

NYS Mathematics Glossary* – Geometry

(*This glossary has been amended from the full SED Commencement Level Glossary of Mathematical Terms (available at <http://www.emsc.nysed.gov/ciai/mst/math/glossary/home.html>) to list only terms indicated to be at the Geometry level.)

This Glossary, intended for teacher use only, provides an understanding of the mathematical terms used in the Regents-approved course entitled Geometry (as reflected in the NYS Mathematics Core Curriculum).

A

AA triangle similarity If there exists a one-to-one correspondence between the vertices of two triangles such that two angles of one triangle are congruent to the corresponding two angles of the second triangle, then the two triangles are similar.

AAS triangle congruence If there exists a one-to-one correspondence between the vertices of two triangles such that two angles and the side opposite one of them in one triangle are congruent to the corresponding parts of the second triangle, then two triangles are congruent.

ASA triangle congruence If there exists a one-to-one correspondence between the vertices of two triangles such that two angles and the included side of one triangle are congruent to the corresponding parts of the second triangle, then two triangles are congruent.

abscissa The horizontal or x-coordinate of a two-dimensional coordinate system.

absolute value The distance from 0 to a number n on a number line. The absolute value of a number n is indicated by $|n|$.

Example: $|-3| = 3$, $|+3| = 3$, and $|0| = 0$.

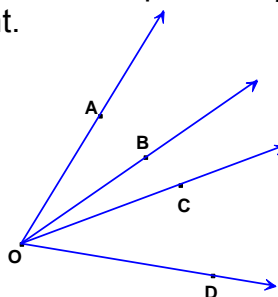
acute angle An angle whose measure is greater than 0° and less than 90° .

acute triangle A triangle that contains three acute angles.

additive property of equality If a , b , and c are real numbers such that $a = b$, then $a + c = b + c$.

adjacent angles Two coplanar angles that share a common vertex and a common side but have no common interior points.

Example: In the figure below, $\angle AOB$ and $\angle BOC$ are a pair of adjacent angles, but $\angle AOC$ and $\angle BOD$ are not adjacent.



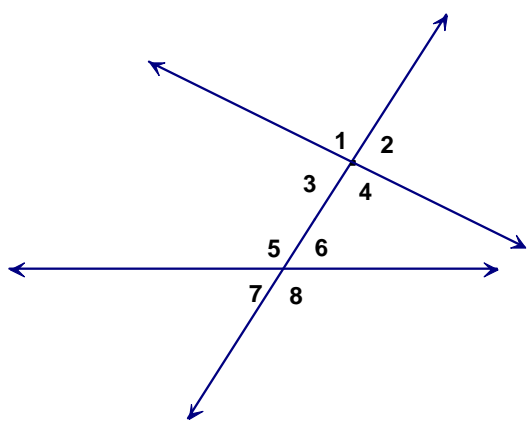
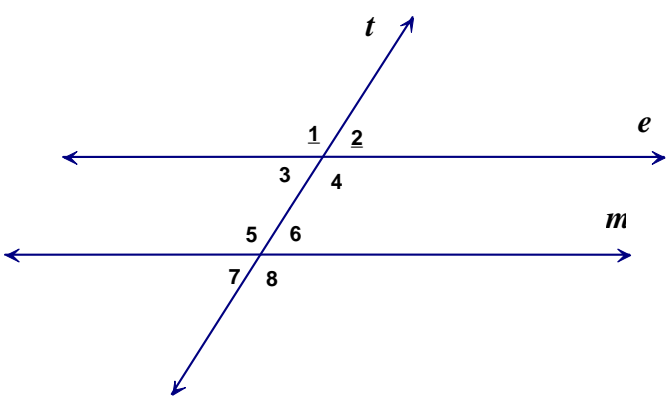
adjacent sides Two sides of any polygon that share a common vertex.

algebraic representation The use of an equation or algebraic expression to model a mathematical relationship.

algorithm a defined series of steps for carrying out a computation or process.

alternate interior angles Any two nonadjacent angles that lie on opposite sides of a transversal and that are interior to the lines. Note: As illustrated in the second example, the lines do *not* need to be parallel.

Example: In both diagrams below, $\angle 4$ and $\angle 5$, and $\angle 3$ and $\angle 6$ are pairs of alternate interior angles.

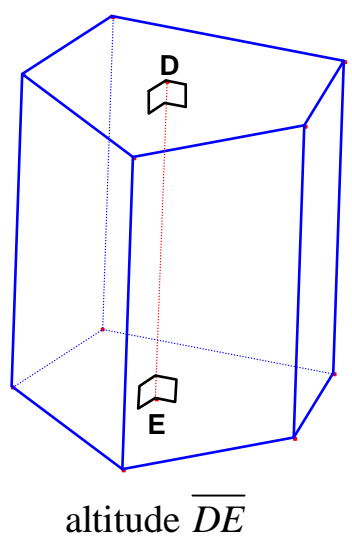
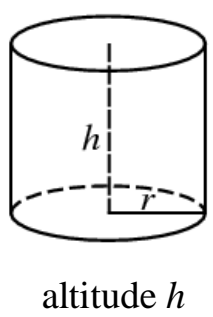
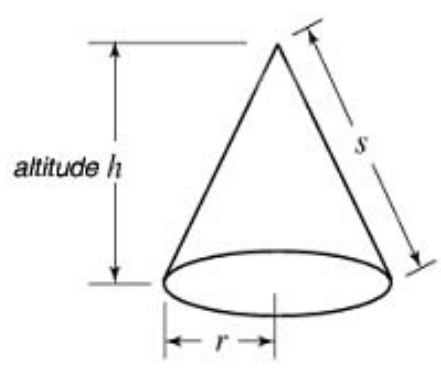


altitude ...

Of a *cone*: A line segment drawn from the vertex of the cone perpendicular to the plane containing its base.

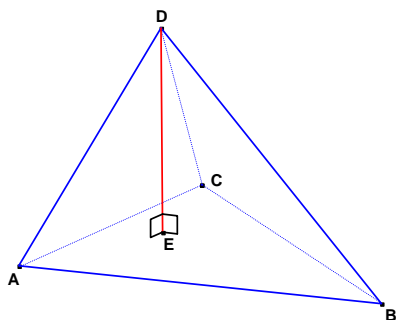
Of a *cylinder*: A line segment drawn from any point on one base of a cylinder perpendicular to the plane containing its other base.

Of a *prism*: A line segment drawn from any point of one base of the prism perpendicular to the plane containing its other base.

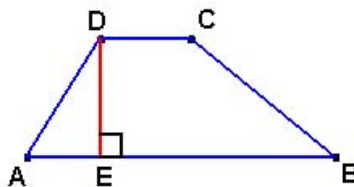


altitude (continued ...)

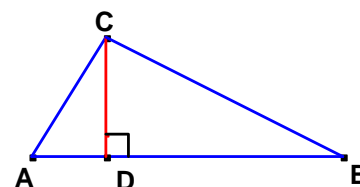
Of a pyramid: A line segment drawn from the vertex of the pyramid perpendicular to the plane containing its base.

altitude \overline{DE}

Of a trapezoid: A line segment drawn from any point on one base of the trapezoid perpendicular to the other base.

altitude \overline{DE}

Of a triangle: A line segment drawn from any vertex of the triangle perpendicular to the line containing its opposite side.

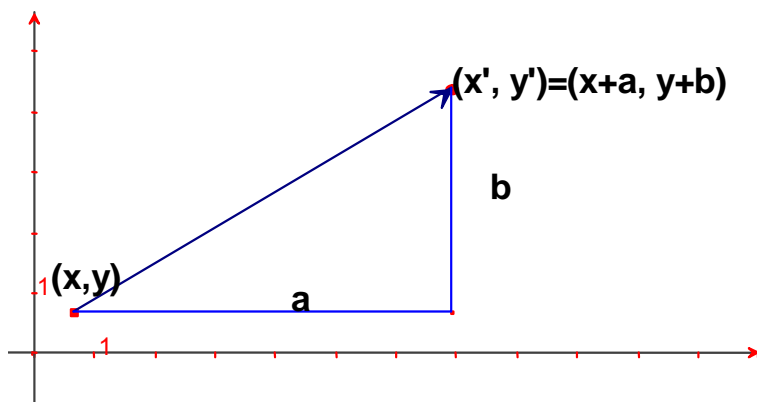
altitude \overline{CD}

analytical geometry An approach to geometry in which the points of a figure are represented by coordinates on the Cartesian plane and algebraic methods of reasoning are used to study the figure.

analytical geometric proof A proof in geometry that employs the coordinate system and algebraic reasoning.

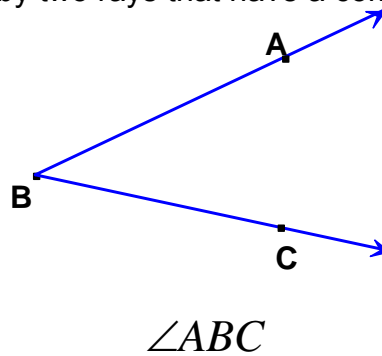
analytical representation of a transformation The functional notation of a transformation using analytical equations.

Example: $T_{a,b}(x, y) = (x+a), (y+b) = (x', y')$ where $x' = x+a$ and $y' = y+b$ is a translation that moves points a units in the x direction and b units in the y direction. See figure below.



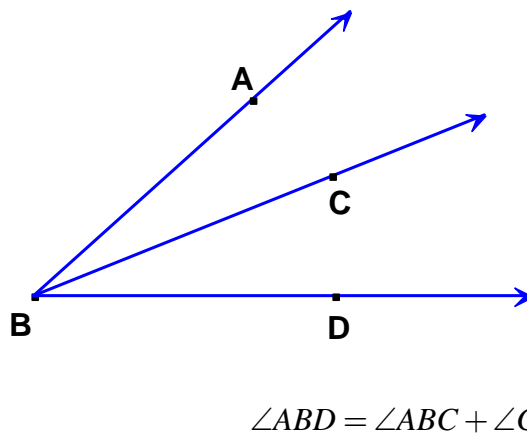
analyze to examine methodically by separating into parts and studying their relationships.

angle A geometric figure formed by two rays that have a common endpoint.



angle addition postulate If $\angle ABC$ and $\angle CBD$ are adjacent angles then $\angle ABD = \angle ABC + \angle CBD$.

Example:



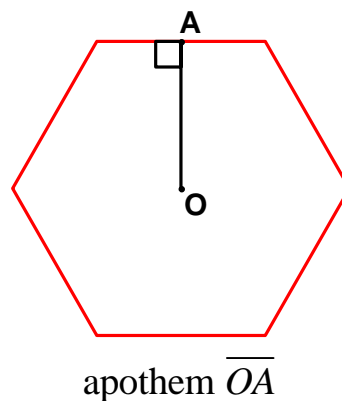
angle bisector A ray that divides an angle into two adjacent congruent angles.

angle measure The number of degrees or radians in an angle.

antecedent The “if” part of a conditional (if..., then...) statement. (See hypothesis.)

apothem A line segment drawn from the center of a regular polygon perpendicular to a side of the polygon.

Example:



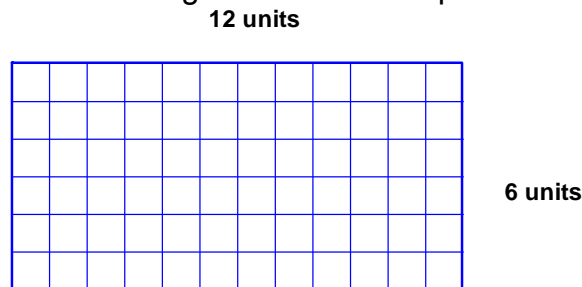
arc length The distance on the circumference of a circle from one endpoint of an arc to the other endpoint, measured along the arc.

arc measure The measure of an arc of the circle in degrees or radians; a unique real number between 0 degrees and 360 degrees or between zero and 2π radians.

arc of a circle See major arc, minor arc.

area of a polygon The unique real number assigned to any polygon which indicates the number of non-overlapping square units contained in the polygon's interior.

Example: The area of the rectangle shown is 72 square units.



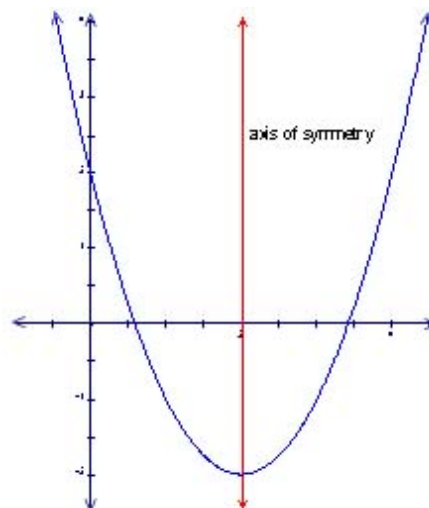
Area=72 square units

argument The communication, in verbal or written form, of the reasoning process that leads to a valid conclusion.

axiom A statement that is accepted without proof.

axis of symmetry A line that divides a plane figure into two congruent reflected halves; Any line through a figure such that a point on one side of the line is the same distance to the axis as its corresponding point on the other side.

Example:

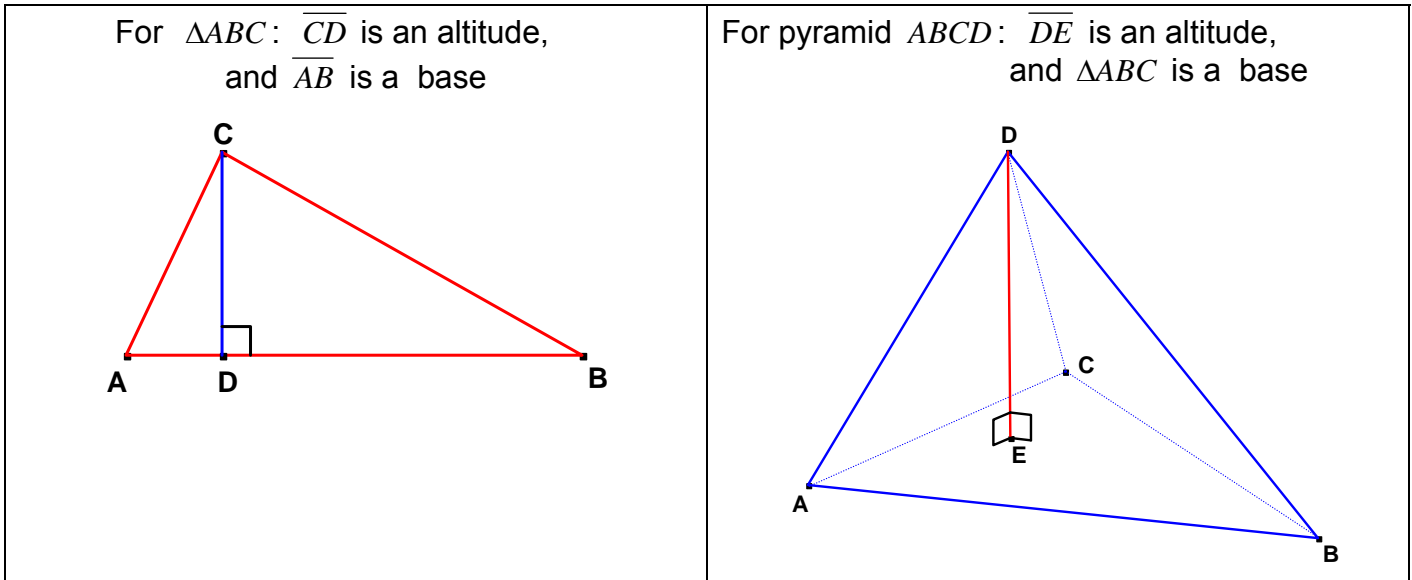


This is a graph of the parabola
 $y = x^2 - 4x + 2$ together with its axis of symmetry $x = 2$.

B

base Any side or face of a geometric figure to which an altitude is drawn.

Examples:



betweenness A point B is between points A and C if and only if $AB + BC = AC$.

Example:



biconditional A statement formed by the conjunction of a conditional statement and its converse; a statement that can be written in “if and only if” form; a definition can always be written as a biconditional statement.

Examples:

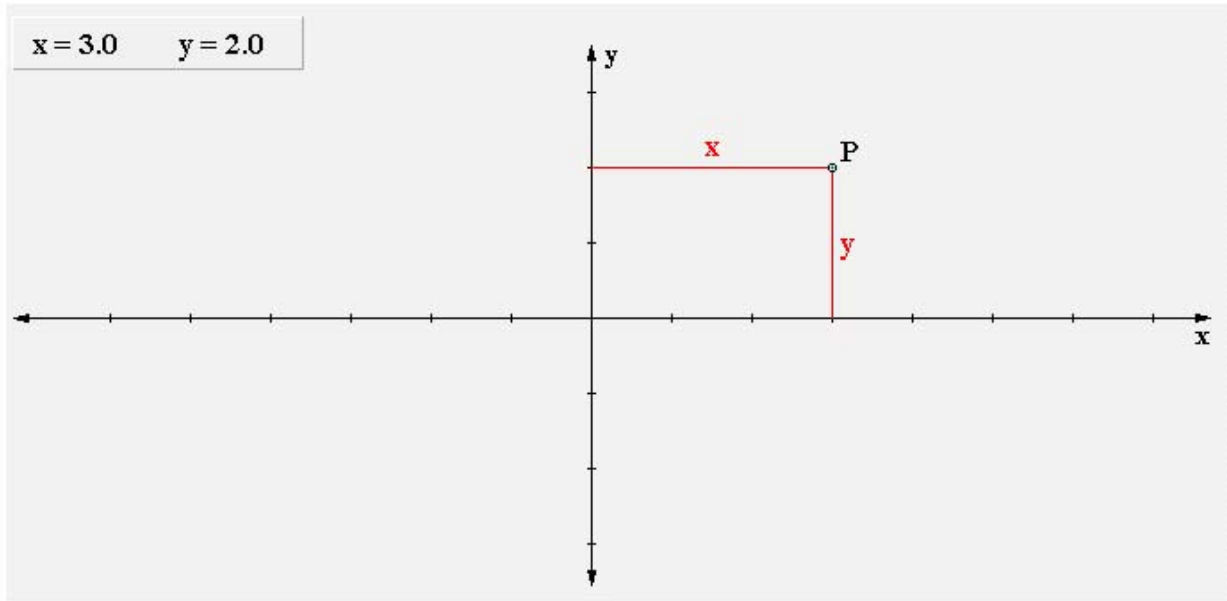
a) $(p \rightarrow q) \wedge (q \rightarrow p)$ is the biconditional of p and q and is written $p \leftrightarrow q$.

b) An angle is a right angle if and only if it has a measure of 90 degrees. This biconditional statement is equivalent to the following two statements: If an angle is a right angle, then it has a measure of 90 degrees and if an angle has a measure of 90 degrees, then it is a right angle.

C

Cartesian coordinates An ordered pair of real numbers that establishes the location or address of a point in a coordinate plane using the distances from two perpendicular intersecting lines called the coordinate axes.

Example: Point P is identified by ordered pair (3,2)



Cartesian plane The set of all points in a plane designated by their Cartesian coordinates.

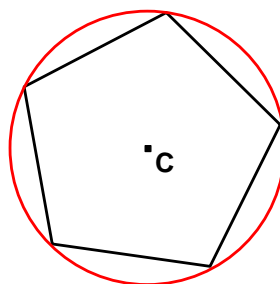
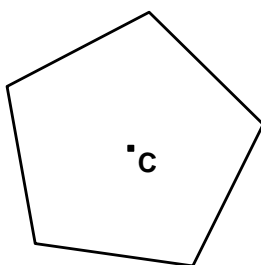
center of a dilation A fixed point in the plane about which all points are expanded or contracted; the only invariant point under dilation.

center of gravity The balance point of an object.

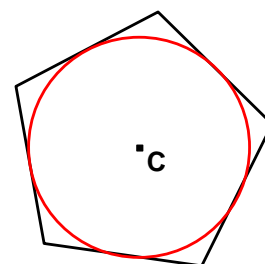
Example: In a triangle, the center of gravity is the point of concurrency of the triangle's medians. This point is also called the centroid.

center of a regular polygon The center of the circle which circumscribes or inscribes a regular polygon.

Examples:



circumscribes



Inscribes

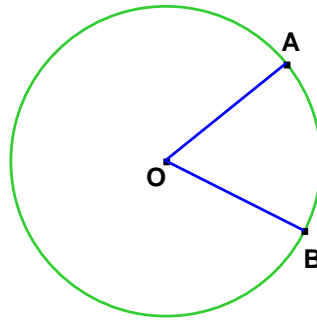
center of a rotation A fixed point in the plane about which all points are rotated.

center-radius equation of a circle The form of the equation of a circle with center (h, k) and radius r given by the formula $(x-h)^2 + (y-k)^2 = r^2$.

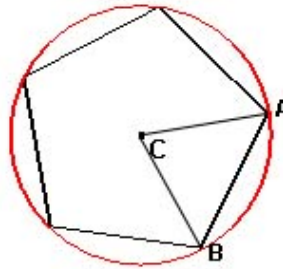
Example: If the coordinates of the center of the circle are $(3, -4)$ and the length of the radius is 5, then the equation of the circle is $(x-3)^2 + (y+4)^2 = 5^2$.

central angle An angle in a circle with vertex at the center of the circle and sides that are radii.

Example: Central angle AOB



central angle of a regular polygon An angle in a regular polygon with vertex at the center of the polygon and sides that are radii of its circumcircle.



centroid The point of concurrency of the medians of a triangle; the center of gravity in a triangle.

chord A line segment joining any two points on a circle. The diameter is the largest chord of a circle.

circle The set of all points (or locus of points) in a plane that are a fixed distance, (called the radius) from a fixed point, (called the center).

$$\cos \theta = \frac{x}{r}, \quad \sin \theta = \frac{y}{r}, \quad r = \sqrt{x^2 + y^2}$$

circumcenter The center of the circle circumscribed about a polygon; the point that is equidistant from the vertices of any polygon.

circumcircle A circle that passes through all of the vertices of a polygon. Also called a circumscribed circle.

circumference The length of or distance around a circle. The formula for circumference is:

$$C = 2\pi r = \pi d$$

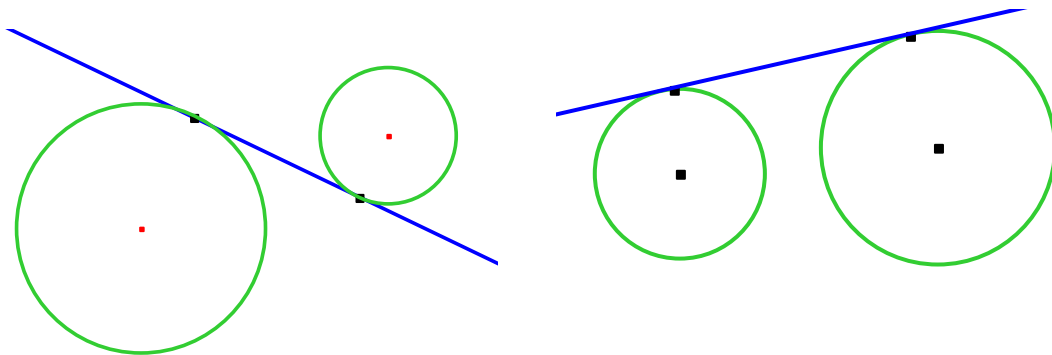
clockwise The direction in which the hands of a clock move around the dial. Used to indicate the orientation of a transformation.

closure A set "S" and a binary operation "*" are said to exhibit closure if applying the binary operation to any two elements in "S" produces a value that is a member of "S".

collinear points Points that lie on the same line.

common tangents Lines that are tangent to two or more circles.

Examples:



complementary angles Two angles the sum of whose measures is 90 degrees.

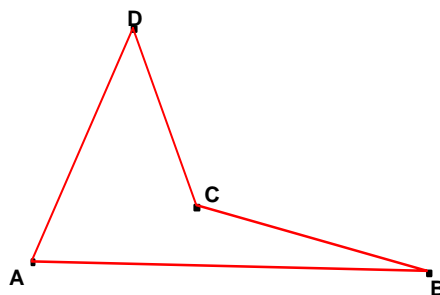
composition of functions A way of combining functions in which the output of one function is used as the input of another function; the formation of a new function h from functions f and g using the rule $h(x) = g \circ f(x) = g[f(x)]$ for all x in the domain of f for which $f(x)$ is in the domain of g .

compound locus: A set of points satisfying two or more locus conditions.

compound statement A statement formed from two or more simple statements using the logic connectives, *or*, *and*, *if...then*, or *if and only if*.

concave polygon A polygon that has at least one diagonal outside the polygon.

concave polygon



concentric circles Two or more circles having the same center and different radii.

conclusion An answer or solution arrived at through logical or mathematical reasoning; the “then” clause in an “if-then” statement; the final statement in a proof which follows logically from previous true statements.

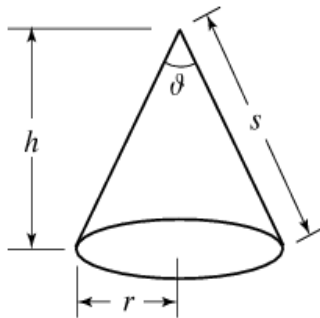
concurrency The concept of three or more lines intersecting in a single (common) point; having a single point of intersection.

Example: The medians of a triangle are concurrent.

conditional statement A statement formed from two given statements by connecting them in the form if..., then... .

Example: “If p then q ” is a conditional statement (p implies q) and is denoted $p \rightarrow q$; p is called the hypothesis and q is called the conclusion.

cone A solid formed by a circular region (the base) and the surface formed by the straight line segments connecting points on the boundary of the base with a fixed point (the vertex) not in the plane of the base.



Example:

conjecture An educated guess; an unproven hypothesis based on observation, experimentation, data collection, etc.

conjunction A compound statement formed using the word “and”. A conjunction is true only if both clauses are true.

Example: Today is Tuesday and the sun is shining.

congruent Having the same size and shape.

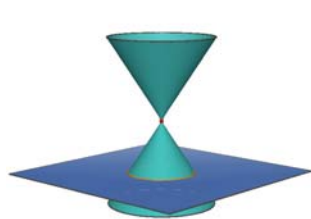
Example: Two *line segments* are congruent if they have the same length.

Two *angles* are congruent if they have the same measure.

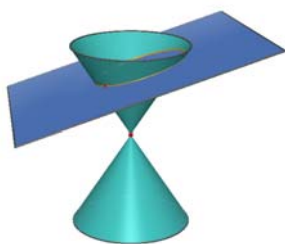
Two *polygons* are congruent if there exists a one-to-one correspondence between their vertices such that their corresponding sides are congruent and their corresponding angles are congruent.

conic sections The plane section created by the intersection of a plane and a cone.

Example: a parabola, a circle, an ellipse, or a hyperbola:



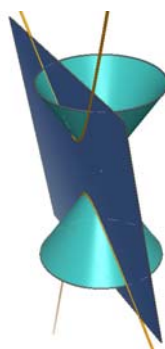
circle



ellipse



parabola



hyperbola

consistency A property of an axiomatic system where no axiom(s) can be used to contradict any other axiom(s).

constant of proportionality The number representing the ratio of any two corresponding sides in two similar geometric figures.

construct To draw a figure using only a compass and a straightedge.

constraints Any restriction placed on the variables in a problem.

contradiction A statement that has been shown to be both true and false.

contrapositive of a statement A statement formed by interchanging the hypothesis and conclusion of a conditional statement and negating each clause.

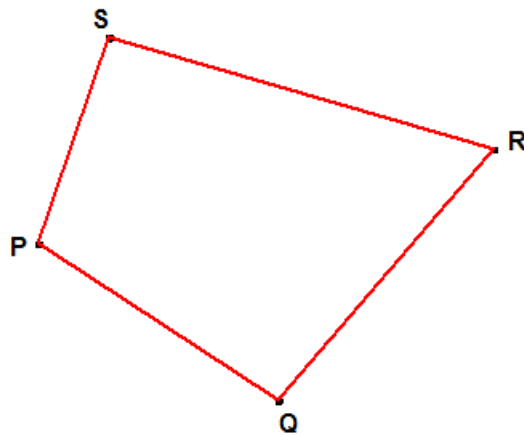
Example: $\sim q \rightarrow \sim p$ is the contrapositive of $p \rightarrow q$.

converse of a statement A statement formed by interchanging the hypothesis and conclusion of a conditional statement

Example: $q \rightarrow p$ is the converse of $p \rightarrow q$.

convex polygon A polygon is convex if a line segment connecting any two points of the polygon lies entirely in the polygon's interior.

convex polygon

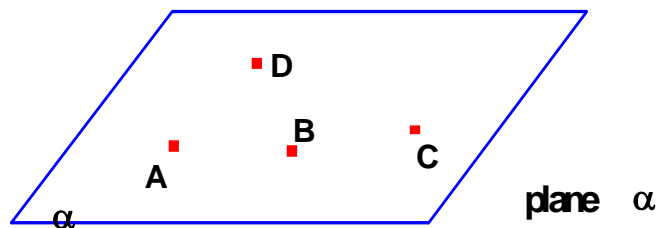


coordinate geometry An approach to geometry in which a point is represented by coordinates and algebraic methods of reasoning are used; also called analytical geometry.

coordinate plane The set of all points in a plane designated by their Cartesian coordinates. Also called the Cartesian plane.

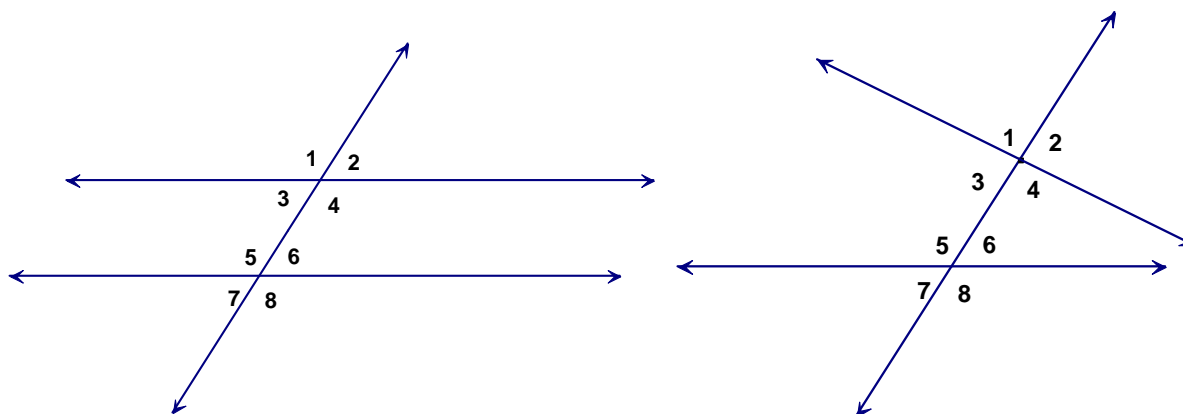
coplanar Any three or more points that lie in the same plane.

Example: Points A , B , C , and D are coplanar



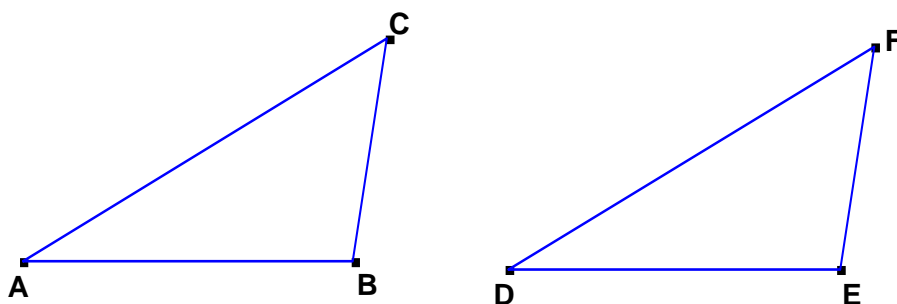
corresponding angles A set of angles formed on each of two or more lines cut by a transversal that are in the same position relative to each line and to the transversal. Note: As illustrated in the second example, the lines do *not* need to be parallel.

Examples: In the both diagrams below, $\angle 1$ and $\angle 5$, $\angle 2$ and $\angle 6$, $\angle 3$ and $\angle 7$, $\angle 4$ and $\angle 8$ are pairs of corresponding angles.



corresponding parts In two geometric figures, the points, sides, and/or angles which are in the same relative position when the figures are placed in a one-to-one correspondence.

Example: In the one-to-one correspondence implied by $\triangle ABC \cong \triangle DEF$, point A corresponds to point D ; side \overline{AB} corresponds to side \overline{DE} ; and $\angle ABC$ corresponds to $\angle DEF$, etc.



counterclockwise The direction opposite the way in which the hands of a clock move around the dial. Used to indicate the orientation of a rotation.

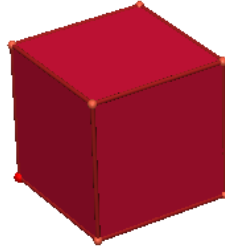
counterexample An example that disproves a general statement.

Example: The statement that the sum of two numbers is less than their product could be refuted by the counterexample that $2+1 > 2 \cdot 1$.

crosssection A plane section perpendicular to the longest axis of a solid.

cube A polyhedron with six square faces. A cube (or hexahedron) is one of the five platonic solids.

Example:



D

decagon A polygon with ten sides.

deductive proof A formal proof based on logical argument that is justified using axioms and/or theorems.

deductive reasoning A process of showing that certain statements follow logically from agreed upon assumptions and proven facts; reasoning from the general to the specific.

Example: Given the following true statements...

If you get a high school diploma, then you took 3 years of math.
John got his high school diploma.

Then the following conclusion can be drawn...
John took 3 years of math.

diagonal A line segment that connects two non-consecutive vertices of a polygon.

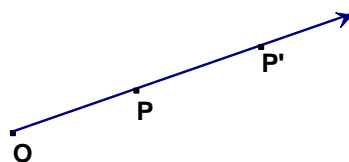
diameter A chord of the circle that passes through the center of the circle.

diameter of a sphere A line segment that connects two points on the surface of a sphere and that passes through the center of the sphere.

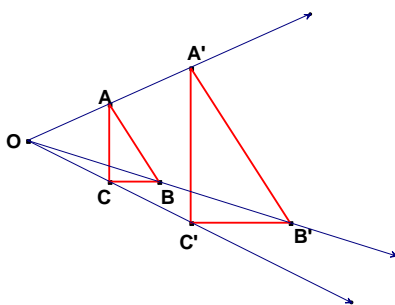
dihedral angle An angle formed by two intersecting planes.

dilation A transformation of the plane such that if O is a fixed point, k is a non-zero real number, and P' is the image of point P , then O , P and P' are collinear and $\frac{OP'}{OP} = k$.

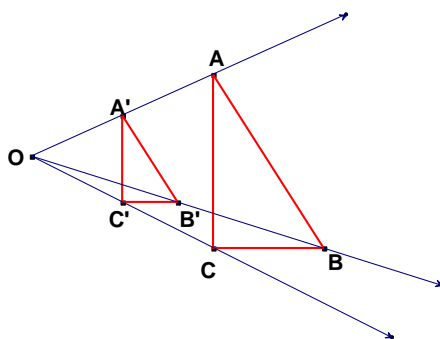
Examples:



P' is the image P under a dilation about O of ratio 2;
 $OP' = 2OP$



$\Delta A'B'C'$ is the image of ΔABC under a dilation about O of ratio 2;
 $OA' = 2OA$, $OB' = 2OB$, and $OC' = 2OC$



$\Delta A'B'C'$ is the image of ΔABC under a dilation about O of ratio $\frac{1}{2}$;
 $OA' = \frac{1}{2}OA$, $OB' = \frac{1}{2}OB$, and $OC' = \frac{1}{2}OC$.

direct transformation Any transformation of the plane that preserves orientation.

Examples: A translation, rotation or a dilation.

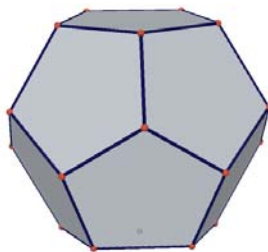
distance between two points: The length of the line segment joining the two points; a unique non-negative real number.

distance between a point and a line The length of the perpendicular segment from the point to the line.

distance between two parallel lines The length of a line segment drawn from any point on one line perpendicular to the second line.

dodecahedron A polyhedron that has twelve faces. A regular dodecahedron is one of the five Platonic solids and has twelve regular pentagons as faces.

Example:



dynamic geometry software Computer or calculator software used to construct and manipulate geometric figures.

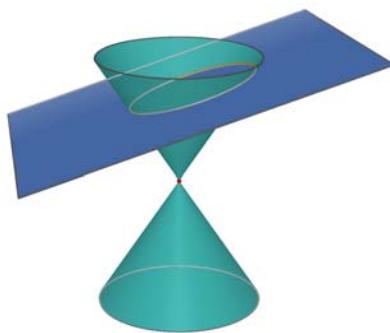
Examples: *Cabri II Geometry™* and *Geometer's Sketchpad®* are two common types of dynamic geometry software.

E

edge of a polyhedron A line segment that connects two consecutive vertices of a polyhedron.

ellipse A set of points P_1 in a plane, such that the sum of the distances from P to two fixed points F_1 and F_2 is a given constant k . Any plane section of a circular conical surface which is a closed curve.

Example: $PF_1 + PF_2 = k$



endpoint A point at either the end of a line segment, or arc, or the initial point of a ray.

equiangular A polygon with all interior angles congruent.

equidistant At the same distance.

equilateral polygon A polygon with all sides congruent.

equilateral triangle A triangle with three congruent sides.

equivalence relation A relation that exhibits the *reflexive*, *symmetric*, and *transitive* properties.

Example: Triangle congruence is an equivalence relation since it is:

reflexive: $\triangle ABC \cong \triangle ABC$,

symmetric: If $\triangle ABC \cong \triangle DEF$ then $\triangle DEF \cong \triangle ABC$, and

transitive: If $\triangle ABC \cong \triangle DEF$ and $\triangle DEF \cong \triangle GHI$ then $\triangle ABC \cong \triangle GHI$

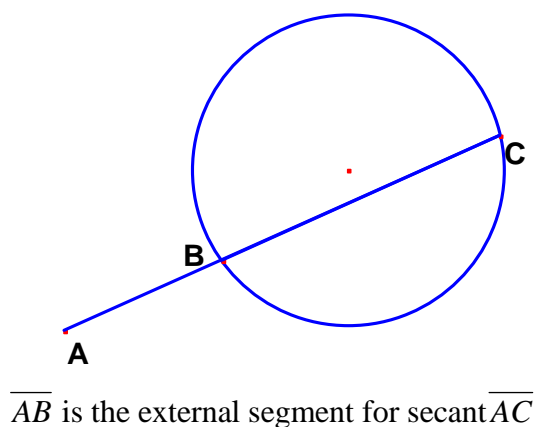
Euclidean Geometry The study of geometry based on definitions undefined terms (point, line and plane) and the assumptions of Euclid (c.a. 330 B.C.)

Euclidean Parallel Postulate Any assumption equivalent to the following statement: If l is any line and P is any point not on l , then there exists exactly one line through P that is parallel to l .

Euler line For any given triangle, the line that contains the circumcenter, the centroid and the orthocenter.

external segment of a secant If a secant is drawn to a circle from an external point, the portion of the secant that lies outside the circle.

Example:



exterior of a geometric figure The set of all points outside a geometric figure.

exterior angle of a polygon An angle formed by a side of a polygon and the extension of an adjacent side.

F

face of a polyhedron Any one of the polygons that bound a polyhedron.

fixed point A point that is its own image under a transformation of the plane.

Example: The center of a rotation or a dilation; a point on the line of reflection.

foot of an altitude The point of intersection of an altitude and the line or plane to which it is perpendicular.

function A rule that assigns to each number x in the function's domain a unique number $f(x)$.

G

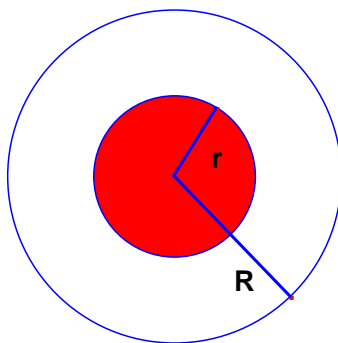
geometric inequality A statement in geometry which indicates that quantity is greater than another quantity.

Example: In a triangle, the measure of an exterior angle is greater than the measure of either remote interior angle.

geometric mean The geometric mean, also called the mean proportional, of two numbers a and b is the square root of their product. If $\frac{a}{m} = \frac{m}{b}$ then m is the geometric mean of a and b .

geometric probability A probability based on geometric relationships such as area, surface area or volume.

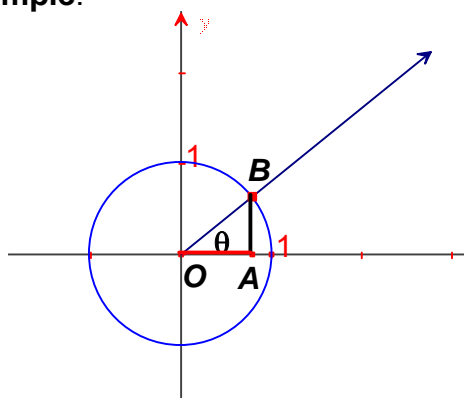
Example:



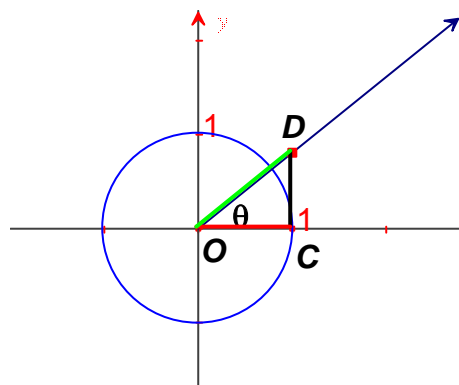
If an arrow hits the target, the probability of hitting the red (shaded) bulls eye is $\frac{\pi r^2}{\pi R^2}$

geometric representation of the circular functions The representation of circular functions on a circle of unit radius. The trigonometric functions are called circular functions because their values are related to the lengths of specific line segments associated with a circle of unit radius.

Example:



$$OA = \cos \theta, AB = \sin \theta, OB = 1$$



$$CD = \tan \theta, OD = \sec \theta, OC = 1$$

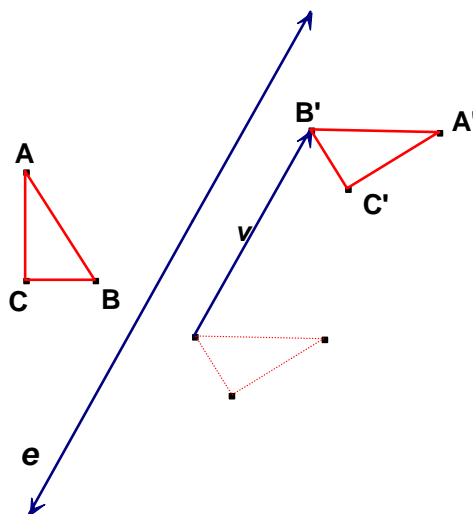
geometric sequence (A2T) A set of terms in which each term is formed by multiplying the preceding term by a nonzero constant.

Example: $8, 4, 2, 1, \frac{1}{2}, \dots$

geometry Branch of mathematics that deals with the properties, measurement, and relationships of points, lines, angles, surfaces, and solids.

glide reflection A transformation that is the composition of a line reflection and a translation through a vector parallel to that line of reflection.

Example:



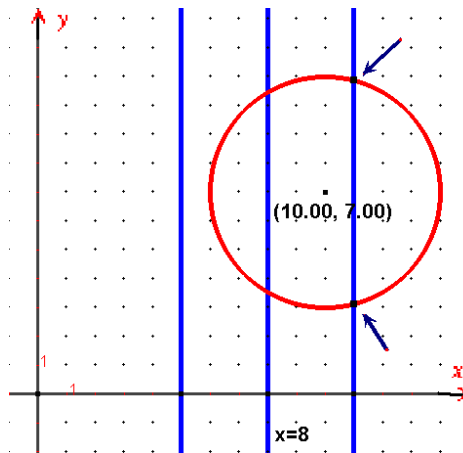
$\Delta A'B'C'$ is the image of ΔABC under a glide reflection that is the composition of a reflection over line l and a translation through vector v .

golden ratio When a line segment \overline{AB} is divided by an interior point P such that $\frac{AB}{AP} = \frac{AP}{PB}$, the ratio $\frac{AB}{AP} = \frac{1}{2}(1 + \sqrt{5})$ is called the golden ratio.

golden rectangle A rectangle whose adjacent sides have a ratio equal to the golden ratio.

graphical representation A graph or graphs used to model a mathematical relationship.

Example: The figure below is a graphical representation of the locus of all points 4 units from $A(10,7)$ and 3 units from $x = 8$.



great circle The intersection of a sphere with any plane passing through the center of the sphere.

Example: The equator is a great circle. All lines of longitude are great circles.

H

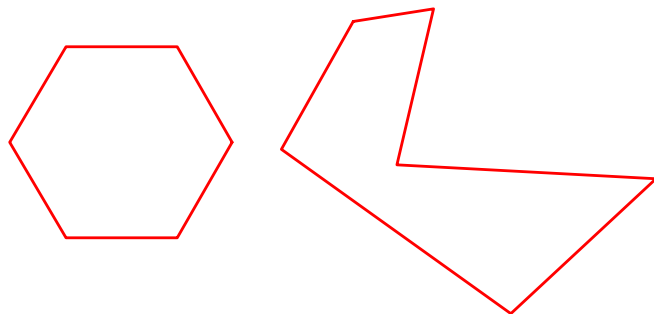
half turn A 180 degree rotation about a point.

hemisphere Half of a sphere bounded by a great circle.

Heron's formula The formula expressing the area of a triangle, A , in terms of its sides a , b , and c . $A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{1}{2}(a+b+c)$ and is called the semi-perimeter.

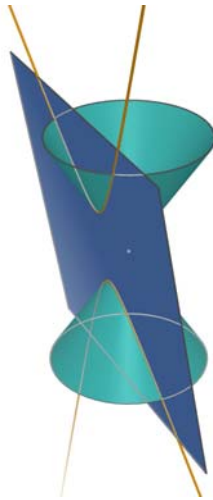
hexagon A polygon with six sides.

Examples:



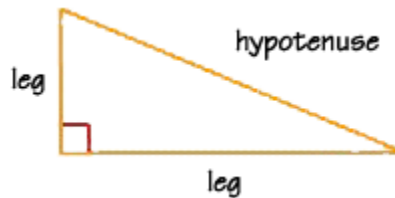
hyperbola Set of points P in a plane such that the difference between the distances from P to the foci F_1 and F_2 is a given constant k .

Example: $|PF_1 - PF_2| = k$



hypotenuse The side of a right triangle opposite the right angle; the longest side of a right triangle.

Example:



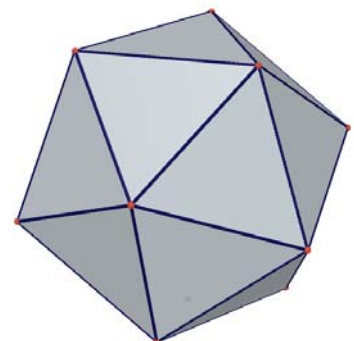
hypotenuse and leg triangle congruence If there exists a one-to-one correspondence between the vertices of two right triangles such that the hypotenuse and leg of one right triangle are congruent to the hypotenuse and corresponding leg of the second right triangle, then the triangles are congruent.

hypothesis An assumed statement used as a premise in a proof; the “given”; the “if” clause of an “if-then” statement. (See also antecedent.)

I

icosahedron A polyhedron having twenty faces. A regular icosahedron is one of the five Platonic solids and has twenty equilateral triangles as faces.

Example:



identity elements For a binary operation $*$ and a set S , I is the identity element if $a * I = a$ and $I * a = a$ for every element a that is in S .

Examples: (1) For addition (+) and the set of Integers, the number 0 is the identity element, because for every integer a : $0 + a = a$ and $a + 0 = a$.
 (2) For multiplication (\times) and the set of Real Numbers, the number 1 is the identity element, because for every Real Number a : $1 \times a = a$ and $a \times 1 = a$.

image The resulting point or set of points under a given transformation; in any function f , the image of x is the functional value $f(x)$ corresponding to x .

Examples: In transformational geometry if $R_{P,90}(A) = A'$, then point A' is the image of point A under the rotation, $R_{P,90}$.
 In the function $f(x) = x^2 + 3$, 7 is the image of 2 under f .

incenter of a triangle The center of the circle that is inscribed in a triangle; the point of concurrence of the three angle bisectors of the triangle which is equidistant from the sides of the triangle.

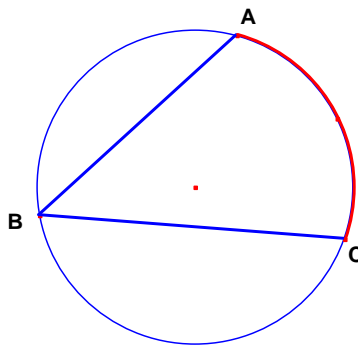
included angle The interior angle formed by two sides of a polygon.

included side The side between two consecutive angles in a polygon.

indirect proof A method of proof in which the statement that is to be proven is assumed false and a contradiction results.

inductive reasoning The process of observing data, recognizing patterns and making generalizations about those patterns.

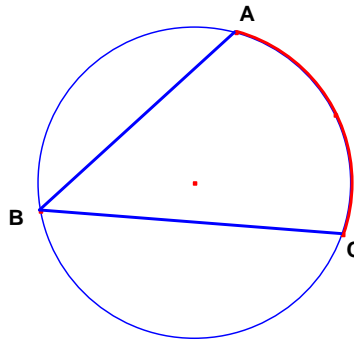
inscribed angle An angle whose vertex lies on the circle and whose sides are chords of a circle.



inscribed circle A circle in the interior of a polygon that is tangent to each side of the polygon.

intercepted arc An arc of a circle whose endpoints lie on the sides of an angle, and all of the points on the arc are in the interior of the angle.

Example:



$\angle ABC$ intercepts arc AC

interior The set of all points inside a geometric figure.

intersecting lines Lines that share a common point.

intersection of sets The intersection of two or more sets is the set of all elements that are common to all of the given sets.

Example: If $A = \{1,2,3,6\}$ and $B = \{0,2,5,6,7\}$, then the intersection of A and B , denoted by $A \cap B$, is $\{2,6\}$

invariant A figure or property that remains unchanged under a transformation of the plane.

inverse of a statement A statement formed by negating both the hypothesis and conclusion of a given conditional.

Example: Given $p \rightarrow q$ the inverse is: $\sim p \rightarrow \sim q$

isometry A transformation of the plane that preserves distance.

If P' is the image of P , and Q' is the image of Q , then the distance from P' to Q' is the same as the distance from P to Q .

isosceles trapezoid A trapezoid in which the non-parallel sides are congruent.

isosceles triangle A triangle that has at least two congruent sides.

J There are no J terms.

K There are no K terms .

L

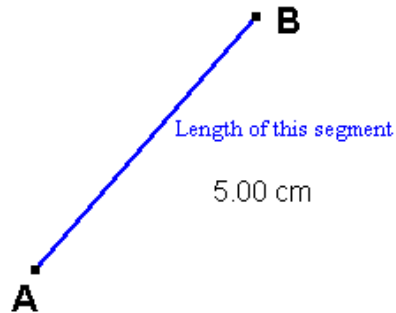
lateral area of a prism The sum of the areas of the faces of the prism not including the bases.

lateral edge A line segment that is the intersection of any two lateral faces of a polyhedron.

lateral face A face of a polyhedron, not including its bases.

length of line segment The distance between the end two end points of a line segment.

Example:



The length of \overline{AB} is AB .

line segment Given any two points A and B , \overline{AB} is equal to the union of points A , B , and all of those points between A and B .

line symmetry A geometric figure has line symmetry if the figure is the image of itself under a reflection in a line.

linear pair of angles Any two adjacent angles whose non-common sides form a line.

locus of points The set of all points satisfying a given condition or conditions.

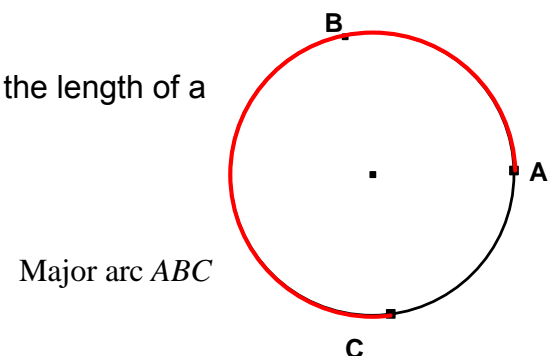
Example: The locus of points that are equidistant from the endpoints of a line segment is the perpendicular bisector of that line segment.

logical equivalence Statements that have the same truth value.

M

major arc In a circle, any arc whose length is greater than the length of a semicircle.

Example:



mean proportional The mean proportional, also called the geometric mean, of two numbers a and b is the square root of their product. If $\frac{a}{m} = \frac{m}{b}$ then $m = \sqrt{ab}$ is the geometric mean of a and b .

measure of an arc The measure of the central angle that subtends the arc.

median of a trapezoid A line segment that connects the midpoints of the two non-parallel sides of the trapezoid.

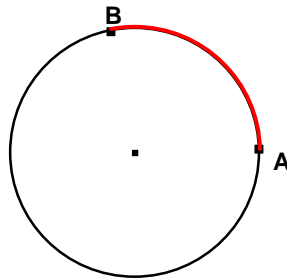
median of a triangle A line segment that connects any vertex of a triangle to the midpoint of the opposite side.

midpoint A point that divides a line segment into two congruent line segments.

midsegment A line segment that connects the midpoints of two sides of a triangle; Also called the midline.

minor arc In a circle, any arc whose length is less than the length of a semicircle.

Example:

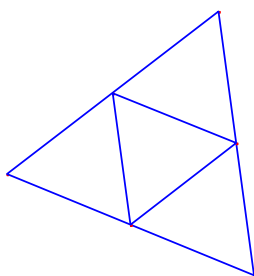


N

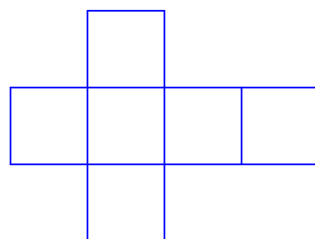
negation For any given statement p , its negation is the statement $\sim p$ (not p) whose truth value is the opposite of the truth value of p .

net A two dimensional pattern consisting of polygons which can be folded to form a polyhedron.

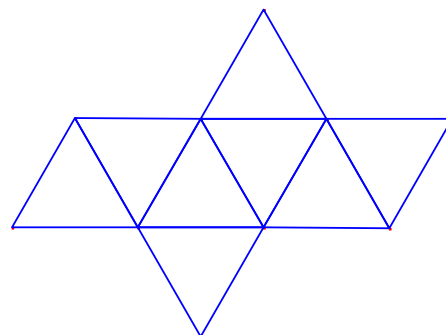
Example: The following are the nets for the Platonic solids.



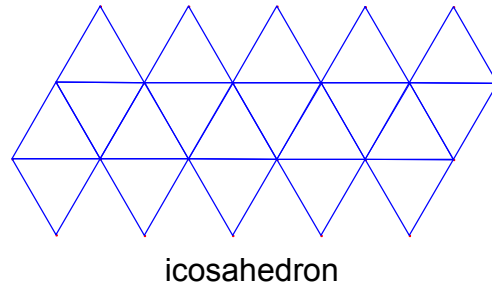
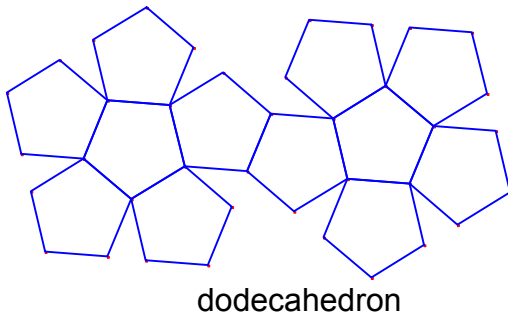
tetrahedron



hexahedron (cube)



octahedron



n-gon A polygon with n sides.

non-collinear points Three or more points that do not lie on the same line.

non-coplanar points Four or more points that do not lie on the same plane.

non-Euclidean geometry A geometry that contains an axiom which is equivalent to the negation of the Euclidean parallel postulate.

Examples:

Riemannian geometry A non-Euclidean geometry using as its parallel postulate any statement equivalent to the following: If l is any line and P is any point not on l , then there are no lines through P that are parallel to l . (Also called elliptic geometry.)

hyperbolic geometry A non-Euclidean geometry using as its parallel postulate any statement equivalent to the following: If l is any line and P is any point not on l , then there exists at least two lines through P that are parallel to l .

O

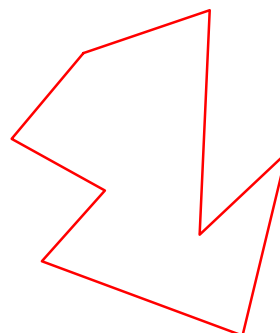
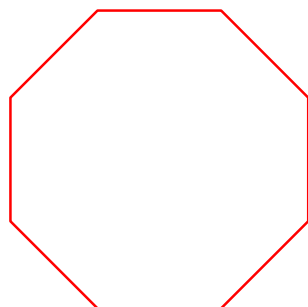
Oblique line and a plane A line and a plane that are neither parallel nor perpendicular.

obtuse angle An angle whose measure is greater than 90 degrees and less than 180 degrees.

obtuse triangle A triangle having one obtuse angle.

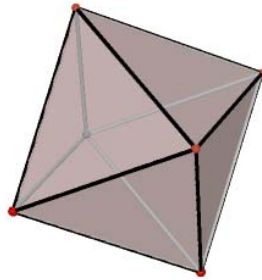
octagon A polygon with 8 sides.

Examples:



octahedron A polyhedron having eight faces. A regular octahedron is one of the five Platonic solids and has eight equilateral triangles as faces.

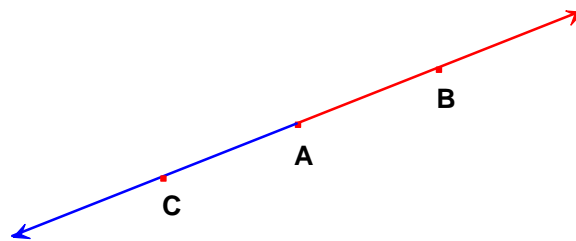
Example:



one-to-one function A function where the inverse is also a function.

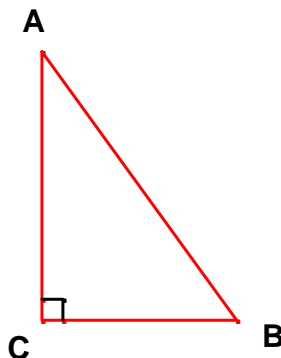
opposite rays Two collinear rays whose intersection is exactly one point.

Example: If A is between B and C, then \overrightarrow{AB} and \overrightarrow{AC} are opposite rays.



opposite side in a right triangle The side across from an angle. In a right triangle the hypotenuse is opposite the right angle and each leg is opposite one of the acute angles.

Example: With respect to $\angle A$, \overline{BC} is the opposite side, and \overline{AC} is the adjacent side. With respect to side \overline{AC} , $\angle B$ is the opposite angle.



opposite transformation A transformation of the plane that changes the orientation of a figure.

Example: Reflections and glide reflections are opposite transformations.

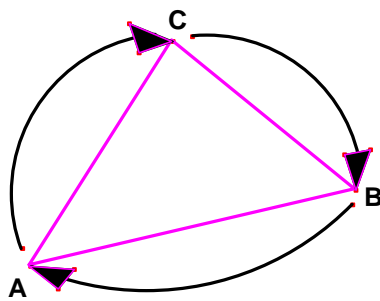
ordered pair Two numbers that are used to identify the position of a point in a plane. The two numbers are called coordinates and are represented by (x, y) .

ordered triple Three numbers that are used to identify the position of a point in space. The three numbers are called coordinates and are represented by (x, y, z) .

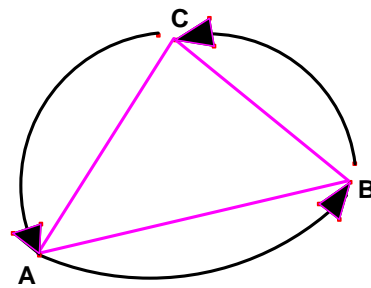
ordinate The vertical coordinate of a two-dimensional rectangular coordinate system; usually denoted by y .

orientation The arrangement of the points, relative to one another, after a transformation; the reference made to the direction traversed (clockwise or counterclockwise) when traveling around a geometric figure.

Example:



$\triangle ACB$ has a clockwise orientation



$\triangle ABC$ has a counterclockwise orientation

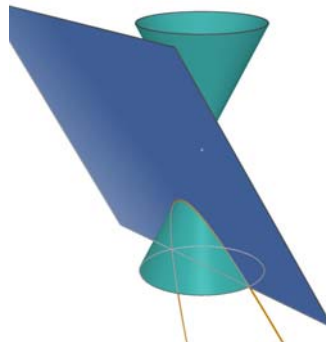
origin The point in the Cartesian coordinate plane at which the horizontal and vertical axes intersect, designated by the ordered pair $(0,0)$.

orthocenter The point of concurrence of the three altitudes of a triangle.

P

parabola Any plane section of a circular conical surface by a plane parallel to the slant height of the cone.

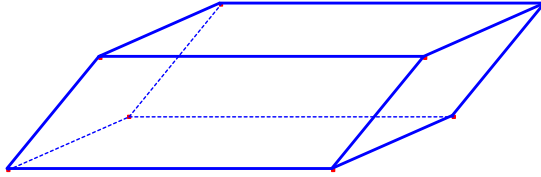
Example:



paragraph proof A written proof in which the statements and their corresponding reasons are written, in paragraph form, using complete sentences.

parallelepiped A prism whose bases are parallelograms.

Example:



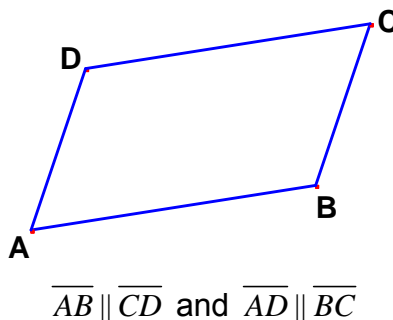
parallel lines Two or more coplanar lines that do not intersect. Parallel line segments or rays are line segments or rays that are subsets of parallel lines.

parallel planes Two or more planes that do not intersect.

parallel postulate Any postulate or axiom that designates the number of lines through a given point that are parallel to a given line.

parallelogram A quadrilateral in which both pairs of opposite sides are parallel.

Example:

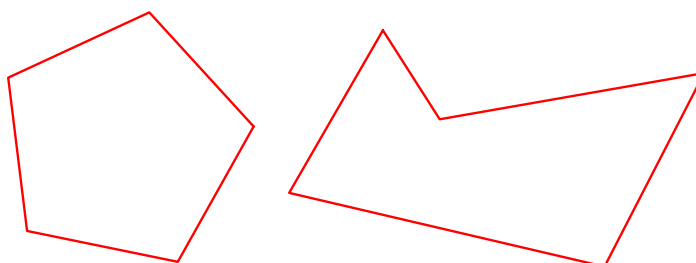


parameter A quantity or constant whose value varies with the circumstances of its application.

Example: In $y = ax^2$ a is a parameter

pentagon A polygon with 5 sides.

Examples:



perimeter The sum of the lengths of all the sides of any polygon.

perpendicular bisector A line, segment or ray that is perpendicular to a line segment at its midpoint.

perpendicular lines Two lines that intersect to form right angles.

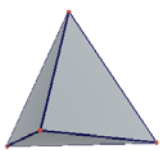
perpendicular planes Two planes that intersect to form right dihedral angles.

pi The irrational number equal to the length of the circumference of a circle divided by the length of its diameter.

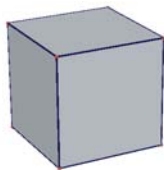
plane An undefined term in geometry usually visualized as a flat surface with no thickness that extends indefinitely in two dimensions.

Platonic solids The five regular polyhedra: tetrahedron, cube, octahedron, dodecahedron and icosahedron.

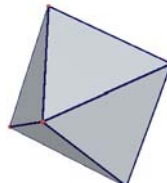
Example:



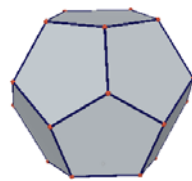
Tetrahedron



Cube



Octahedron



Dodecahedron



Icosahedron

point An undefined term in geometry usually visualized as a dot representing a non-dimensional location in space.

point of concurrency A point that is the intersection of three or more lines.

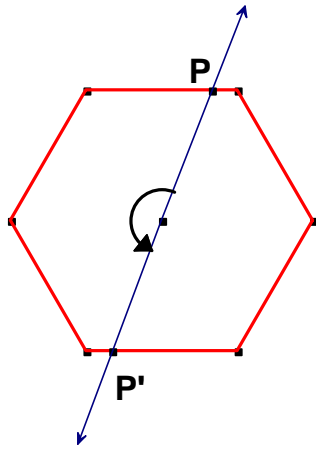
point of tangency The point where a tangent line intersects a curve.

point-slope equation of a line The equation of a line formed using its slope and the coordinates of a point on the line, where m is the slope of the line and (x_1, y_1) are the coordinates of the given point.

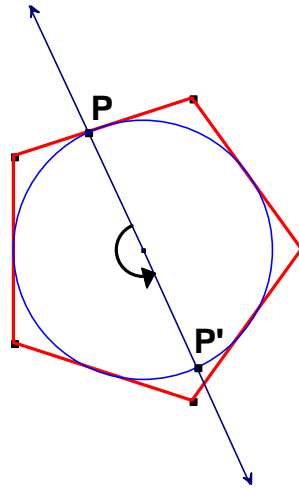
Example: If the coordinates of a point on the line are (x_1, y_1) and the slope is m , then the equation of the line is $(y - y_1) = m(x - x_1)$.

point symmetry A geometric figure has point symmetry if every point on the figure is the image of itself under a rotation of 180° about some fixed point.

Examples:



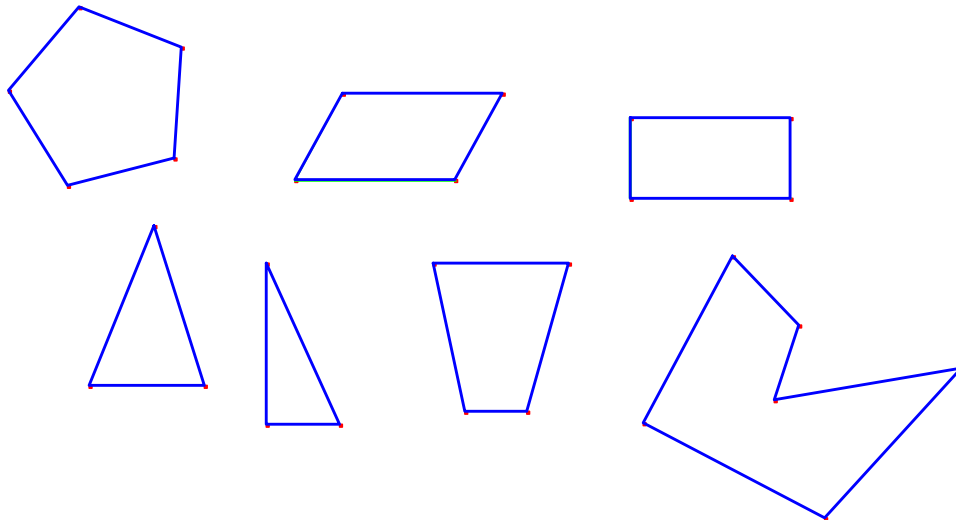
A regular hexagon has point symmetry about its center.



A pentagon does not have point symmetry

polygon A closed plane figure formed by three or more line segments that meet only at their endpoints.

Examples:



polyhedron A solid figure bounded by polygons.

position vector A coordinate vector whose initial point is the origin. Any vector can be expressed as an equivalent position vector by translating the vector so that it originates at the origin.

postulate A statement assumed to be true without proof.

preimage The original point or points of a transformation.

premise A proposition upon which an argument is based or from which a conclusion is drawn.

prism A polyhedron with two congruent, parallel, polygonal bases and whose lateral faces are parallelograms.

proof by contradiction A method of proof which demonstrates the truth of an implication by proving that the negation of the conclusion of that implication leads to a contradiction; also called an indirect proof.

proportional Two variables are proportional if they maintain a constant ratio. See also direct variation.

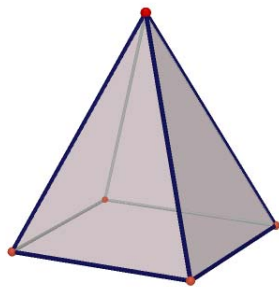
Examples:

If cans of soup cost 75 cents each, the cost of any quantity of cans is proportional to the quantity of cans because the ratio of the total cost to the quantity of cans is always 75 cents:1 can.

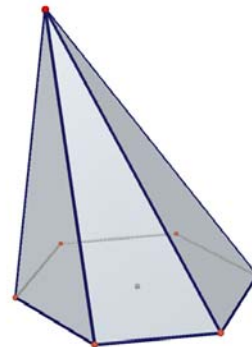
The perimeter of any square is proportional to the length of one of its sides because the ratio of the length of one side to the perimeter is always 1:4.

pyramid A polyhedron having a polygonal base and triangles as lateral faces.

Example:



right square pyramid



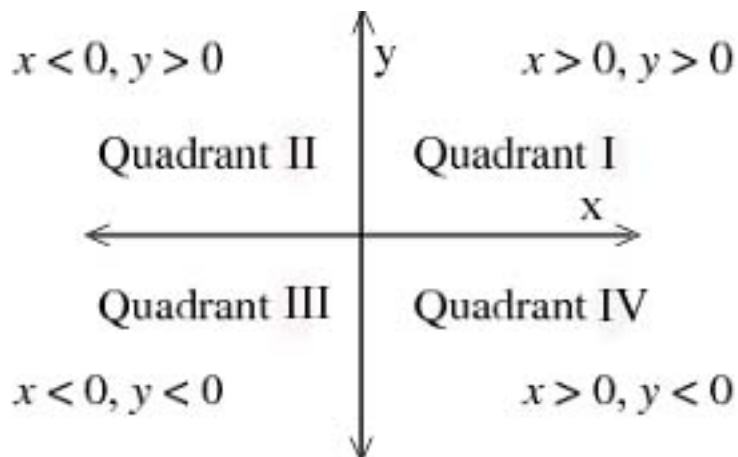
hexagonal pyramid

Pythagorean theorem The mathematical relationship stating that in any right triangle the sum of the squares of the lengths of the two legs is equal to the square of the length of the hypotenuse; if a and b are the lengths of the legs and c is the length of the hypotenuse, then $a^2 + b^2 = c^2$.

Q

quadrant The four regions of a plane created by the intersection of the coordinate axes. Each of these quadrants has a number designation:

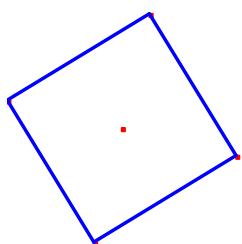
Example:



quadratic equation An equation that can be written in the form $ax^2 + bx + c = 0$, where a , b , and c are real constants and $a \neq 0$.

quadrilateral A polygon with 4 sides.

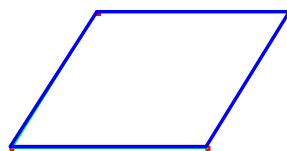
Examples



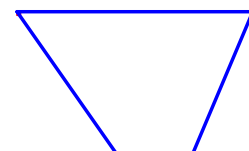
square



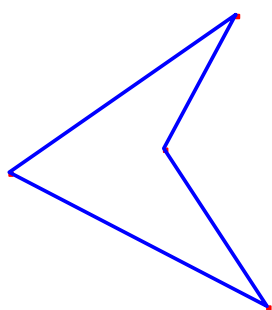
rectangle



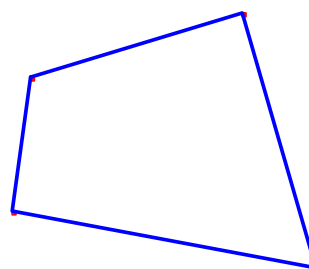
parallelogram



trapezoid



concave quadrilateral



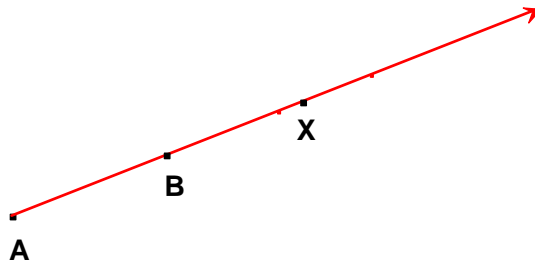
quadrilateral

R

radical The root of a quantity as indicated by the radical sign.

radius A line segment drawn from the center of a circle to a point on the circle.

ray Given any two points A and B , \overrightarrow{AB} is equal to the union of \overline{AB} and all of those points X such that B is between X and A .



reason A true statement justifying a step in a proof; the use of logic, examples, etc. to determine a result.

rectangle A parallelogram containing one right angle; a quadrilateral with four right angles.

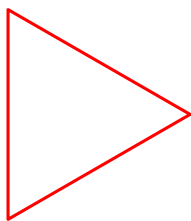
rectangular coordinates An ordered pair of real numbers that establishes the location of a point in a coordinate plane using the distances from two perpendicular intersecting lines called the coordinate axes. (See also Cartesian coordinates.)

reflection An isometry where if l is any line and P is any point not on l , then $r_l(P) = P'$ where l is the perpendicular bisector of $\overline{PP'}$ and if $P \in l$ then $r_l(P) = P$.

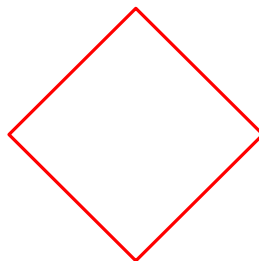
reflexive property of equality A property of real numbers that states $a = a$.

regular polygon A polygon which is both equilateral and equiangular.

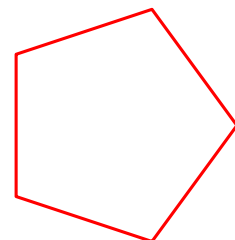
Example:



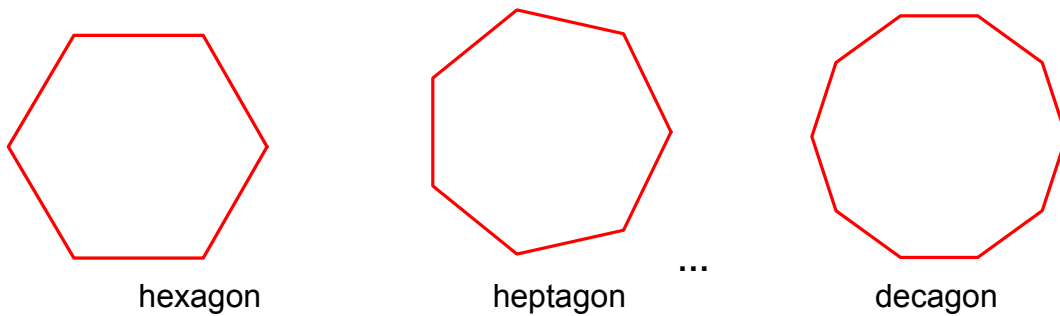
equilateral triangle



square

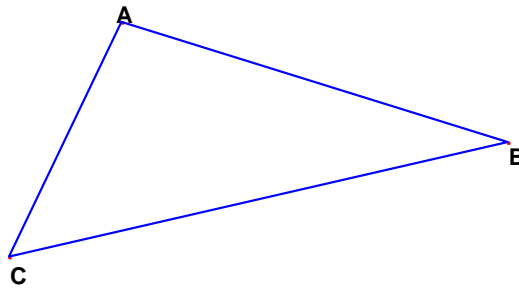


pentagon



regular pyramid A pyramid whose base is a regular polygon and whose lateral faces are congruent isosceles triangles.

remote interior angles Either interior angle of a triangle that is not adjacent to a given exterior angle of the triangle. Also called non-adjacent interior angles.



With respect to vertex A , $\angle B$ and $\angle C$ are remote interior angles.

restricted domain The domain resulting from a restriction placed on a function, based on the context of the problem.

rhombus A parallelogram with two adjacent congruent sides; a quadrilateral with four congruent sides.

right angle An angle formed by two perpendicular lines, the measure of which is 90° .

right circular cylinder A cylinder whose bases are circles and whose altitude passes through the center of both bases.

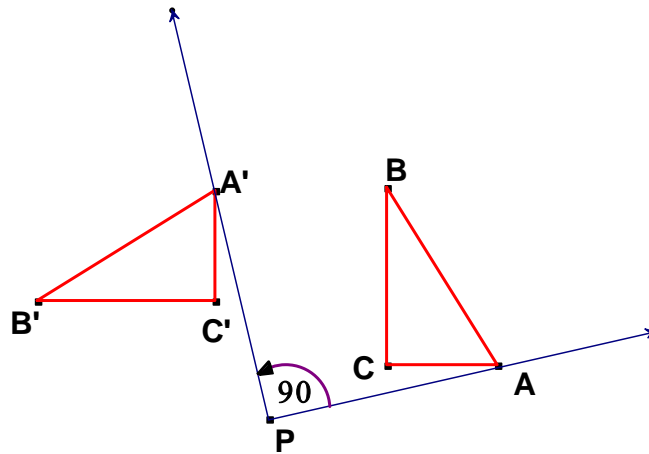
right circular cone A cone whose base is a circle and whose altitude passes through the center of its base.

right pyramid A pyramid whose lateral faces are isosceles triangles.

right triangle A triangle with one right angle.

rotation An isometry where if P is a fixed point in the plane, θ is any angle and $A \neq P$ then $R_{P,\theta}(A) = A'$ where $m\angle APA' = \theta$ and $R_{P,\theta}(P) = P$.

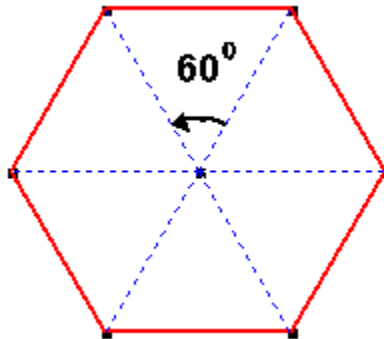
Example:



$$R_{P, 90^\circ}(\triangle ABC) = \triangle A'B'C'$$

rotational symmetry A geometric figure has rotational symmetry if the figure is the image of itself under a rotation about a point through any angle whose measure is not a multiple of 360° .

Example:



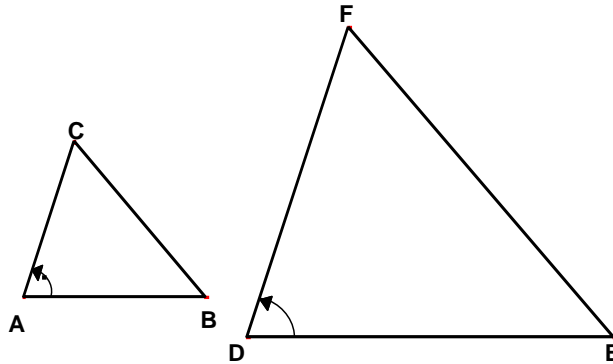
A regular hexagon has rotational symmetry of 60° , 120° , 180° , 240° , and 300°

S

SAS triangle congruence If there exists a one-to-one correspondence between the vertices of two triangles, such that two sides and the included angle of one triangle are congruent to the corresponding two sides and included angle of the second triangle, then the two triangles are congruent.

SAS Similarity Theorem If there exists a one-to-one correspondence between the vertices of two triangles, such that two pairs of corresponding sides are proportional and their included angles are congruent, then the two triangles are similar.

Example:



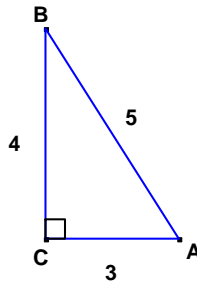
$\triangle ABC$ is similar to $\triangle DEF$ because $\angle BAC \cong \angle EDF$ and $\frac{AC}{AB} = \frac{DF}{DE}$

scalene triangle A triangle with no congruent sides.

secant (of a circle) A line that intersects a circle in exactly two points.

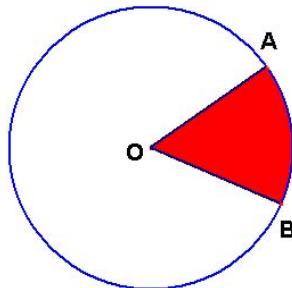
secant (of an angle) For a given acute angle θ in a right triangle, $\sec \theta$, is the ratio of the length of the hypotenuse to the length of the side adjacent to the acute angle θ ; the reciprocal of the cosine ratio of the given angle. See also circular function.

Example: In this right triangle, $\sec A = \frac{5}{3}$ and $\sec B = \frac{5}{4}$



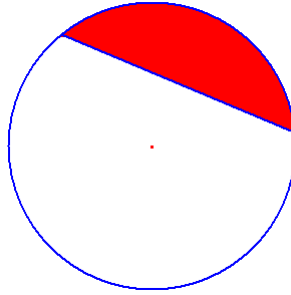
sector of a circle A region bounded by an arc of the circle and the two radii to the endpoints of the arc.

Example: The shaded area in the circle below is a sector of circle O.



segment of a circle The region bounded by a chord and the arc subtended by that chord.

Example: The shaded part of the circle is called a segment of a circle.

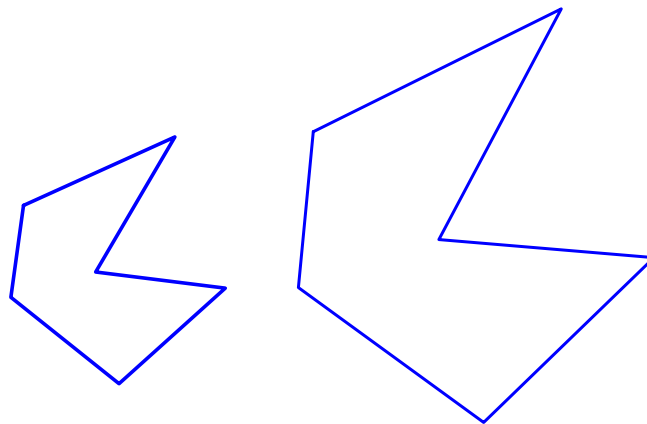


semi-circle Either of the arcs of a circle determined by the endpoints of a diameter.

set A well-defined collection of items.

similar polygons Two polygons which have the same shape but not necessarily the same size.

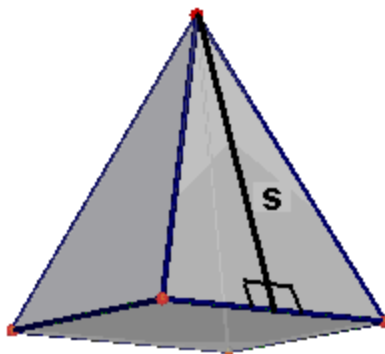
Example:



skew lines Two non-coplanar lines that do not intersect.

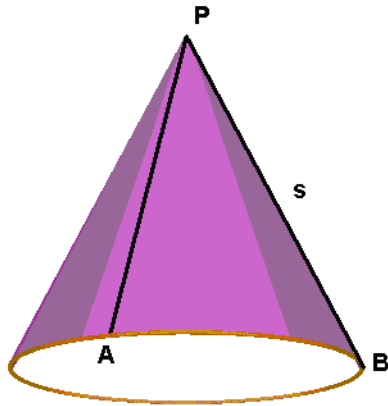
slant height Of a *pyramid*: The altitude of a lateral face of a pyramid.

Examples:



S is the slant height of the pyramid.

Of a *cone*: The length of a line segment drawn on the lateral surface of a cone from its vertex to a point on the circle that determines its base



$PA = PB = s$ is the slant height of the cone.

slope The measure of the steepness of a line; the ratio of vertical change to horizontal change; if point P is (x_1, y_1) and point Q is (x_2, y_2) the slope of \overline{PQ} is $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$.

Example: The slope of the line containing the points A(-3,7) and B(5, -2) is $\frac{(-2) - (7)}{(5) - (-3)} = \frac{-9}{8}$

slope - intercept equation of a line The equation of a line formed using its slope and its y-intercept. If the coordinates of the y-intercept of the line are $(0, b)$ and the slope is m , then the equation of the line is $y = mx + b$.

sphere The locus of points in space at a given distance from a fixed point.

square A rectangle with two congruent adjacent sides.

SSS triangle congruence If there exists a one-to-one correspondence between the vertices of two triangles, such that all three sides of one triangle are congruent to the corresponding sides of the second triangle, then the two triangles are congruent.

straightedge An object with no marked units of measure that is used for drawing straight lines

substitution property Any quantity can be replaced by an equal quantity.

Example: If $a + x = b$ and $x = c$ then $a + c = b$.

subtraction property of equality If the same or equal quantities are subtracted from same or equal quantities, then the results are equal.

Example: If $a = b$ then $a - c = b - c$.

supplementary angles Two angles the sum of whose measures is 180 degrees.

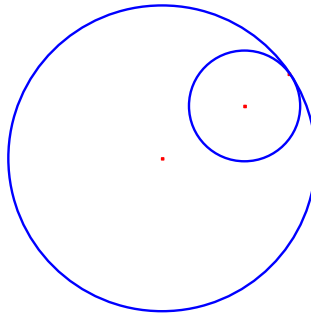
surface area The sum of the areas of all the faces or curved surfaces of a solid figure.

symmetric property of equality A property of the real numbers that states: If $a = b$ then $b = a$.

T

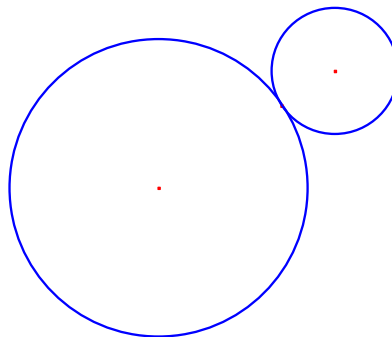
tangent circles (internal) Two circles are internally tangent if they intersect in exactly one point and one circle lies in the interior of the other circle.

Example:



tangent circles (external) Two circles are externally tangent if they meet in exactly one point and neither circle has any points in the interior of the other circle.

Example:

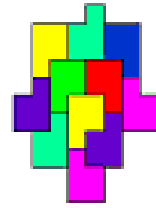
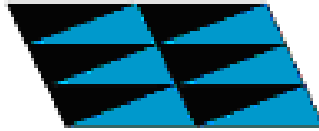
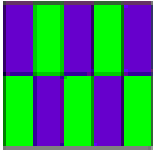


tangent line to a circle A line that intersects a circle in exactly one point.

tangent segment A line segment that is a subset of a tangent line. This usually refers to the line segment drawn from an external point to the point of tangency.

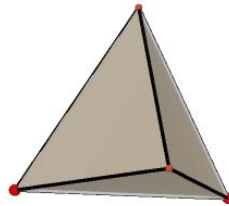
tessellation A repeating pattern covering a plane.

Examples:



tetrahedron A polyhedron with four faces; one of the five Platonic solids that has four equilateral triangles as faces (pyramid).

Example:



theorem A general statement that requires proof.

three-dimensional space The set of all points in space. The position of each point can be represented by a unique ordered triple (x,y,z) .

transformation A one-to-one mapping of points in the plane to points in the plane.

transformational geometry A method for studying geometry that illustrates congruence and similarity by the use of transformations.

transformational proof A proof that employs the use of transformations.

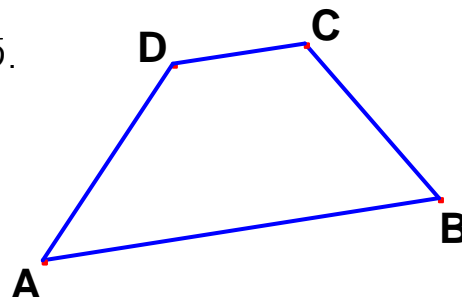
transitive property of equality A property of the real numbers that states: If $a = b$ and $b = c$ then $a = c$.

translation A transformation where every point moves the same direction through the same distance.

transversal A line that intersects two (or more) other lines in distinct points.

trapezoid A quadrilateral with exactly one pair of parallel sides.

Example: In the trapezoid below, $\overline{AB} \parallel \overline{CD}$.



triangle inequality theorem In any triangle, the sum of the lengths of two sides is greater than the length of the third side.

trichotomy property A property of the real numbers that states: for every x and y , one and only one of the following conditions is true: $x < y$; $x = y$, $x > y$.

trigonometry of the right triangle The trigonometric functions for acute angles are the ratios of the sides of the right triangle containing the angle.

Examples:

$$\sin \theta = \frac{\text{length of the side opposite } \theta}{\text{length of the hypotenuse}},$$

$$\cos \theta = \frac{\text{length of the side adjacent to } \theta}{\text{length of the hypotenuse}},$$

$$\tan \theta = \frac{\text{length of the side opposite } \theta}{\text{length of the side adjacent to } \theta}$$

truth value A value, (typically T or F), indicating whether a statement is true or false.

two column proof The outline of a written proof in which the statements and their corresponding reasons are listed in two separate columns.

two-dimensional space The set of all points in the plane. The position of each point can be represented by a unique ordered pair (x,y) . Figures such as angles, pairs of parallel and intersecting lines, circles and polygons exist in two-dimensional space.

U

undefined terms The fundamental components of an axiomatic system whose understanding is agreed upon but not formally defined. In geometry undefined terms traditionally include point, line, and plane.

union of sets The union of two or more sets is the set of all elements contained in at least one of the sets.

Example: if Set $A = \{2,4,6,8,10\}$ and Set $B = \{1,2,3,4,5,6\}$, then the union of sets A and B , written as $A \cup B$, is $\{1,2,3,4,5,6,8,10\}$.

V

valid argument A logical argument supported by known facts or assumed axioms; an argument in which the premise leads to a conclusion.

vector A quantity that has both magnitude and direction; represented geometrically by a directed line segment.

vertex of an angle The point of intersection of the two rays that form the sides of the angle.

vertex of a polygon A point where the edges of a polygon intersect.

vertex of a cone or pyramid The fixed point, not in the plane of the base, to which all points on the perimeter of the base are connected.

vertical angles The two nonadjacent angles formed when two lines intersect.

volume A measure of the number of cubic units needed to fill the space inside a solid figure.

X

x-axis One of the two intersecting lines used to establish the coordinates of points in the Cartesian plane; in that plane, the line whose equation is $y = 0$; in space the axis perpendicular to the yz -plane.

x-coordinate The first coordinate in any (x,y) ordered pair; the number represents how many units the point is located to the left or right of the y -axis; also called abscissa.

x-intercept The point at which the graph of a relation intercepts the x -axis. The ordered pair for this point has a value of $y = 0$.

Example: The equation $y = 8 + 2x$ has an x -intercept of -4 .

Y

y-axis One of the two intersecting lines used to establish the coordinates of points in the Cartesian plane; in that plane, the line whose equation is $x = 0$; in space the axis perpendicular to the xz -plane.

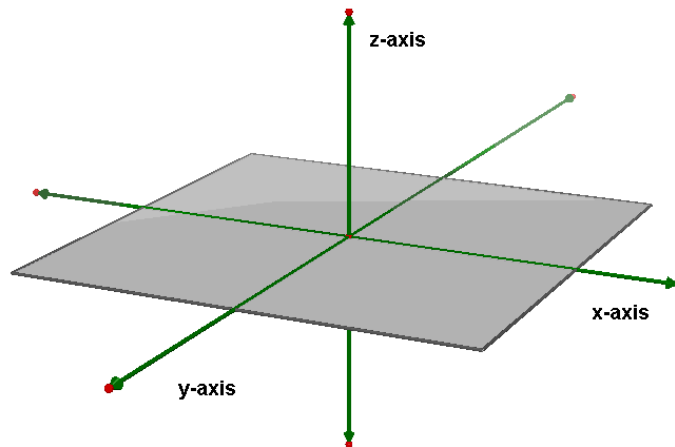
y-coordinate The second coordinate in any (x,y) ordered pair; the number represents how many units the point is located above or below of the x -axis; also called ordinate.

y-intercept The point at which a graph of a relation intercepts the y -axis. The ordered pair for this point has a value of $x = 0$.

Example: The equation $y = 8 + 2x$ has a y -intercept of 8 .

Z

z-axis A line perpendicular to the plane determined by the x-axis and y-axis at their point of intersection; this axis is used as a reference to determine the third component of the ordered triple (x, y, z) .



z-coordinate The third coordinate in any (x,y,z) ordered triple; the number represents how many units the point is located above or below of the xy -plane.

zero product property If a and b are real numbers, then $ab = 0$ if and only if $a = 0$ or $b = 0$, or a and $b = 0$.