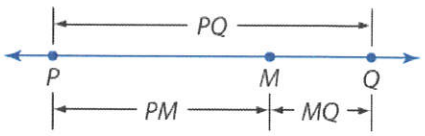
Chapter 1

KeyConcept Betweenness of Points

Words

Point M is between points P and Q if and only if P, Q, and M are collinear and $PM + MQ = PQ$.

Model



KeyConcept Distance Formula (on Number Line)

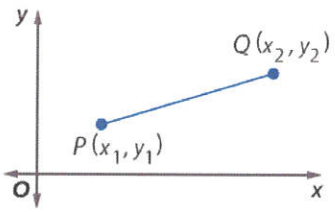
Words The distance between two points is the absolute value of the difference between their coordinates.

Symbols If P has coordinate x_1 and Q has coordinate x_2, $PQ = |x_2 - x_1|$ or $|x_1 - x_2|$.

KeyConcept Distance Formula (in Coordinate Plane)

If P has coordinates (x_1, y_1) and Q has coordinates (x_2, y_2), then

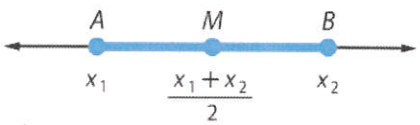
$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$



KeyConcept Midpoint Formula (on Number Line)

If $\overline{AB}$ has endpoints at x_1 and x_2 on a number line, then the midpoint M of $\overline{AB}$ has coordinate

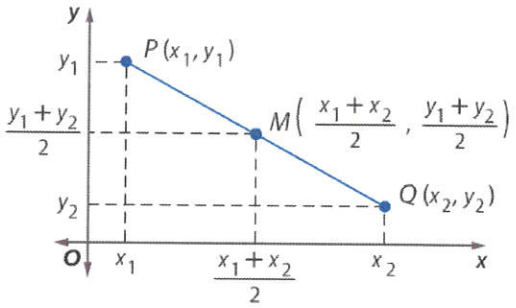
$$\frac{x_1 + x_2}{2}.$$



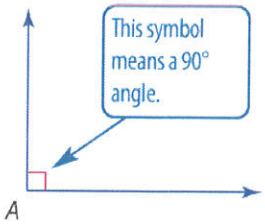
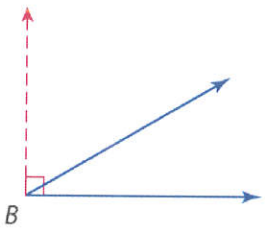
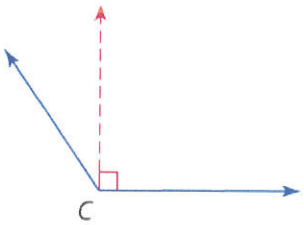
KeyConcept Midpoint Formula (in Coordinate Plane)

If $\overline{PQ}$ has endpoints at $P(x_1, y_1)$ and $Q(x_2, y_2)$ in the coordinate plane, then the midpoint M of $\overline{PQ}$ has coordinates

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right).$$



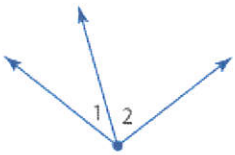
KeyConcept Classify Angles

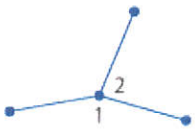
right angle	acute angle	obtuse angle
		
$m\angle A = 90$	$m\angle B < 90$	$180 > m\angle C > 90$

KeyConcept Special Angle Pairs

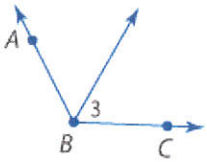
Adjacent angles are two angles that lie in the same plane and have a common vertex and a common side, but no common interior points.

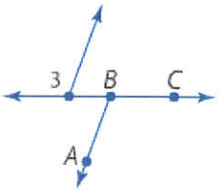
Examples $\angle 1$ and $\angle 2$ are adjacent angles.





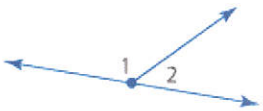
Nonexamples $\angle 3$ and $\angle ABC$ are nonadjacent angles



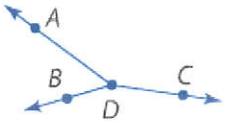


A **linear pair** is a pair of adjacent angles with noncommon sides that are opposite rays.

Example $\angle 1$ and $\angle 2$

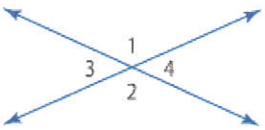


Nonexample $\angle ADB$ and $\angle ADC$

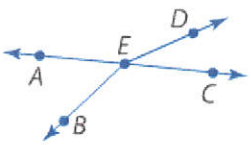


Vertical angles are two nonadjacent angles formed by two intersecting lines.

Examples $\angle 1$ and $\angle 2$; $\angle 3$ and $\angle 4$



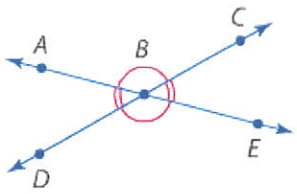
Nonexample $\angle AEB$ and $\angle DEC$



KeyConcept Angle Pair Relationships

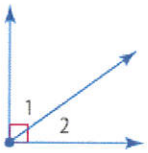
Vertical angles are congruent.

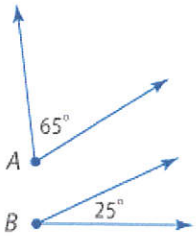
Examples $\angle ABC \cong \angle DBE$ and $\angle ABD \cong \angle CBE$



Complementary angles are two angles with measures that have a sum of 90.

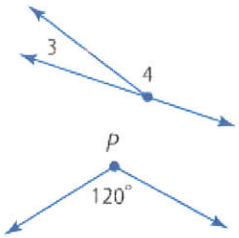
Examples $\angle 1$ and $\angle 2$ are complementary.
$\angle A$ is complementary to $\angle B$.

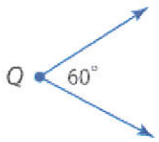




Supplementary angles are two angles with measures that have a sum of 180.

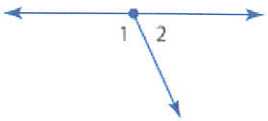
Examples $\angle 3$ and $\angle 4$ are supplementary.
$\angle P$ and $\angle Q$ are supplementary.





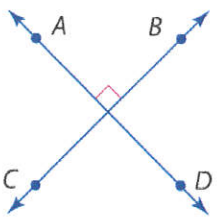
The angles in a linear pair are supplementary.

Example $m\angle 1 + m\angle 2 = 180$



KeyConcept Perpendicular Lines

- Perpendicular lines intersect to form four right angles.
- Perpendicular lines intersect to form congruent adjacent angles.
- Segments and rays can be perpendicular to lines or other line segments and rays.
- The right angle symbol in the figure indicates that the lines are perpendicular.



Symbol $\perp$ is read *is perpendicular to.* **Example** $\overleftrightarrow{AD} \perp \overleftrightarrow{CB}$

KeyConcept Interpreting Diagrams

CAN be Assumed

All points shown are coplanar.

G, H, and J are collinear.

$\overrightarrow{HM}$, $\overrightarrow{HL}$, $\overrightarrow{HK}$, and $\overleftrightarrow{GJ}$ intersect at H.

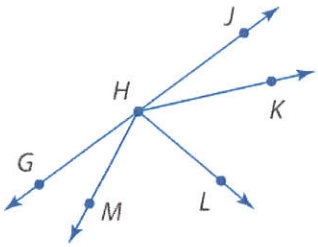
H is between G and J.

L is in the interior of $\angle MHK$.

$\angle GHM$ and $\angle MHL$ are adjacent angles.

$\angle GHL$ and $\angle LHJ$ are a linear pair.

$\angle JHK$ and $\angle KHG$ are supplementary.



CANNOT be Assumed

Perpendicular lines: $\overrightarrow{HM} \perp \overrightarrow{HL}$

Congruent angles: $\angle JHK \cong \angle GHM$

$\angle JHK \cong \angle KHL$

$\angle KHL \cong \angle LHM$

Congruent segments: $\overline{GH} \cong \overline{HJ}$

$\overline{HJ} \cong \overline{HK}$

$\overline{HK} \cong \overline{HL}$

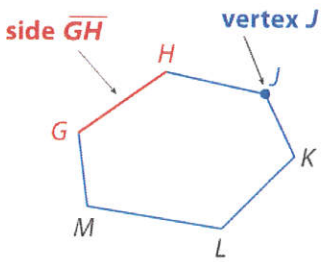
$\overline{HL} \cong \overline{HG}$

KeyConcept Polygons

A **polygon** is a closed figure formed by a finite number of coplanar segments called *sides* such that

- the sides that have a common endpoint are noncollinear, and
- each side intersects exactly two other sides, but only at their endpoints.

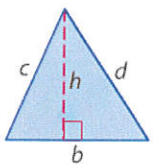
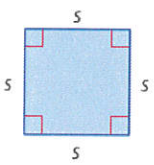
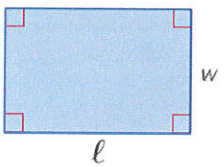
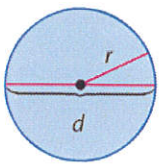
The vertex of each angle is a **vertex of the polygon**. A polygon is named by the letters of its vertices, written in order of consecutive vertices.



polygon *GHJKLM*

Number of Sides	Polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon
8	octagon
9	nonagon
10	decagon
11	hendecagon
12	dodecagon
n	n-gon

KeyConcept Perimeter, Circumference, and Area

Triangle	Square	Rectangle	Circle
			
$P = b + c + d$	$P = s + s + s + s$ $= 4s$	$P = \ell + w + \ell + w$ $= 2\ell + 2w$	$C = 2\pi r$ or $C = \pi d$
$A = \frac{1}{2}bh$	$A = s^2$	$A = \ell w$	$A = \pi r^2$

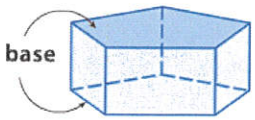
P = perimeter of polygon; A = area of figure; C = circumference

b = base, h = height; ℓ = length, w = width; r = radius, d = diameter

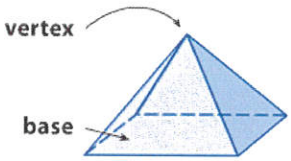
KeyConcept Types of Solids

Polyhedrons

A **prism** is a polyhedron with two parallel congruent faces called **bases** connected by parallelogram faces.

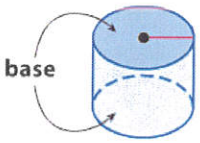


A **pyramid** is a polyhedron that has a polygonal base and three or more triangular faces that meet at a common vertex.

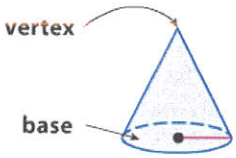


Not Polyhedrons

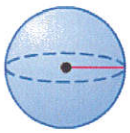
A **cylinder** is a solid with congruent parallel circular bases connected by a curved surface.



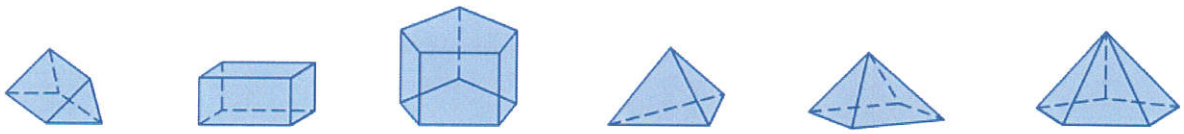
A **cone** is a solid with a circular base connected by a curved surface to a single vertex.



A **sphere** is a set of points in space that are the same distance from a given point. A sphere has no faces, edges, or vertices.

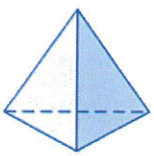
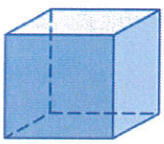
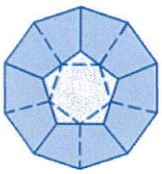


Polyhedrons or *polyhedra* are named by the shape of their bases.

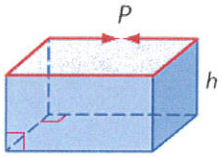
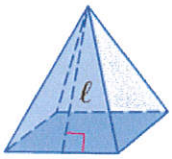
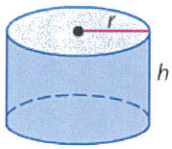
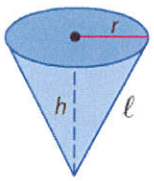
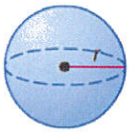


triangular prism | **rectangular prism** | **pentagonal prism** | **triangular pyramid** | **rectangular pyramid** | **pentagonal pyramid**

KeyConcept Platonic Solids

Tetrahedron	Hexahedron or Cube	Octahedron	Dodecahedron	Icosahedron
				
4 equilateral triangle faces	6 square faces	8 equilateral triangular faces	12 regular pentagonal faces	20 equilateral triangular faces

KeyConcept Surface Area and Volume

Prism	Regular Pyramid	Cylinder	Cone	Sphere
				
$S = Ph + 2B$	$S = \frac{1}{2}P\ell + B$	$S = 2\pi rh + 2\pi r^2$	$S = \pi r\ell + \pi r^2$	$S = 4\pi r^2$
$V = Bh$	$V = \frac{1}{3}Bh$	$V = \pi r^2 h$	$V = \frac{1}{3}\pi r^2 h$	$V = \frac{4}{3}\pi r^3$

S = total surface area — V = volume — h = height of a solid

P = perimeter of the base — B = area of base — ℓ = slant height, r = radius