Glossary

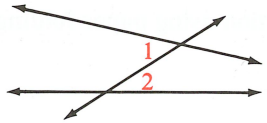
acute angle: An angle with measure between 0 and 90. (p. 17)

acute triangle: A triangle with three acute angles. (p. 93)

adjacent angles: Two angles in a plane that have a common vertex and a common side but no common interior points. (p. 19)

adjacent arcs: Arcs of a circle that have exactly one point in common. (p. 339)

alternate interior angles: Two nonadjacent interior angles on opposite sides of a transversal. Angles 1 and 2 are alternate interior angles. (p. 74)

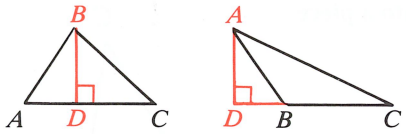


altitude of a parallelogram: Any segment perpendicular to the line containing a base from any point on the opposite side. (p. 424)

altitude of a solid: *See* prism, pyramid, cone, cylinder.

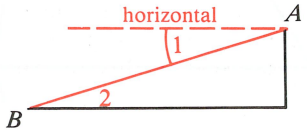
altitude of a trapezoid: Any segment perpendicular to a line containing one base from a point on the opposite base. (p. 435)

altitude of a triangle: The perpendicular segment from a vertex to the line containing the opposite side. In the figure, $\overline{BD}$ and $\overline{AD}$ are altitudes. (p. 152)



angle: A figure formed by two rays that have the same endpoint. The two rays are called the *sides* of the angle. Their common endpoint is the *vertex*. (p. 17)

angle of depression: When a point B is viewed from a higher point A, as shown by the diagram below, $\angle 1$ is the angle of depression. (p. 317)



angle of elevation: When a point A is viewed from a lower point B, as shown by the diagram at the left below, $\angle 2$ is the angle of elevation. (p. 317)

apothem: The (perpendicular) distance from the center of a regular polygon to a side. (p. 441)

auxiliary line: A line (or ray or segment) added to a diagram to help in a proof. (p. 94)

axes: Usually, two perpendicular lines used to establish a coordinate system. (p. 523)

axiom: A statement that is accepted without proof. (p. 12)

base of an isosceles triangle: *See* legs of an isosceles triangle.

base of a parallelogram: Any side of a parallelogram can be considered its base. The term *base* may refer to the line segment or its length. (p. 424)

base of a pyramid: *See* pyramid.

bases of a prism: *See* prism.

bases of a trapezoid: *See* trapezoid.

biconditional: A statement that contains the words "if and only if." (p. 34)

bisector of an angle: The ray that divides the angle into two congruent adjacent angles. (p. 19)

bisector of a segment: A line, segment, ray, or plane that intersects the segment at its midpoint. (p. 13)

center of a circle: *See* circle.

center of a regular polygon: The center of the circumscribed circle. (p. 441)

central angle of a circle: An angle with its vertex at the center of the circle. (p. 339)

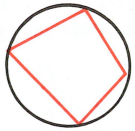
central angle of a regular polygon: An angle formed by two radii drawn to consecutive vertices. (p. 441)

chord: A segment whose endpoints lie on a circle. (p. 329)

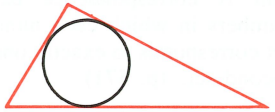
circle: The set of points in a plane that are a given distance from a given point in the plane. The given point is the *center*, and the given distance is the *radius*. (p. 329)

circumference of a circle: The perimeter of a circle given by the limiting number approached by the perimeters of a sequence of regular inscribed polygons. For radius r, $C = 2\pi r$. (p. 446)

circumscribed circle: A circle is circumscribed about a polygon when each vertex of the polygon lies on the circle. The polygon is *inscribed* in the circle. (p. 330)



circumscribed polygon: A polygon is *circumscribed* about a circle when each side of the polygon is tangent to the circle. The circle is *inscribed* in the polygon. (p. 334)



collinear points: Points all in one line. (p. 6)

common tangent: A line that is tangent to each of two coplanar circles. A common *internal* tangent intersects the segment joining the centers. A common *external* tangent does not intersect that segment. (p. 334)

complementary angles: Two angles whose measures have the sum 90. (p. 50)

composite of mappings: A transformation that combines two mappings. The composite of mappings S and T maps P to P'' where $T(P) = P'$ and $S(P') = P''$. Also called a product of mappings. (pp. 599, 605)

concentric circles: Circles that lie in the same plane and have the same center. (p. 330)

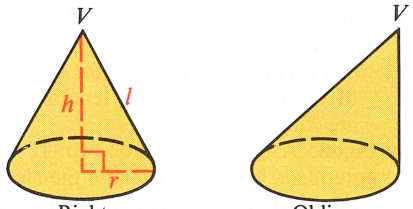
concentric spheres: Spheres that have the same center. (p. 330)

conclusion: *See* if-then statement.

concurrent lines: Two or more lines that intersect in one point. (p. 386)

conditional statement: *See* if-then statement.

cone: The diagrams illustrate a *right cone* and an *oblique cone*. Both have circular *bases* and a *vertex* V. In the right cone, h is the length of the *altitude*, l is the *slant height*, and r is the *radius*. (p. 490)



Right Oblique

congruence mapping: *See* isometry.

congruent angles: Angles that have equal measures. (p. 19)

congruent arcs: Arcs, in the same circle or in congruent circles, that have equal measures. (p. 340)

congruent circles (or spheres): Circles (or spheres) that have congruent radii. (p. 330)

congruent figures: Figures having the same size and shape. (p. 117)

congruent polygons: Polygons whose vertices can be matched up so that the corresponding parts (angles and sides) of the polygons are congruent. (p. 118)

congruent segments: Segments that have equal lengths. (p. 13)

contraction: *See* dilation.

contrapositive of a conditional: The contrapositive of the statement *If p, then q* is the statement *If not q, then not p*. (p. 208)

converse: The converse of the statement *If p, then q* is the statement *If q, then p*. (p. 33)

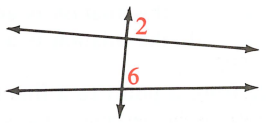
convex polygon: A polygon such that no line containing a side of the polygon contains a point in the interior of the polygon. (p. 101)

coordinate plane: The plane of the x-axis and the y-axis. (p. 523)

coplanar points: Points all in one plane. (p. 6)

corollary of a theorem: A statement that can be proved easily by applying the theorem. (p. 94)

corresponding angles: Two angles in corresponding positions relative to two lines. In the figure, $\measuredangle$ 2 and 6 are corresponding angles. (p. 74)

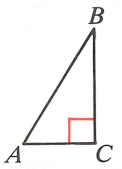


cosine (cos):

cosine of $\angle A = \dfrac{AC}{AB}$

or $\cos A = \dfrac{\text{adjacent}}{\text{hypotenuse}}$

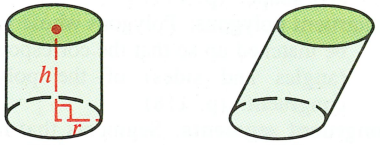
(p. 312)



counterexample: An example used to prove that an if-then statement is false. For that counterexample, the hypothesis is true and the conclusion is false. (p. 33)

cube: A rectangular solid with square faces. (p. 476)

cylinder: The diagrams illustrate a *right cylinder* and an *oblique cylinder*. In a right cylinder, the segment joining the centers of the circular *bases* is an *altitude*. The length of an altitude is the *height*, h, of the cylinder. A radius of a base is a *radius*, r, of the cylinder. (p. 490)



Right Oblique

decagon: A 10-sided polygon. (p. 101)

deductive reasoning: Proving statements by reasoning from accepted postulates, definitions, theorems, and given information. (p. 45)

diagonal: A segment joining two non-consecutive vertices of a polygon. (p. 102)

diameter: A chord that contains the center of a circle. (p. 329)

dilation: A dilation with center O and nonzero scale factor k maps any point P to a point P' determined as follows:

(1) If $k > 0$, P' lies on $\overrightarrow{OP}$ and $OP' = k \cdot OP$.

(2) If $k < 0$, P' lies on the ray opposite $\overrightarrow{OP}$ and $OP' = |k| \cdot OP$.

(3) The center O is its own image.

If $|k| > 1$, the dilation is an *expansion*.

If $|k| < 1$, the dilation is a *contraction*. (p. 592)

distance from a point to a line (or plane): The length of the perpendicular segment from the point to the line (or plane). (p. 154)

dot product: For vectors (a, b) and (c, d), the number $ac + bd$. The dot product of perpendicular vectors is zero. (p. 543)

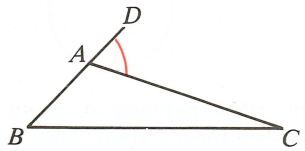
equal vectors: Vectors with the same magnitude and the same direction. (p. 540)

equiangular triangle: A triangle with all angles congruent. (p. 93)

equilateral triangle: A triangle with all sides congruent. (p. 93)

expansion: *See* dilation.

exterior angle of a triangle: The angle formed when one side of the triangle is extended. $\angle DAC$ is an exterior angle of $\triangle ABC$, and $\measuredangle B$ and C are *remote interior angles* with respect to $\angle DAC$. *Exterior angle* is also applied to other polygons. (p. 95)



function: A correspondence between sets of numbers in which each number in the first set corresponds to exactly one number in the second set. (p. 571)

geometric mean: If a, b, and x are positive numbers with $\frac{a}{x} = \frac{x}{b}$, then x is the geometric mean between a and b. (p. 285)

glide: *See* translation.

glide reflection: A transformation in which every point P is mapped to a point P'' by these steps: (1) a glide maps P to P', and (2) a reflection in a line parallel to the glide line maps P' to P″. (p. 584)

glide reflection symmetry: A figure has glide reflection symmetry if there is a glide reflection that maps the figure onto itself. (p. 610)

golden ratio: *See* golden rectangle.

golden rectangle: A rectangle such that its length l and width w satisfy the equation $\frac{l}{w} = \frac{l + w}{l}$. The ratio $l:w$ is called the *golden ratio*. (p. 253)

great circle: The intersection of a sphere with any plane passing through the center of the sphere. (p. 331)

half-turn: A rotation through 180°. (p. 589)

height: The length of an altitude of a polygon or solid. (p. 424)

Heron's formula: A formula for finding the area of a triangle when the lengths of its sides are known. (p. 434)

hexagon: A 6-sided polygon. (p. 101)

hypotenuse: In a right triangle the side opposite the right angle. The other two sides are called *legs*. (p. 141)

hypothesis: *See* if-then statement.

identity transformation: The mapping that maps every point to itself. (p. 605)

if-then statement: A statement whose basic form is *If p, then q*. Statement p is the *hypothesis* and statement q is the *conclusion*. (p. 33)

image: *See* mapping.

indirect proof: A proof in which you assume temporarily that the conclusion is not true, and then deduce a contradiction. (p. 214)

inductive reasoning: A kind of reasoning in which the conclusion is based on several past observations. (p. 106)

inscribed angle: An angle whose vertex is on a circle and whose sides contain chords of the circle. (p. 349)

inscribed circle: *See* circumscribed polygon.

inscribed polygon: *See* circumscribed circle.

intersection of two figures: The set of points that are in both figures. (p. 6)

inverse of a conditional: The inverse of the statement *If p, then q* is the statement *If not p, then not q*. (p. 208)

inverse of a transformation: The inverse of T is the transformation S such that $S \circ T = I$. (p. 606)

isometry: A transformation that maps every segment to a congruent segment. Also called a *congruence mapping*. (p. 572)

isosceles trapezoid: A trapezoid with congruent legs. (p. 190)

isosceles triangle: A triangle with at least two sides congruent. (p. 93)

kite: A quadrilateral that has two pairs of congruent sides, but opposite sides are not congruent. (p. 193)

lateral area of a prism: The sum of the areas of its lateral faces. (p. 476)

lateral edges of a prism: *See* prism.

lateral edges of a pyramid: *See* pyramid.

lateral faces of a prism: *See* prism.

lateral faces of a pyramid: *See* pyramid.

legs of an isosceles triangle: The two congruent sides. The third side is the *base*. (p. 134)

legs of a right triangle: *See* hypotenuse.

legs of a trapezoid: *See* trapezoid.

length of a segment: The distance between its endpoints. (p. 11)

linear equation: An equation whose graph is a line. (p. 548)

line symmetry: A figure has line symmetry if there is a symmetry line k such that the reflection R_k maps the figure onto itself. (p. 609)

locus: The set of all points, and only those points, that satisfy one or more conditions. (p. 401)

logically equivalent statements: Statements that are either both true or both false. (p. 208)

magnitude of a vector $\overrightarrow{AB}$: The length AB. (p. 539)

major arc: *See* minor and major arcs.

mapping: A correspondence between points. Each point P in a given set is *mapped* to exactly one point P' in the same or a different set. P' is called the *image* of P, and P is called the *preimage* of P'. (p. 571)

measure of a major arc: *See* minor and major arcs.

measure of a minor arc: *See* minor and major arcs.

measure of an angle: A unique positive number, less than or equal to 180, that is paired with the angle. (p. 17)

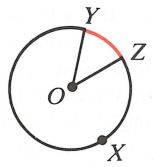
measure of a semicircle: *See* semicircles.

median of a trapezoid: The segment that joins the midpoints of the legs. (p. 191)

median of a triangle: A segment from a vertex to the midpoint of the opposite side. (p. 152)

midpoint of a segment: The point that divides the segment into two congruent segments. (p. 13)

minor and major arcs: $\overset{\frown}{YZ}$ is a minor arc of $\odot O$. $\overset{\frown}{YXZ}$ is a major arc. The *measure of a minor arc* is the measure of its central angle, here $\angle YOZ$. The *measure of a major arc* is found by subtracting the measure of the minor arc from 360. (p. 339)



***n*–gon:** A polygon of n sides. (p. 101)

oblique solid: *See* cone, cylinder, prism.

obtuse angle: An angle with measure between 90 and 180. (p. 17)

obtuse triangle: A triangle with one obtuse angle. (p. 93)

octagon: An 8-sided polygon. (p. 101)

quadrant: Any one of the four regions into which the plane is divided by the coordinate axes. (p. 523)

quadrilateral: A 4-sided polygon. (p. 101)

radius of a circle: *See* circle.

radius of a regular polygon: The distance from the center to a vertex. (p. 441)

radius of a right cylinder: *See* cylinder.

ratio: The ratio of x to y ($y \neq 0$) is $\frac{x}{y}$ and is sometimes written $x:y$. (pp. 241, 242)

ray: The ray AC ($\overrightarrow{AC}$) consists of segment $\overline{AC}$ and all other points P such that C is between A and P. The point named first, here A, is the *endpoint of* $\overrightarrow{AC}$. (p. 11)

rectangle: A quadrilateral with four right angles. (p. 184)

rectangular solid: A right rectangular prism. (p. 475) *See also* prism.

reflection: A transformation in which a *line of reflection* acts like a mirror, reflecting points to their images. A reflection in a line m maps every point P to a point P' such that: (1) if P is not on line m, then m is the perpendicular bisector of $\overline{PP'}$; and (2) if P is on line m, then $P' = P$. (p. 577)

regular polygon: A polygon that is both equiangular and equilateral. (p. 103)

regular pyramid: *See* pyramid.

remote interior angles: *See* exterior angle of a triangle.

rhombus: A quadrilateral with four congruent sides. (p. 184)

right angle: An angle with measure 90. (p. 17)

right solid: *See* cone, cylinder, prism.

right triangle: A triangle with one right angle. (p. 93)

rotation: A rotation about point O through $x°$ is a transformation such that: (1) if point P is different from O, then $OP' = OP$ and $m\angle POP' = x$; and (2) if point P is the same as O, then $P' = P$. (p. 588)

rotational symmetry: A figure has rotational symmetry if there is a rotation that maps the figure onto itself. (p. 609)

same-side interior angles: Two interior angles on the same side of a transversal. (p. 74)

scalar multiple of a vector: The product of the vector (a, b) and the real number k is the scalar multiple (ka, kb). (p. 540)

scale factor: For similar polygons, the ratio of the lengths of two corresponding sides. (p. 249)

scalene triangle: A triangle with no sides congruent. (p. 93)

secant of a circle: A line that contains a chord. (p. 329)

sector of a circle: A region bounded by two radii and an arc of the circle. (p. 452)

segment of a line: Two points on the line and all points between them. The two points are called the *endpoints* of the segment. (p. 11)

segments divided proportionally: $\overline{AB}$ and $\overline{CD}$ are divided proportionally if points L and M lie on $\overline{AB}$ and $\overline{CD}$, respectively, and $\frac{AL}{LB} = \frac{CM}{MD}$. (p. 269)

semicircles: The two arcs of a circle that are cut off by a diameter. The *measure of a semicircle* is 180. (p. 339)

sides of an angle: *See* angle.

sides of a triangle: *See* triangle.

similarity mapping: A transformation that maps any figure to a similar figure. *See also* dilation. (p. 593)

similar polygons: Two polygons are similar if their vertices can be paired so that corresponding angles are congruent and corresponding sides are in proportion. (p. 249)

similar solids: Solids that have the same shape but not necessarily the same size. (p. 508)

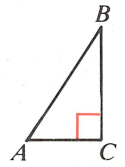
simplest form of a radical: No perfect square factor other than 1 is under the radical sign, no fraction is under the radical sign, and no fraction has a radical in its denominator. (p. 287)

sine (sin):

sine of $\angle A = \frac{BC}{AB}$

or $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$

(p. 312)



skew lines: Lines that are not coplanar. (p. 73)

slant height of a regular pyramid: *See* pyramid.

slant height of a right cone: *See* cone.

slope of a line: The steepness of a nonvertical line, defined by $m = \frac{y_2 - y_1}{x_2 - x_1}$, $x_1 \neq x_2$, where $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ are two points on the line. (p. 529)

space: The set of all points. (p. 6)

one-to-one mapping (or function): A mapping (or function) from set A to set B in which every member of B has exactly one preimage in A. (p. 571)

opposite rays: Given three collinear points R, S, T: If S is between R and T, then $\overrightarrow{SR}$ and $\overrightarrow{ST}$ are opposite rays. (p. 11)

origin: The intersection point, denoted $O(0, 0)$, of the x-axis and the y-axis in a coordinate plane. (p. 523)

parallel line and plane: A line and a plane that do not intersect. (p. 73)

parallel lines: Coplanar lines that do not intersect. (p. 73)

parallelogram: A quadrilateral with both pairs of opposite sides parallel. (p. 167)

parallel planes: Planes that do not intersect. (p. 73)

pentagon: A 5-sided polygon. (p. 101)

perimeter of a polygon: The sum of the lengths of its sides. (p. 445)

perpendicular bisector of a segment: A line (or ray or segment) that is perpendicular to the segment at its midpoint. (p. 153)

perpendicular line and plane: A line and a plane are perpendicular if and only if they intersect and the line is perpendicular to all lines in the plane that pass through the point of intersection. (p. 128)

perpendicular lines: Two lines that intersect to form right angles. (p. 56)

plane symmetry: A figure in space has plane symmetry if there is a symmetry plane X such that reflection in the plane maps the figure onto itself. (p. 610)

point of tangency: *See* tangent to a circle.

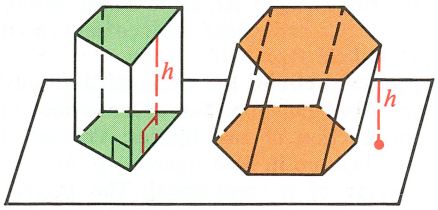
point symmetry: A figure has point symmetry if there is a symmetry point O such that the half-turn H_O maps the figure onto itself. (p. 609)

polygon: A plane figure formed by coplanar segments (*sides*) such that (1) each segment intersects exactly two other segments, one at each endpoint; and (2) no two segments with a common endpoint are collinear. (p. 101)

postulate: A statement that is accepted without proof. (p. 12)

preimage: *See* mapping.

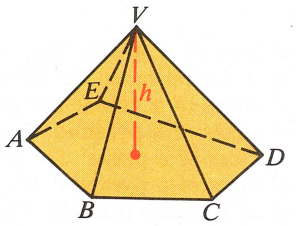
prism: The solids shown are *prisms*. The shaded faces are the *bases* (congruent polygons lying in parallel planes). The other faces are *lateral faces* and all are parallelograms. Adjacent lateral faces intersect in parallel segments called *lateral edges*. An *altitude* of a prism is a segment joining the two base planes and perpendicular to both. The length of an altitude is the *height*, h, of the prism. Figure (A), in which the lateral faces are rectangles, is called a *right prism*. Figure (B) is an *oblique prism*. (p. 475)



product of mappings: *See* composite of mappings.

proportion: An equation stating that two ratios are equal. The first and last terms are the *extremes*; the middle terms are the *means*. (pp. 242, 245)

pyramid: The diagram shows a pyramid. Point V is its *vertex*; the pentagon $ABCDE$ is its *base*. The five triangular faces meeting at V are *lateral faces*; they intersect in segments called *lateral edges*. The segment from the vertex perpendicular to the base is the *altitude*, and its length is the *height*, h, of the pyramid.



In a *regular pyramid*, the base is a regular polygon, all lateral edges are congruent, all lateral faces are congruent isosceles triangles, and the altitude meets the base at its center. The height of a lateral face is the *slant height* of the pyramid. (p. 482)

Pythagorean triple: Any triple of positive integers a, b, and c, such that $a^2 + b^2 = c^2$. (p. 299)

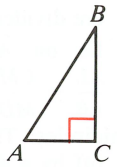
sphere: The set of all points in space that are a given distance from a given point. (p. 329)
square: A quadrilateral with four right angles and four congruent sides. (p. 184)
straight angle: An angle with measure 180. (p. 17)
sum of two vectors: The sum of the vectors (a, b) and (c, d) is the vector $(a + c, b + d)$. (p. 541)
supplementary angles: Two angles whose measures have the sum 180. (p. 50)
symmetry: A figure in the plane has symmetry if there is an isometry, other than the identity, that maps the figure onto itself. (p. 609)

tangent (tan):

$$\text{tangent of } \angle A = \frac{BC}{AC}$$

$$\text{or } \tan A = \frac{\text{opposite}}{\text{adjacent}}$$

(p. 305)



tangent circles: Coplanar circles that are tangent to the same line at the same point. (p. 334)
tangent to a circle: A line in the plane of the circle that intersects the circle in exactly one point, called the *point of tangency*. (p. 329)
tessellation: A pattern in which congruent copies of a figure completely fill the plane without overlapping. (p. 610)
theorem: A statement that can be proved. (p. 23)
total area of a prism: The sum of the areas of all its faces. (p. 476)
transformation: A one-to-one mapping from the whole plane to the whole plane. (p. 572)
translation: A transformation that glides all points of the plane the same distance in the same direction, and maps any point (x, y) to the point $(x + a, y + b)$ where a and b are constants. Also called a *glide*. (pp. 583, 584)
translational symmetry: A figure has translational symmetry if there is a translation that maps the figure onto itself. (p. 610)
transversal: A line that intersects two or more coplanar lines in different points. (p. 74)
trapezoid: A quadrilateral with exactly one pair of parallel sides, called *bases*. The other sides are *legs*. (p. 190)
triangle: The figure formed by three segments joining three noncollinear points. Each of the three points is a *vertex* of the triangle and the segments are the *sides*. (p. 93)

vector: Any quantity that has both magnitude and direction. (p. 539)
Venn diagram: A circle diagram that may be used to represent a conditional. (p. 208)
vertex angle of an isosceles triangle: The angle opposite the base. (p. 134)
vertex of an angle: *See* angle.
vertex of a pyramid: *See* pyramid.
vertex of a triangle: *See* triangle.
vertical angles: Two angles whose sides form two pairs of opposite rays. $\measuredangle$ 1 and 2 are vertical angles, as are $\measuredangle$ 3 and 4. (p. 51)