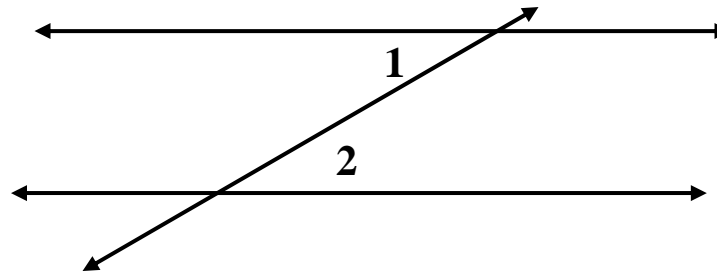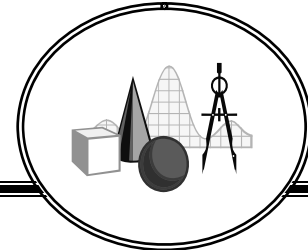# alternate interior angles

Definition and illustration (if applicable):
two non-adjacent angles that lie on the opposite sides of a transversal between two lines that the transversal intersects (a description of the location of the angles); alternate interior angles are congruent if the lines intersected by the transversal are parallel.
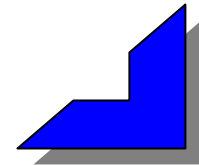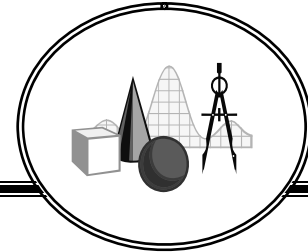
<1 and <2 are alternate interior angles.

Associated terms: parallel lines

arc

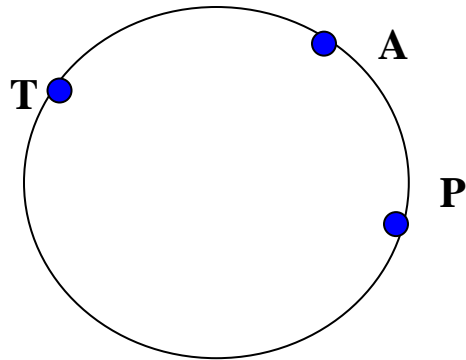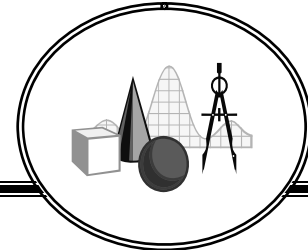**Definition and illustration (if applicable):**

part of a circle

minor arcs $\overarc{AT}$ $\overarc{AP}$ $\overarc{TP}$

major arcs $\overarc{ATP}$ $\overarc{TPA}$

T

A

P

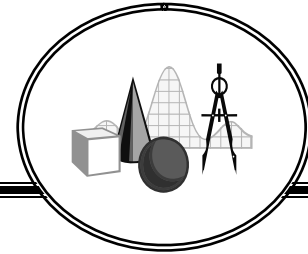**Associated terms:** circle, minor arc, major arc

arc length

Definition and illustration (if applicable):

the length in linear measure of an arc of a circle; the product of the ratio of the arc measure and 360º *and* the circumference of the circle
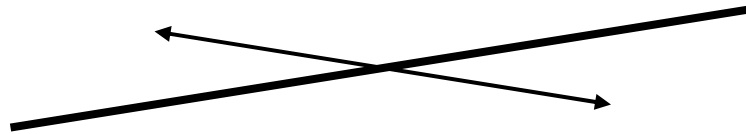
Associated terms:
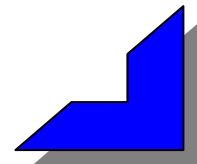
bisector (of a line segment)

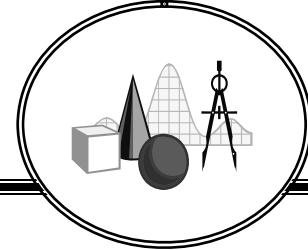**Definition and illustration (if applicable):**

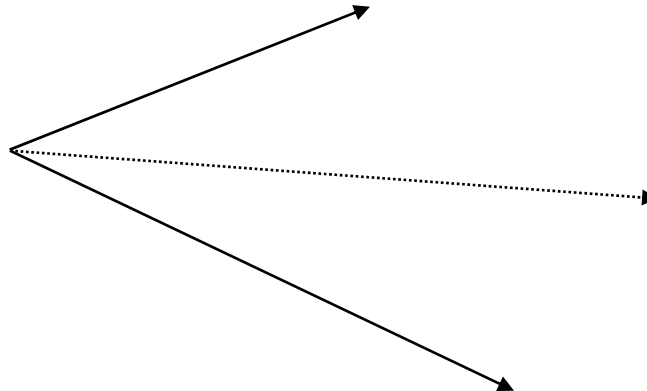a line, segment, ray, or plane that intersects a segment at its midpoint

Associated terms:

bisector (of an angle)
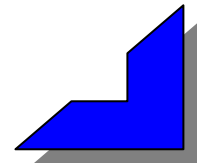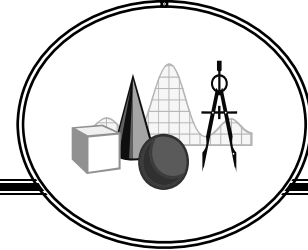
Definition and illustration (if applicable):

a line or ray that divides the angle into two congruent angles.

Associated terms:

central angle

Definition and illustration (if applicable):

an angle whose vertex is the center of the circle and whose sides are radii of the circle. The sum of the measures of the central angles in a circle is 360 degrees.
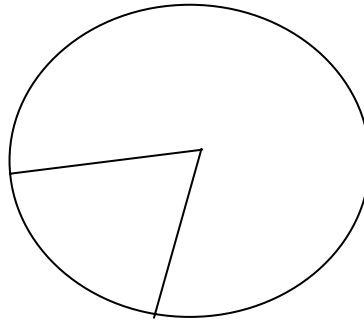
Associated terms:
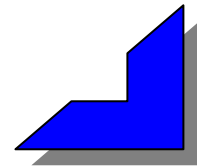
chord

Definition and illustration (if applicable):

a line segment whose endpoints lie on the circle.

If a chord goes through the center of a circle, it is a diameter.

chord

diameter

Associated terms:

circle

Definition and illustration (if applicable):
all points lying in one plane that are equidistant from a fixed point (the center of the circle)
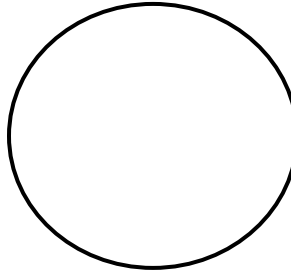
Associated terms:
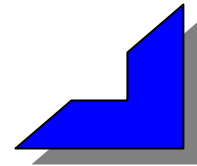
conditional statement

Definition and illustration (if applicable):
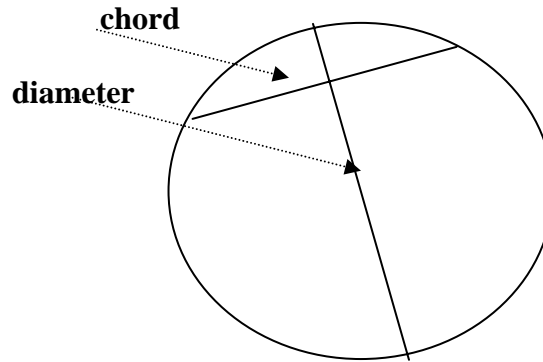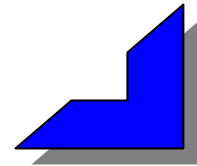 A statement that can be written in the form "If p, then q." p is the hypothesis and
    q is the conclusion. Symbolically, if p, then q can be written as p $\longrightarrow$ q.

Associated terms: converse, inverse, contrapositive, negation, Law of Syllogism,
Law of the Contrapositive, Law of Detachment

contrapositive
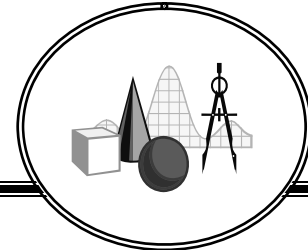
Definition and illustration (if applicable):

In the contrapositive of a conditional statement, the hypothesis and conclusion are both reversed and negated. "If p, then q." becomes "If not q, then not p.". The contrapositve has the same truth value as the original statement.

Associated terms: converse, inverse, conditional, negation, Law of Syllogism, Law of the Contrapositive

converse

Definition and illustration (if applicable):

In the converse of a conditional statement, the hypothesis and conclusion are reversed. "If p, then q." becomes "If q, then p.".
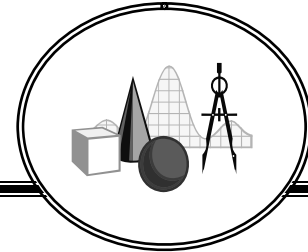
Associated terms: contrapositive, inverse, conditional, negation, Law of Syllogism, Law of the Contrapositive, Law of Detachment

convex polygon

Definition and illustration (if applicable):

a polygon in which no diagonal contains points outside of the polygon.

Associated terms:

corresponding angles
(parallel lines)

Definition and illustration (if applicable):

two angles that lie on the same side of a transversal, in corresponding positions with respect to the two lines that the transversal intersects.

∠1 and ∠5 are corresponding angles.
∠2 and ∠6, ∠3 and ∠7, and ∠4 and ∠8 are also corresponding angles.

Associated terms:
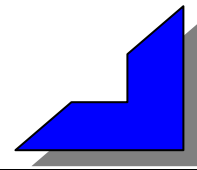
corresponding angles
(in polygons)

Definition and illustration (if applicable):

      angles that are in the same position in different plane figures
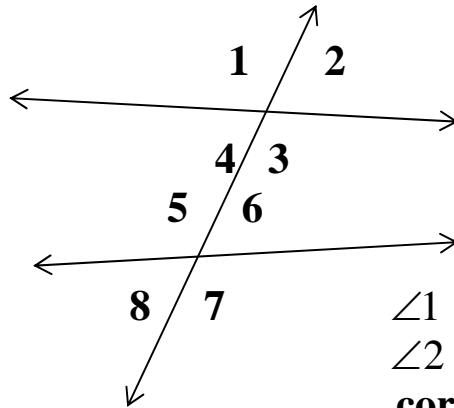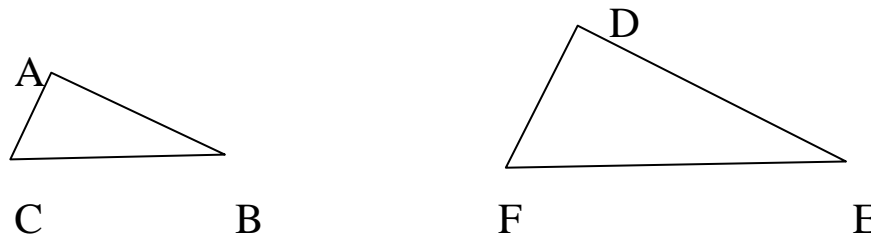
$\angle A$ **and** $\angle D$ **are corresponding angles in** $\triangle ABC$ **and** $\triangle DEF$. $\angle B$ **and** $\angle E$ **are corresponding angles.** $\angle C$ **and** $\angle F$ **are corresponding angles.**
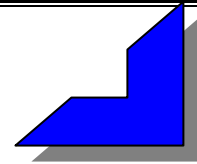
Associated terms:

cosine

Definition and illustration (if applicable):

a trigonometric function abbreviated cos

In a right triangle, the ratio of the length of the leg adjacent to the reference angle to the length of the hypotenuse
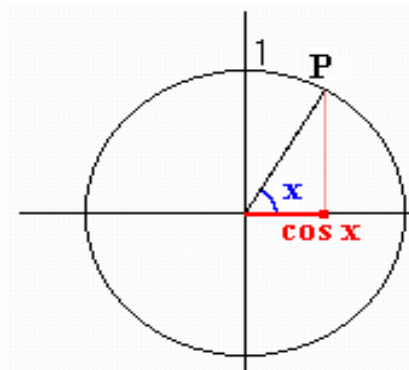
Associated terms: sine, trigonometry, tangent

dimension

Definition and illustration (if applicable):

the number of coordinates used to express a position; for example, a line has dimension one, a plane dimension two, and space dimension three.
The points of n-dimensional space have n coordinates
$(x_1, x_2 , \ldots, x_n)$.

Associated terms:

Euclidean geometry

Definition and illustration (if applicable):
a geometric system based on the five postulates of Euclid

1. A straight line can be drawn joining any two points.

2. Any straight line segment can be extended indefinitely in a straight line.

3. Given any straight line segment, a circle can be drawn having the segment as radius and one endpoint as center.
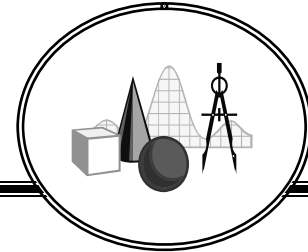
4. All right angles are congruent.

5. If two lines are drawn which intersect a third in such a way that the sum of the inner angles on one side is less than two right angles, then the two lines inevitably must intersect each other on that side if extended far enough. This postulate is equivalent to what is known as the parallel postulate (the parallel postulate)

Associated terms: non-Euclidean geometry

exterior angle of a polygon
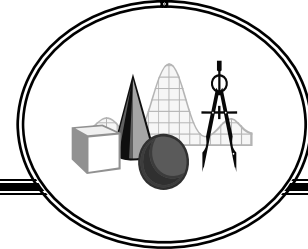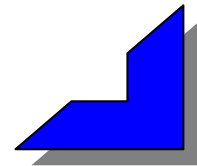
Definition and illustration (if applicable):
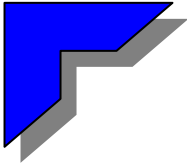an angle formed when one side of a polygon is extended; the angle is adjacent to an interior angle of the polygon
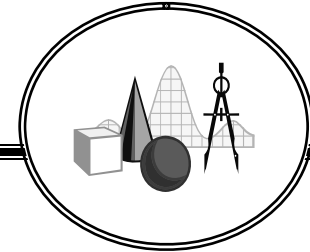
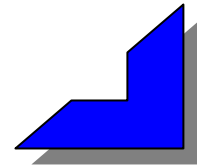interior angle
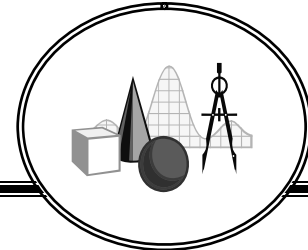
exterior angle
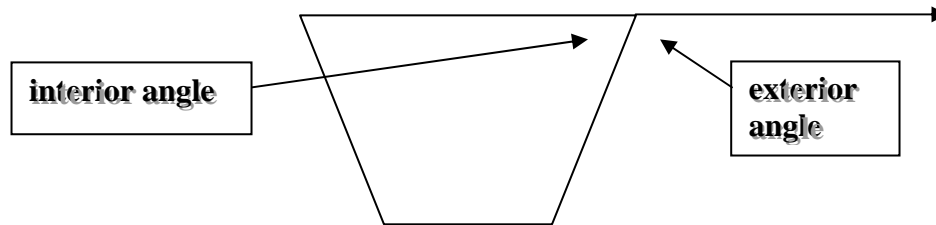
Associated terms:

geometry

Definition and illustration (if applicable):

the branch of mathematics that deals with the position, size, and shape of figures

Associated terms:

if and only if
(conditional statements)

Definition and illustration (if applicable):

In an equivalence statement, the words *if and only if* may be represented by the short symbol *iff*. Then the definition of an equivalence statement is written as follows:

p iff q = (p implies q) and (q implies p).

Here the first implication means that when p is true, q must be true, and we cannot have p true and q false. The second implication means that when q is true, p must be true, and we cannot have q true and p false.

Therefore, in an equivalence statement the only possibilities are: (1) p and q both true, and (2) p and q both false. Then p and q are said to be equivalent.

Associated terms:

Law of Syllogism

Definition and illustration (if applicable):

Suppose the statements *p implies q* and *q implies r* are both true. Then we may write:
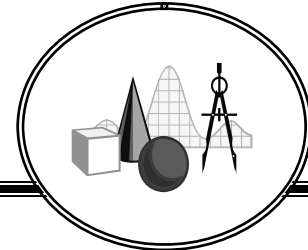
(p implies q) and (q implies r).

The first implication means that when p is true, q must also be true and we cannot have p true and q false. The second implication means that when q is true r must also be true, and we cannot have q true and r false. These results show that when p is true r must also be true, and we cannot have p true and r false. In other words: p implies r.

We may summarize this result as follows:

From (p implies q) and (q implies r) we conclude (p implies r).

Associated terms: Law of Detachment, Law of Contrapositive

Law of Detachment

Definition and illustration (if applicable):

Suppose that the statements *p* and *p implies q* are both true. Then we may write: p and (p implies q).

By the definition of the implication, this is: p and (not-p or q).

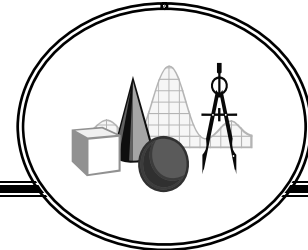By the distributive law, we now have: (p and not-p) or (p and q).

By the law of contradiction *p and not-p* is false, so *p and q* must be true. This shows we may conclude that *q* is true, because we have already supposed that *p* is true.

We may summarize this result as follows: From p and (p implies q) we conclude q.

Associated terms: Law of Syllogism, Law of Contrapositive

Law of Contrapositive

Definition and illustration (if applicable):

In an equivalence statement, the words *if and only if* may be represented by the short symbol *iff*. Then the definition of an equivalence statement is written as follows:
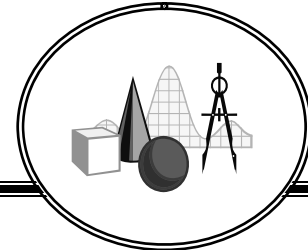
p iff q = (p implies q) and (q implies p).

Here the first implication means that when p is true, q must be true, and we cannot have p true and q false. The second implication means that when q is true, p must be true, and we cannot have q true and p false.

Therefore, in an equivalence statement the only possibilities are: (1) p and q both true, and (2) p and q both false. Then p and q are said to be equivalent.

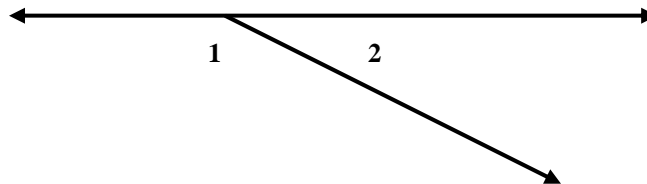## Associated terms: Law of Syllogism, Law of Detachment

linear pair

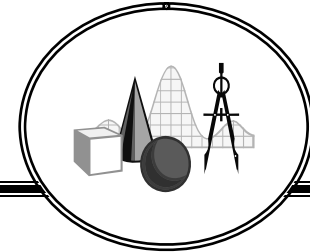**Definition and illustration (if applicable):**

two adjacent angles whose non-common sides are opposite rays; the sum of the measures of the angles in a linear pair is 180 º
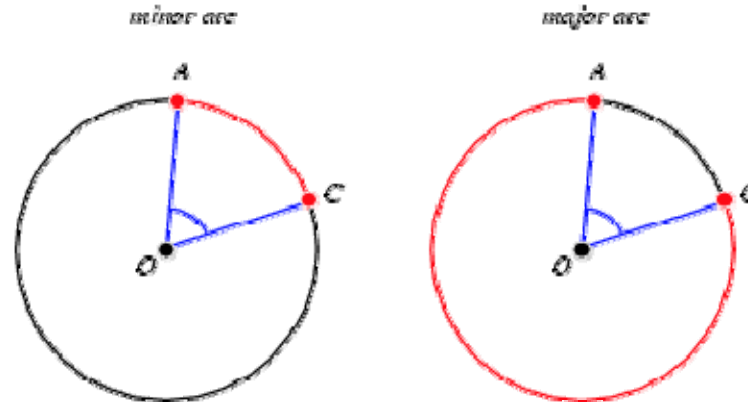
<1 and <2 comprise a linear pair.
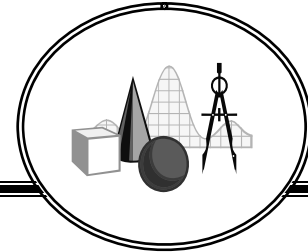
1   2

Associated terms:

major arc

Definition and illustration (if applicable):

an arc that measures 180º or more

minor arc   major arc

Associated terms: circle, arc, minor arc

midpoint

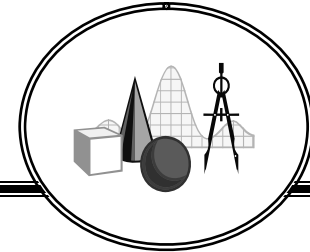**Definition and illustration (if applicable):**

**the point halfway between the endpoints of a segment; a midpoint divides a
segment into two congruent segments**

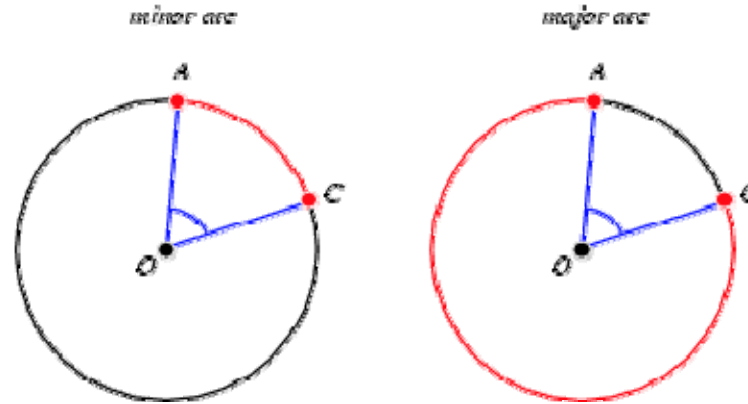$$M = \left(\frac{(X_1 + X_2)}{2} , \frac{(Y_1 + Y_2)}{2} \right)$$
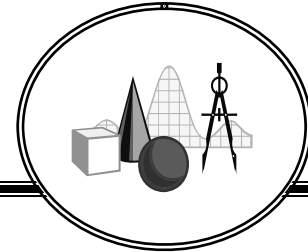
Associated terms:

minor arc

Definition and illustration (if applicable):

an arc that measures less than 180º

minor arc   major arc

Associated terms: circle, arc, major arc

negation

Definition and illustration (if applicable):

From the definition we have: p implies q = not-p or q.

Therefore, taking the negation of each side of the equation, we have: ~ (p implies q) = ~ (~ p or q).

From the negation law for logical OR we have: ~ (~ p or q) = ~ (~ p) and ~ q.

Therefore ~ (p implies q) = ~ (~ p) and ~ q.

From the double negative law we have: ~ (~ p) = p.

Therefore ~ (p implies q) = p and ~ q.

Associated terms: converse, inverse, contrapositive, Law of Syllogism, Law of Detachment, Law of the Contrapositive

non-Euclidean geometry

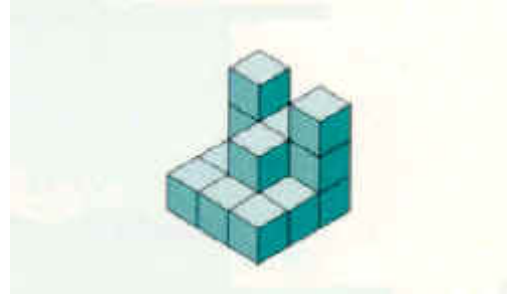**Definition and illustration (if applicable):**

Using only five postulates, Euclid (325 B.C. – 265 B.C.) was able to prove most of the usual theorems in geometry. One of the five postulates Euclid used was Parallel Postulate: Through a point not on a given line, there is exactly one line parallel to the given line. In the eighteenth century, mathematicians began to explore two different parallel postulates: Spherical Geometry--Through a point not on a given line, there is no line parallel to the given line and Hyperbolic Geometry-- Through a point not on a given line, there is more than one line parallel to the given line. Since then, these geometries have been validated as complete and consistent systems.
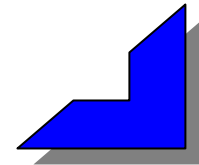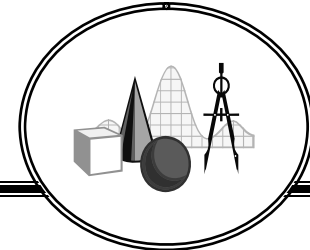
Associated terms:

orthogonal drawings
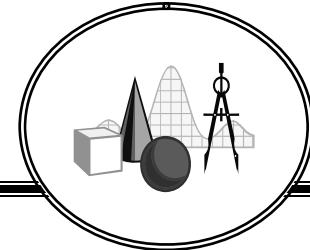
Definition and illustration (if applicable):

the two dimensional top view, front view, and right-side view of a three-dimensional drawing
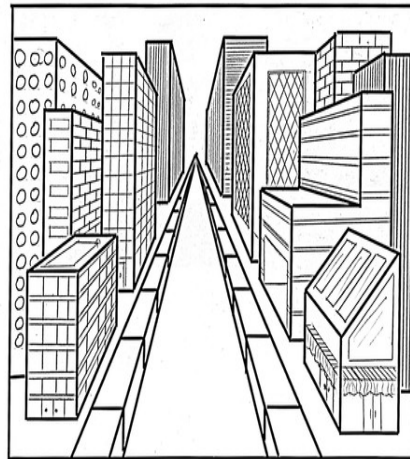
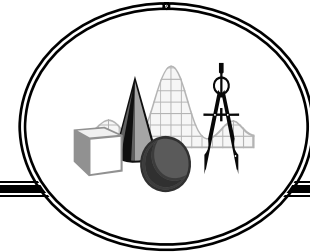**Associated terms:**

perspective drawing

Definition and illustration (if applicable):
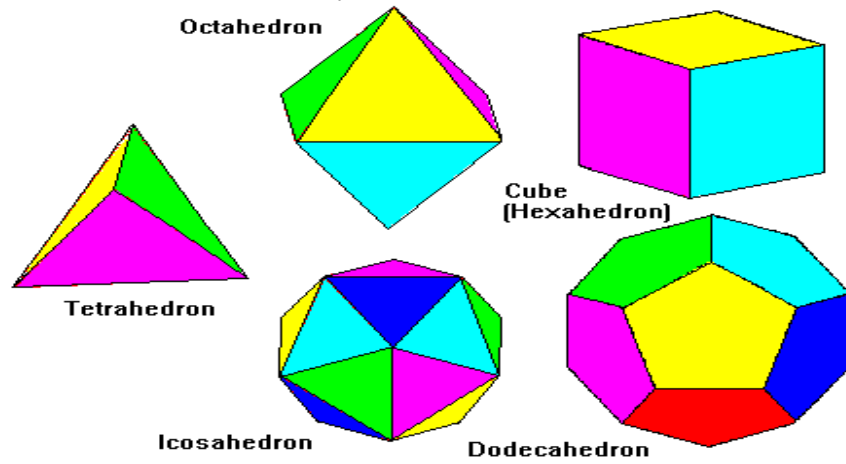a drawing that makes a two-dimensional image look like a three-dimensional object

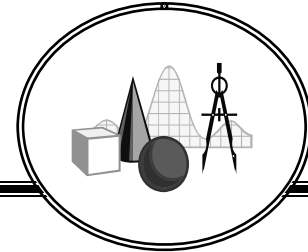**Associated terms: vanishing point**

platonic solids

Definition and illustration (if applicable):

the five regular polyhedra: tetrahedron, hexahedron, octahedron, dodecahedron, or icosahedron

Octahedron

Cube
(Hexahedron)

Tetrahedron

Icosahedron

Dodecahedron

Associated terms: polyhedron

postulate

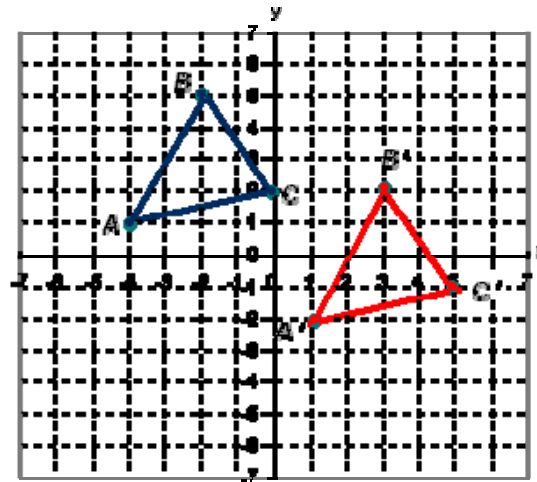**Definition and illustration (if applicable):**

   postulate, or axiom, indicates a statement or assumption that is agreed by everyone to be so obvious or self-evident that no proof is necessary; and which can be used to prove other statements or theorems. Neither axioms nor postulates can be proved (within a system) using more basic statements.

Associated terms: theorem
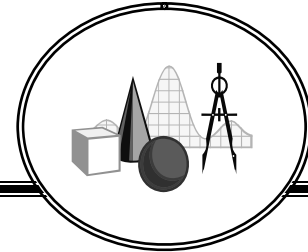
pre-image
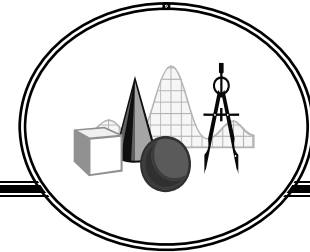
Definition and illustration (if applicable):

the position of a figure before a transformation

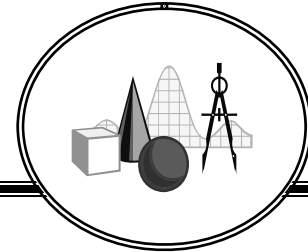**Associated terms:** transformation, translation, dilation, rotation, reflection

proof

Definition and illustration (if applicable):

a valid argument in which all of the premises are true

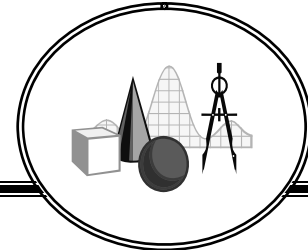**Associated terms:**

regular polygon

Definition and illustration (if applicable):

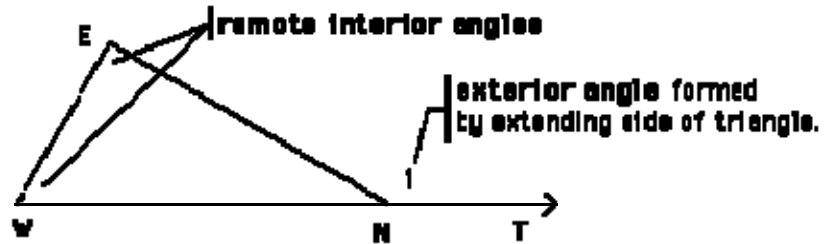a polygon that has congruent sides and congruent angles

Associated terms:
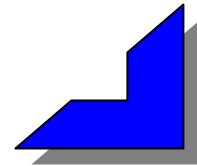
remote interior angles
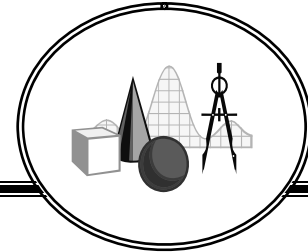# (in a polygon)

Definition and illustration (if applicable):

the angles of a triangle that are not adjacent to a given exterior angle

remote interior angles

exterior angle formed
by extending side of triangle.

E

W   N   T
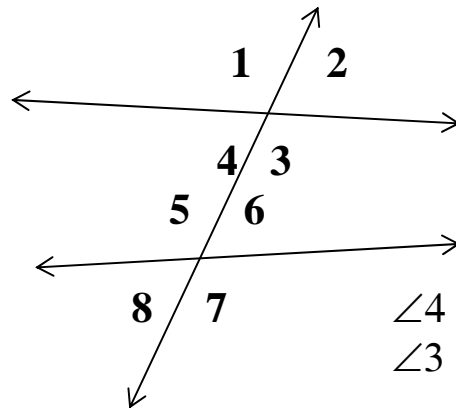
Associated terms:

same-side interior angles

Definition and illustration (if applicable):

two angles that lie on the same side of a transversal and between the lines cut by the transversal, in corresponding positions with respect to the two lines that the transversal intersects.
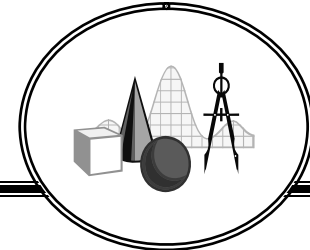
1   2

4 3

5   6

8 7 $\angle 4$ and $\angle 5$ are same-side interior angles.
             $\angle 3$ and $\angle 6$ are also same-side interior angles.

Associated terms: alternate interior angles, parallel lines, corresponding angles
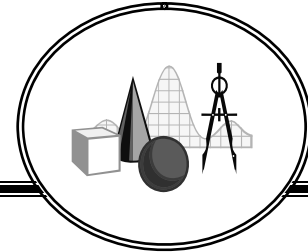
scale

Definition and illustration (if applicable):

scale is the ratio of any length in a scale drawing to the corresponding actual length; the lengths may be in different units
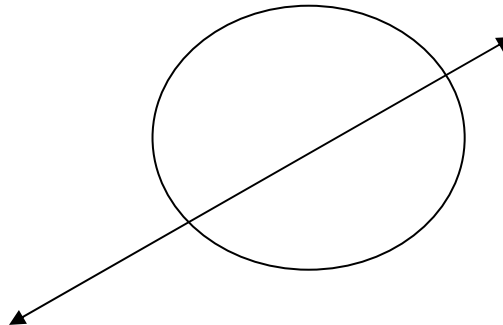
Associated terms: scale drawing

Geometry

secant

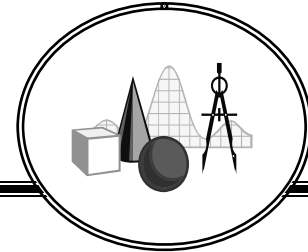**Definition and illustration (if applicable):**

a line, ray, or segment that intersects a circle at two points (i.e. that contains a chord). A secant to a sphere is a line, ray, or segment that intersects a sphere at two points.
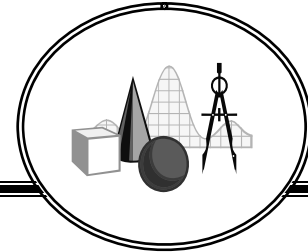
Associated terms: circle, chord

semicircle

Definition and illustration (if applicable):

an arc that is one-half of a circle; an arc that is subtended by a diameter
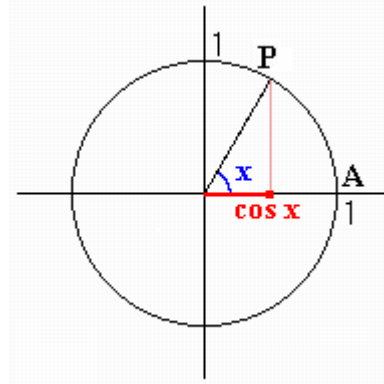
Associated terms:

sine
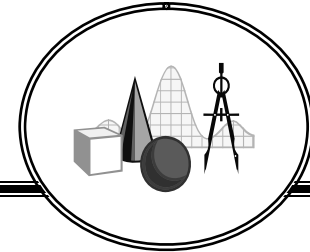
Definition and illustration (if applicable):

a trigonometric function abbreviated sin.
In a right triangle, the ratio of the length of the leg opposite the reference angle to the length of the hypotenuse.
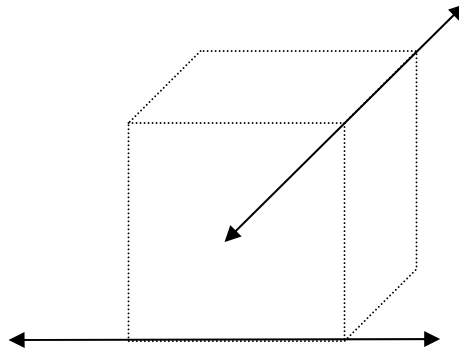

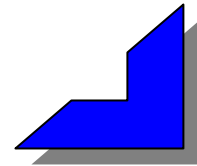**Associated terms: trigonometry, cosine, tangent**

skew lines

Definition and illustration (if applicable):

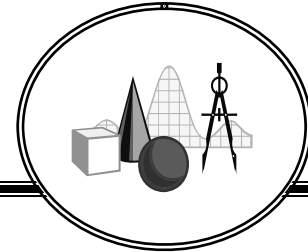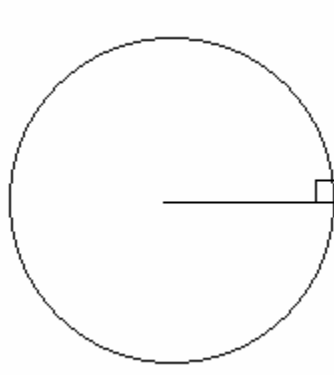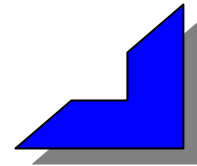### non-coplanar lines that do not intersect

Associated terms:

tangent
(to a circle)

Definition and illustration (if applicable):

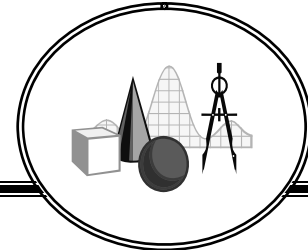a line that intersects a circle in exactly one point

Associated terms:

tangent
(trigonometric function)

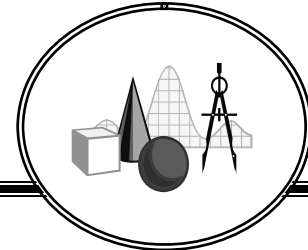**Definition and illustration (if applicable):**
a trigonometric function abbreviated tan; the ratio between the sine of an angle
and the cosine of the same angle
In a right triangle, the ratio of the length of the leg opposite the reference angle to
the length of the leg adjacent to the given angle.

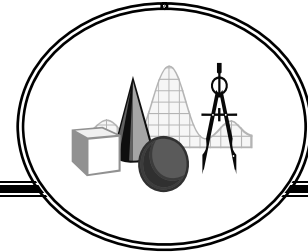**Associated terms:** sine, cosine, trigonometry

theorem

Definition and illustration (if applicable):
  a statement or conjecture that can be proven to be true based on postulates, definitions, or other proven theorems
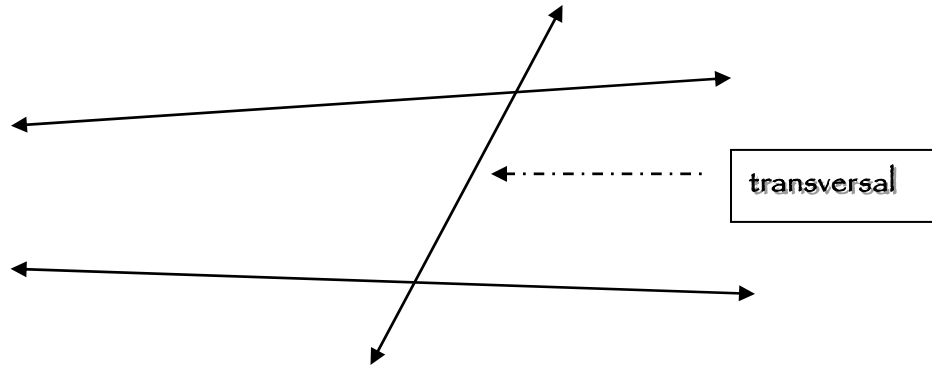
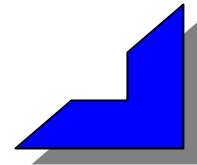**Associated terms: proof, postulate**

transversal

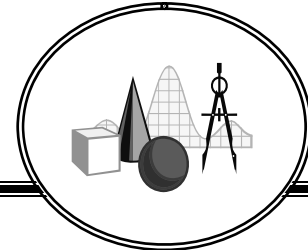**Definition and illustration (if applicable):**
 a line that intersects two or more other lines in the same plane at different points

transversal

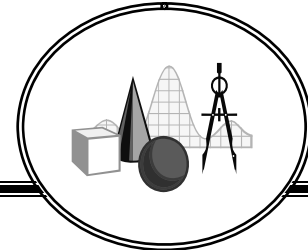**Associated terms: parallel lines**

trigonometry

Definition and illustration (if applicable):
a branch of mathematics which studies the relationships between sides and angles of a triangle; the six trigonometric functions are sine, cosine, tangent, cotangent, secant, and cosecant

**Associated terms:**   sine, cosine, tangent

undefined terms

Definition and illustration (if applicable):
basic concepts that are described because they cannot be rigorously defined impossible to define every term because eventually the definitions would become circular; point, line, and plane are generally taken as undefined terms in geometry

Associated terms:

vanishing point
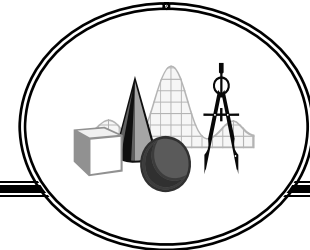
Definition and illustration (if applicable):

a point in a perspective drawing to which parallel lines appear to converge

Associated terms: perspective drawing