area	$0.5 * \text{diagonal1} * \text{diagonal2}$

Circle Formulas

Area	$\pi * \text{radius}^2$
Circumference	$2 * \pi * \text{radius}$ or $\pi * \text{diameter}$

3D Shapes

Volume and Surface Area

Cube Volume	side^3
Cube Surface Area	$6 * \text{side}^2$
Rectangular Prism Volume	$\text{length} * \text{width} * \text{height}$

Rectangular Prism Surface Area	$2 * (\text{length} * \text{width} + \text{length} * \text{height} + \text{width} * \text{height})$
Sphere Volume	$\frac{4}{3} * \pi * \text{radius}^3$
Sphere Surface Area	$4 * \pi * \text{radius}^2$
Cylinder Volume	$\pi * \text{radius}^2 * \text{height}$
Cylinder Surface Area	$2 * \pi * \text{radius} * \text{height} + 2 * \pi * \text{radius}^2$
Cone Volume	$\frac{1}{3} * \pi * \text{radius}^2 * \text{height}$
Cone Surface Area	$\pi * \text{radius} * (\text{radius} + \text{sqrt}(\text{height}^2 + \text{radius}^2))$