

# Appendix

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# Glossary

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## A

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**acute triangle** An acute triangle is a triangle with all three angles less than  $90^\circ$ .

**altitude** An altitude of a triangle is a line segment connecting a vertex to the line containing the opposite side and perpendicular to that side.

### **angle-angle-angle (AAA) similarity**

The angle-angle-angle (AAA) similarity test says that if two triangles have corresponding angles that are congruent, then the triangles are similar. Because the sum of the angles in a triangle must be  $180^\circ$ , we really only need to know that two pairs of corresponding angles are congruent to know the triangles are similar.

**angle bisector** An angle bisector is a ray that cuts the angle exactly in half, making two equal angles.

## C

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**central angle** A central angle is an angle with its vertex at the center of a circle.

**centroid** The centroid of a triangle is the point where the three medians meet. This point is the center of mass for the triangle. If you cut a triangle out of a piece of paper and put your pencil point at the centroid, you could balance the triangle.

**circle** A circle is the set of all points in a plane that are equidistant from a given point in the plane, which is the center of the circle.

**circumcenter** The circumcenter of a triangle is the point where the three perpendicular bisectors meet. This point is the same distance from each of the three vertices of the triangles.

**concave polygon** A concave polygon is any polygon with an angle measuring more than  $180^\circ$ . Concave polygons look like they are collapsed or have one or more angles dented in.

**concurrent** When three or more lines meet at a single point, they are said to be concurrent. In a triangle, the three medians, three perpendicular bisectors, three angle bisectors, and three altitudes are each concurrent.

**congruent** Two figures are congruent if all corresponding lengths are the same, and if all corresponding angles have the same measure. Colloquially, we say they “are the same size and shape,” though they may have different orientation. (One might be rotated or flipped compared to the other.)

**congruent triangles** Congruent triangles are triangles that have the same size and shape. In particular, corresponding angles have the same measure, and corresponding sides have the same length.

**converse** Converse means the “if” and “then” parts of a sentence are switched. For example, “If two numbers are both even, then their sum is even” is a true statement. The converse would be “If the sum of two numbers is even, then the numbers are even,” which is not a true statement.

**convex polygon** A convex polygon is any polygon that is not concave.

**coordinates** Points are geometric objects that have only location. To describe their location, we use coordinates. We begin with a standard reference frame (typically the x- and y-axes). The coordinates of a point describe where it is located with respect to this reference frame. They are given in the form  $(x,y)$  where the x represents how far the point is from 0 along the x-axis, and the y represents how far it is from 0 along the y-axis. The form  $(x,y)$  is a standard convention that allows everyone to mean the same thing when they reference any point.

**cosine** If angle A is an acute angle in a right triangle, the cosine of A is the length of the side adjacent to angle A, divided by the length of the hypotenuse of the triangle. We often abbreviate this as  $\cos A = (\text{adjacent})/(\text{hypotenuse})$ .

**cross section** A cross section is the face you get when you make one slice through an object.

## D

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**diameter** A circle’s diameter is a segment that passes through the center and has its endpoints on the circle.

# Glossary, cont'd.

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## E

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**edge** An edge is a line segment where two faces intersect.

**equilateral triangle** An equilateral triangle is a triangle with three equal sides.

## F

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**face** A face is a polygon by which a solid object is bound. For example, a cube has six faces. Each face is a square.

**frieze pattern** A frieze pattern is an infinite strip containing a symmetric pattern.

## G

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**glide reflection** A glide reflection is a combination of two transformations: a reflection over a line followed by a translation in the same direction as the line.

## H

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**hypotenuse** The hypotenuse in a right triangle is the side of the triangle that is opposite to the right angle.

## I

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**incenter** The incenter of a triangle is the point where the three angle bisectors meet. This point is the same distance from each of the three sides of the triangle.

**inscribed angle** An inscribed angle is an angle whose vertex is on a circle and whose rays intersect the circle.

**intercept** An intercept is an intersection of a graph with one of the axes. An intersection with the horizontal axis is often referred to as an x-intercept, and an intersection with the vertical axis is often referred to as a y-intercept.

**irregular polygon** An irregular polygon is any polygon that is not regular.

**isosceles trapezoid** An isosceles trapezoid is a quadrilateral with one pair of parallel sides and congruent base angles, or it is a trapezoid with congruent base angles.

**isosceles triangle** An isosceles triangle is a triangle with two equal sides.

## K

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**kite** A kite is a quadrilateral that has two pairs of adjacent sides congruent (the same length).

## L

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**line** A line has only one dimension: length. It continues forever in two directions (so it has infinite length), but it has no width at all. A line connects two points via the shortest path, and then continues on in both directions.

**line segment** A line segment is the portion of a line lying strictly between two points. It has a finite length and no width.

**line symmetry** or **reflection symmetry** A polygon has line symmetry, or reflection symmetry, if you can fold it in half along a line so that the two halves match exactly. The folding line is called the line of symmetry.

## M

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**median** A median is a segment connecting any vertex of a triangle to the midpoint of the opposite side.

**midline** A midline is a segment connecting two consecutive midpoints of a triangle.

**midline theorem** The midline theorem states that a midline of a triangle creates a segment that is parallel to the base and half as long.

## N

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**net** A net is a two-dimensional representation of a three-dimensional object.

## O

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**obtuse triangle** An obtuse triangle is a triangle with one angle more than  $90^\circ$ .

**orthocenter** The orthocenter of a triangle is the point where the three altitudes meet, making them concurrent.

# Glossary, cont'd.

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## P

**parallel lines** Parallel lines are two lines in the same plane that never intersect. Another way to think about parallel lines is that they are “everywhere equidistant.” No matter where you measure, the perpendicular distance between two parallel lines is constant.

**parallelogram** A parallelogram is a quadrilateral that has two pairs of opposite sides that are parallel.

**perpendicular bisector** The perpendicular bisector of a line segment is perpendicular to that segment and bisects it; that is, it goes through the midpoint of the segment, creating two equal segments.

**plane** A plane is a flat, two-dimensional object. We often represent a plane by a piece of paper, a blackboard, or the top of a desk. In fact, none of these is actually a plane, because a plane must continue infinitely in all directions and have no thickness at all. A plane can be defined by two intersecting lines or by three non-collinear points.

**Platonic solid** A Platonic solid is a solid such that all of its faces are congruent regular polygons and the same number of regular polygons meet at each vertex.

**point** A point specifies only location; it has no length, width, or depth. We usually represent a point with a dot on paper, but the dot we make has some dimension, while a true point has dimension 0.

**polygon** A polygon is a two-dimensional geometric figure with these characteristics:

It is made of straight line segments.

Each segment touches exactly two other segments, one at each of its endpoints.

It is closed—it divides the plane into two distinct regions, one inside and the other outside the polygon.

**polyhedron** A polyhedron is a closed three-dimensional figure. All of the faces are made up of polygons.

**Pythagorean theorem** The Pythagorean theorem states that if you have a right triangle, then the square built on the hypotenuse is equal to the sum of the squares built on the other two sides.  $a^2 + b^2 = c^2$

## Q

**quadrilateral** A quadrilateral is a polygon with exactly four sides.

## R

**radius** The radius of a circle is the distance from the circle's center to a point on the circle, and is constant for a given circle.

**ray** A ray can be thought of as a half a line. It has a point on one end, and it extends infinitely in the other direction.

**rectangle** A rectangle is a quadrilateral with four right angles.

**reflection** Reflection is a rigid motion, meaning an object changes its position but not its size or shape. In a reflection, you create a mirror image of the object. There is a particular line that acts like the mirror. In reflection, the object changes its orientation (top and bottom, left and right). Depending on the location of the mirror line, the object may also change location.

**regular polygon** A regular polygon has sides that are all the same length and angles that are all the same size.

**rhombus** A rhombus is a quadrilateral that has all four sides congruent.

**right triangle** A right triangle is a triangle with one right ( $90^\circ$ ) angle.

**rotation** Rotation is a rigid motion, meaning an object changes its position but not its size or shape. In a rotation, an object is turned about a “center” point, through a particular angle. (Note that the “center” of rotation is not necessarily the “center” of the object or even a point on the object.) In a rotation, the object changes its orientation (top and bottom). Depending on the location of the center of rotation, the object may also change location.

**rotation symmetry** A figure has rotation symmetry if you can rotate (or turn) that figure around a center point by fewer than  $360^\circ$  and the figure appears unchanged.

# Glossary, cont'd.

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## S

**scalene triangle** A scalene triangle is a triangle with all three sides unequal.

**side-angle-side (SAS) congruence** Side-angle-side (SAS) congruence states that if any two sides of a triangle are equal in length to two sides of another triangle and the angles between each pair of sides have the same measure, then the two triangles are congruent; that is, they have exactly the same shape and size.

**side-angle-side (SAS) similarity** The side-angle-side (SAS) similarity test says that if two triangles have two pairs of sides that are proportional and the included angles are congruent, then the triangles are similar.

**side-side-side (SSS) congruence** The side-side-side (SSS) congruence states that if the three sides of one triangle have the same lengths as the three sides of another triangle, then the two triangles are congruent.

**side-side-side (SSS) similarity** The side-side-side (SSS) similarity test says that if two triangles have all three pairs of sides in proportion, the triangles must be similar.

**similar** Two polygons are similar polygons if corresponding angles have the same measure and corresponding sides are in proportion.

**similar triangles** Similar triangles are triangles that have the same shape but possibly different size. In particular, corresponding angles are congruent, and corresponding sides are in proportion.

**sine** If angle  $A$  is an acute angle in a right triangle, the sine of  $A$  is the length of the side opposite to angle  $A$  divided by the length of the hypotenuse of the triangle. We often abbreviate this as  $\sin A = (\text{opposite})/(\text{hypotenuse})$ .

**square** A square is a regular quadrilateral.

**symmetry** A design has symmetry if you can move the entire design by either rotation, reflection, or translation, and the design appears unchanged.

## T

**tangent** If angle  $A$  is an acute angle in a right triangle, the tangent of  $A$  is the length of the side opposite to angle  $A$  divided by the length of the side adjacent to angle  $A$ . We often abbreviate this as  $\tan A = (\text{opposite})/(\text{adjacent})$ .

**tangram** A tangram is a seven-piece puzzle made from a square. A typical tangram set contains two large isosceles right triangles, one medium isosceles right triangle, two small isosceles right triangles, a square, and a parallelogram.

**theorem** A theorem in mathematics is a proven fact. A theorem about right triangles must be true for every right triangle; there can be no exceptions. Just showing that an idea works in several cases is not enough to make an idea into a theorem.

**translation** Translation is a rigid motion, meaning an object changes its position but not its size or shape. In a translation, an object is moved in a given direction for a particular distance. A translation is therefore usually described by a vector, pointing in the direction of movement and with the appropriate length. In translation, the object changes its location, but not its orientation (top and bottom, left and right).

**translation symmetry** Translation symmetry can be found only on an infinite strip. For translation symmetry, you can slide the whole strip some distance, and the pattern will land back on itself.

**transversal** A transversal is a line that passes through (transverses) two other lines. We often consider what happens when the two other lines are parallel to each other.

**trapezoid** A trapezoid is a quadrilateral that has one pair of opposite sides that are parallel.

**triangle inequality** The triangle inequality says that for three lengths to make a triangle, the sum of the lengths of any two sides must be greater than the third length.

# Glossary, cont'd.

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## V

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**van Hiele levels** Van Hiele levels make up a theory of five levels of geometric thought developed by Dutch educators Pierre van Hiele and Dina van Hiele-Geldof. The levels are (0) visualization, (1) analysis, (2) informal deduction, (3) deduction, and (4) rigor. The theory is useful for thinking about what activities are appropriate for students, what activities prepare them to move to the next level, and for designing activities for students who may be at different levels.

**vector** A vector can be used to describe a translation. It is drawn as an arrow. The arrowhead points in the direction of the translation, and the length of the vector tells you the length of the translation.

**Venn diagram** A Venn diagram uses circles to represent relationships among sets of objects.

**vertex** A vertex is the point where two sides of a polygon meet.

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