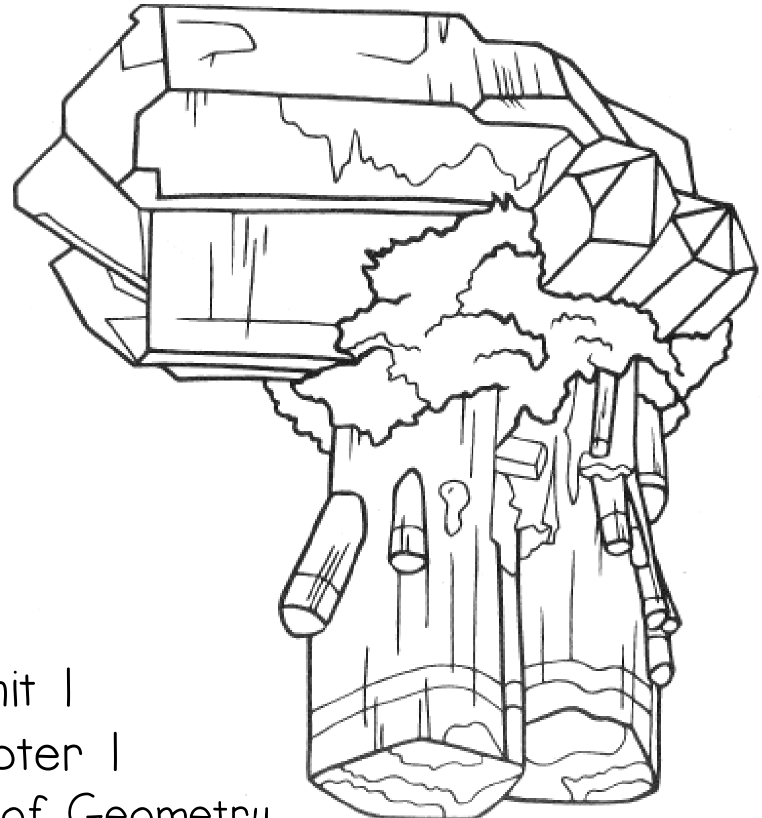
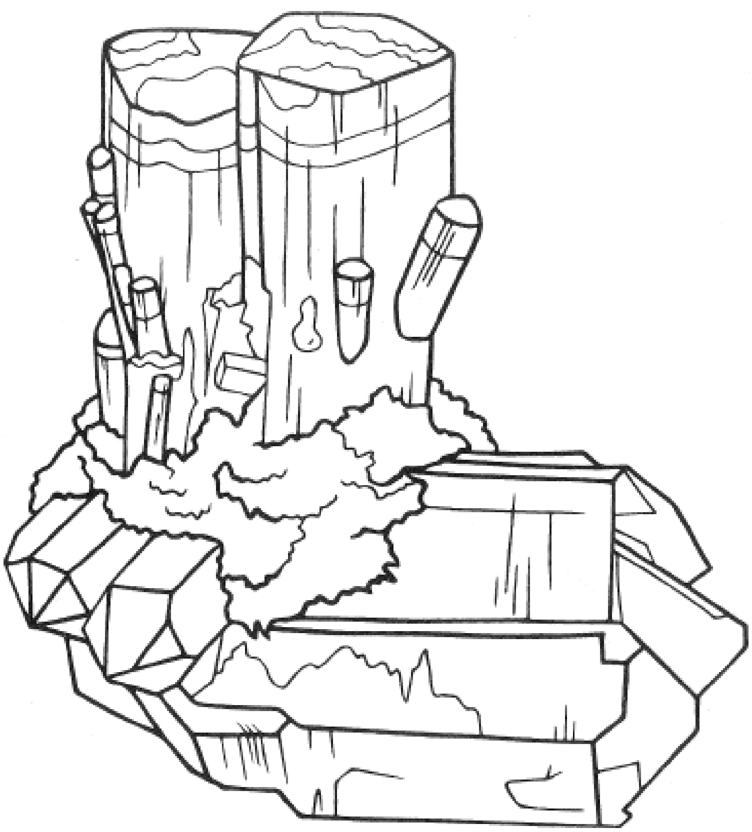
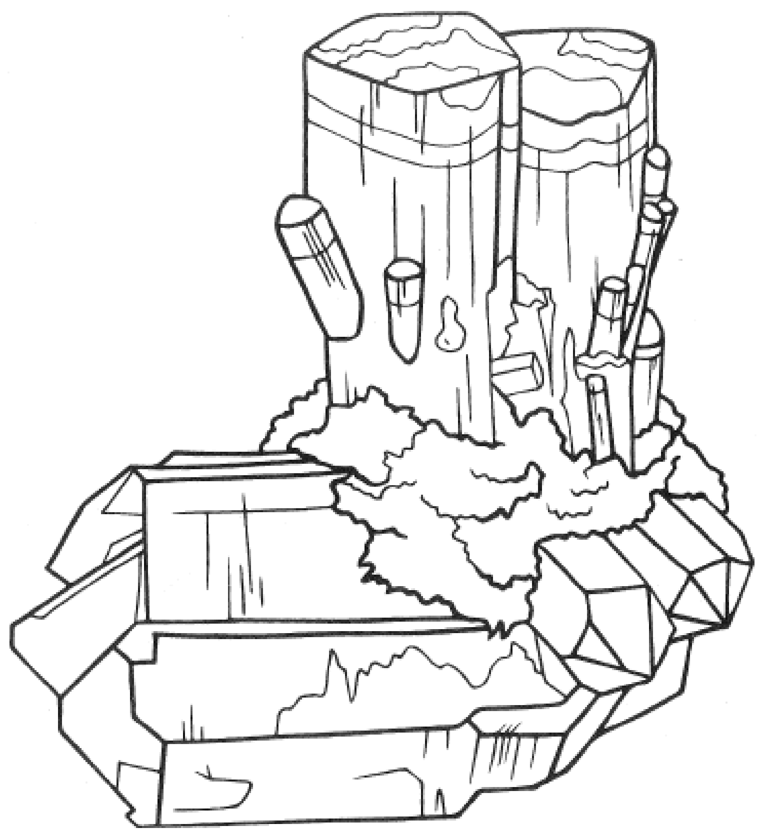


Unit 1
Chapter 1
Foundations of Geometry

Name _____________

Hour ____





Geometry Unit 1 – Foundations of Geometry
Chapter 1

Monday **August 26**	1.1 Understanding Points, Lines, & Planes
Tuesday **August 27**	1.2 Linear Measure DHQ 1.1
Block **Wed/Thurs.** **August 28-29**	1.3 Distance and Midpoints – day 1 Practice Measuring Angles DHQ 1.2
Friday **August 30**	1.3 Distance and Midpoints – day 2 DHQ 1.3 – part 1
Monday **September 2**	Labor Day Holiday
Tuesday **September 3**	1.4 Angle Measure DHQ 1.3 – part 2
Block **Wed/Thurs.** **September 4-5**	1.5 Angle Relationships – Adjacent, Linear Pair, Vertical Quiz 1-1 to 1-3 DHQ 1-4
Friday **September 6**	1.5 Angle Relationships – Supplementary, Complementary DHQ 1-5
Monday **September 9**	Unit 1 Review
Tuesday **September 10**	Unit 1 Review
Block **Wed/Thurs.** **Sept 10-11**	Unit 1 Test
Friday **September 12**	Start Unit 2 – Chapter 9

There is no failure. Only feedback. ~ Anonymous

1.1 Understanding Points, Lines, & Planes

<u>Objective</u>: *1) identify and model points, lines, and planes; 2) identify intersecting lines and planes.*

****

undefined terms →

KeyConcept Undefined Terms

A **point** is a location. It has neither shape nor size.

Named by a capital letter

Example point *A*

A **line** is made up of points and has no thickness or width. There is exactly one line through any two points.

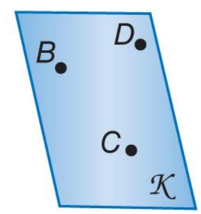
Named by the letters representing two points on the line or a lowercase script letter

Example line *m*, line *PQ* or $\overleftrightarrow{PQ}$, line *QP* or $\overleftrightarrow{QP}$

A **plane** is a flat surface made up of points that extends infinitely in all directions. There is exactly one plane through any three points not on the same line.

Named by a capital script letter or by the letters naming three points that are not all on the same line

Example plane $\mathcal{K}$, plane *BCD*, plane *CDB*, plane *DCB*, plane *DBC*, plane *CBD*, plane *BDC*



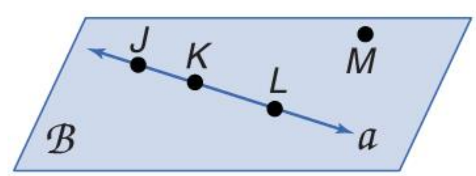
Collinear *points* → points that lie on the same line

Coplanar *points* → points that lie in the same plane

<u>**Example 1-1-1: Name Lines and Planes**</u>

Use the figure to name each of the following.

a. a line containing point *K*



b. a plane containing point *M*

Example 1-1-2: Model Points, Lines, and planes

A. Name the geometric shape modeled by a 10 x 12 patio.

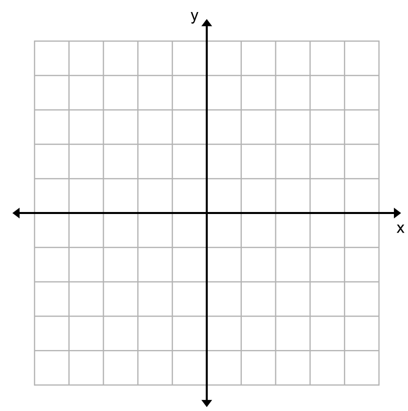
B. Name the geometric shape modeled by a button on a table.

Example 1-1-3: Draw Geometric Figures

Draw and label a figure for each relationship.

A. Plane R contains lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{DE}$, which intersect at point P. Add a point C on plane R so that it is not collinear with $\overleftrightarrow{AB}$or $\overleftrightarrow{DE}$.

B. $\overleftrightarrow{QR}$on a coordinate plane contains $Q(-2, 4)$ and $R(4, -4)$. Add point T so that T is collinear with these points.

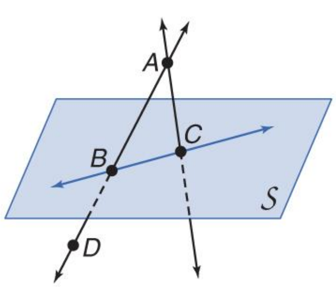


Intersection → the set of points two or more geometric figures have in common.

If two lines intersect, then they intersect in a ____________________.

If two planes intersect, then they intersect in a __________________.

Example 1-1-4-i: Interpret Diagrams



A. How many planes appear in this figure?

B. Name three collinear points.

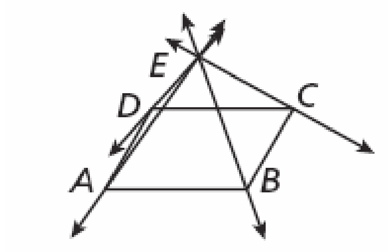
C. Are points A, B, C and D coplanar? Explain.

D. At what point do $\overleftrightarrow{DB}$ and $\overleftrightarrow{CA}$ intersect?

Example 1-1-4-ii: Interpret Diagrams:

A. Name four coplanar points.

B. Name three lines.



Example 1-1-5: **Sketch a figure that shows each of the following.**

A. lines a and b intersecting at point P

B. $\overleftrightarrow{WD}$ lying in plane P

C. two lines intersecting in one point in a plane, but only one of the lines lies in the plane

D. points R, M, and D are collinear, but A is not

Thinking Questions

1. What are some other objects that point, lines and planes could be used to represent?
2. What are some other ways that combinations of points, lines, and planes are used?
3. Describe a point, a line and a plane. Can you clearly define these geometric terms?
4. What is the difference between a description and a definition?

1.2 Linear Measure

<u>Objective</u>: *1) to measure segments and 2) to be able to make calculations with those measurements*

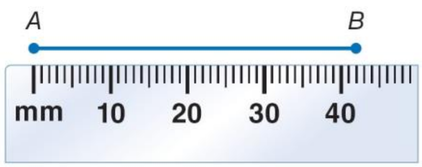
Segments and Rays		
DEFINITION	**NAME**	**DIAGRAM**
Segment or (line segment): The part of a line consisting of 2 points and all points between them.		
Endpoint: A point at one end of a segment or the starting point of a ray.		

Important Tip-All measurements are approximations dependent upon the smallest unit of measure available on the measuring instrument.

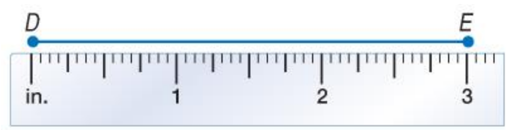
<u>Example 1-2-1 Lengths</u>

Find the length of the segment using each ruler.

A. **Length of $\overline{AB}$**



B. **Length of $\overline{DE}$**



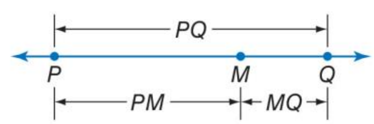
In order for a point to be considered ***between*** two other points, all three points must lie on the same line and the sum of the two smaller segments must total the largest segment.

KeyConcept Betweenness of Points

Words

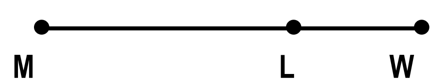
Point M is between points P and Q if and only if P, Q, and M are collinear and $PM + MQ = PQ$.

Model



Postulate- A statement that describes a fundamental relationship between the basic terms of geometry.

Example of Segment Addition Postulate:



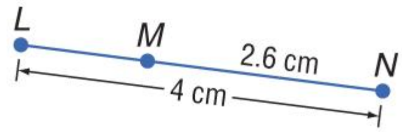
<u>Example 1-2-3: Find Measurements by Adding</u>

Find *XZ*. Assume that the figure is not drawn to scale.

(*XZ* means the measure of $\overline{XZ}$)

Example 1-2-4: Find Measurements by Subtracting

Find LM. Assume that the figure is not drawn to scale.

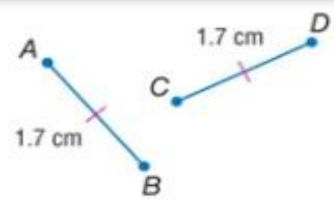


Example 1-2-5: Write and Solve Equations to Find Measurements

Find the value of *x* and *MN* if *N* is between *M* and *P*, $MP = 60, MN = 6x - 7,$ and $NP = 2x + 3.$ Draw a figure to represent this information. Then write and solve an equation relating the given measures.

KeyConcept Congruent Segments

Words	Congruent segments have the same measure.
Symbols	$\cong$ is read *is congruent to*. Red slashes on the figure also indicate congruence.
Example	$\overline{AB} \cong \overline{CD}$



Equal vs congruent

Lengths are ____________ and segments are ________________.

It is correct to say $AB = CD$ and ____ $\cong$ ____. It is **NOT** correct to say _____ = _____ or that $AB \cong CD$.

Example 1-2-5: Real World – Congruent Segments

The Arial font is often used because it is easy to read. Study the word *time* shown in Arial type. Each letter can be broken into individual segments. The letter T has two segments, a short horizontal segment, and a longer vertical segment. Assume that all segments overlap where they meet. Which segments are congruent?

T I M E

Thinking Questions

1. How many points are there between any two endpoints of a segment?

2. If point M is between points C and D, then CD is (always, sometimes, or never) greater then CM or MD? Explain Why.

3. If point B is between points Q and A, then what statement can be made?

4. Draw and label a picture that contains lines, planes, and simple geometric shapes.

1.3 Distance and Midpoints

Objective: *1) find the distance between two points and 2) the midpoint of a segment*

Day 1:

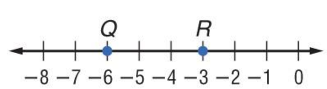
KeyConcept Distance Formula (on Number Line)

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

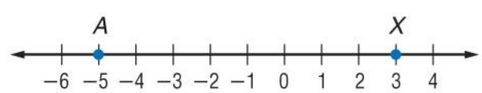
Symbols If P has coordinate x_1 and Q has coordinate x_2, $PQ = |x_2 - x_1|$ or $|x_1 - x_2|$.

Example 1-3-1: Find Distance on a Number Line

a. Use the number line to find QR.



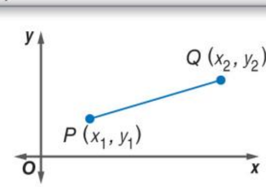
b. Use the number line to find AX.



KeyConcept Distance Formula (in Coordinate Plane)

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

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



Example 1-3-2: Find Distance on a Coordinate Plane

Find the distance between the two points algebraically.

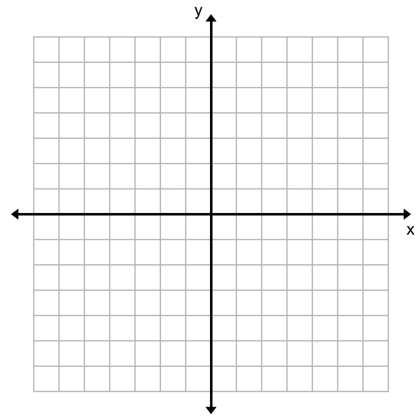
a. $C(-4,-6)$ and $D(5,-1)$

b. $E(-4,1)$ and $F(3,-1)$

Check

Graph the ordered pairs and apply the Pythagorean Theorem.

What is Pythagorean Thm? ____________________



Midpoint---

Midpoint Formula(s)

KeyConcept Midpoint Formula (on Number

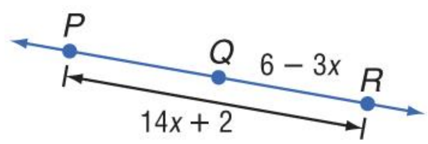
If $\overline{AB}$ has endpoints at x_1 and x_2 on a number line, then the midpoint M of $\overline{AB}$ has coordinate

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

Segment Bisector— any segment, line, or plane that intersects a segment at its midpoint is called a segment bisector

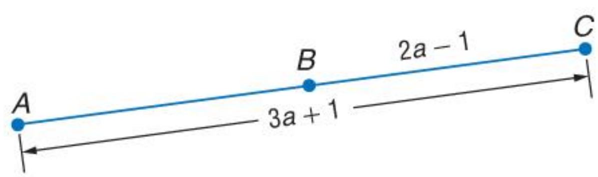
Example 1-3-6-i: Finding the lengths of a bisected segment.

Find the measure of $\overline{PQ}$ if Q is the midpoint of $\overline{PR}$.



Example 1-3-6-ii: Finding the lengths of a bisected segment.

Find the measure of $\overline{AC}$ if B is the midpoint of $\overline{AC}$.



Example 1-3-3: Find the midpoint on a number-line

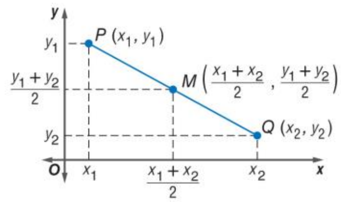
Marco places a couch so that its end is perpendicular and 2.5 feet away from the wall. The couch is 90" wide. How far is the midpoint of the couch back from the wall in feet?

Day 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

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



Example 1-3-5: Find the coordinates of the Midpoint

a. $G(8, -6), H(-14, 12)$

b. $X(-2, 3), Y(-8, -9)$

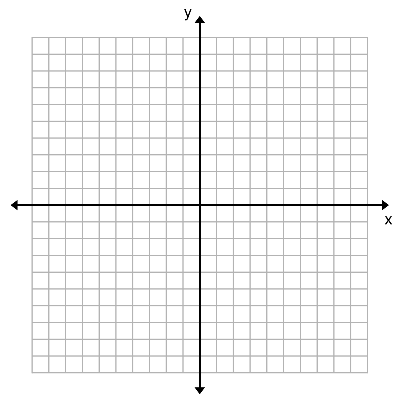
Example 1-3-5: Find the coordinates of the missing endpoint if B is the midpoint of AC

Algebraically

a. $A(-8, 6), B(-5, 10)$

Graphically

b. $B(-1, 3), C(5, 6)$



Thinking Questions

1. What is the relationship between the distance formula and the Pythagorean Theorem?

2. What is the correlation between a mean and the midpoint?

3. How is the midpoint formula different than the slope formula?

4. What is the difference between the two phrases "between two points" and "a point bisects the segment"?

1.4 Angle Measure

Objectives: 1) to measure and classify angles; identify and 2) use congruent angles and the bisector of an angle.

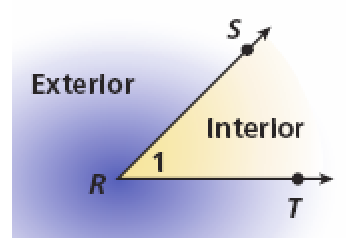
Definition	Diagram	Name
Ray A part of a line that starts at an endpoint and extends forever in one direction.		
Opposite rays 2 rays that have a common endpoint and form a line		

Angle → formed by two non-collinear rays that have a common endpoint

Vertex → common endpoint of an angle

Angle Names:

"angle" symbol → ∠ or ∡



Example 1-4-1-i: Angles and their Parts

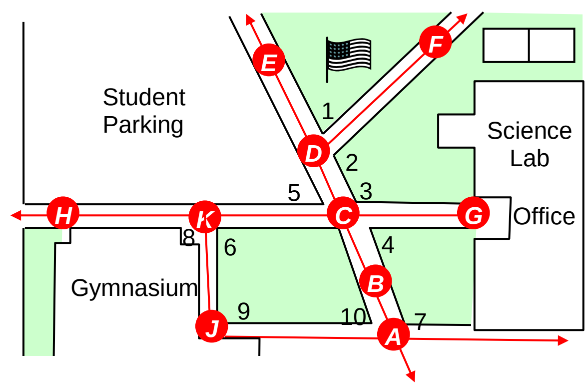
Use the map of a high school shown.

a. Name all angles that have *K* as a vertex.

b. Name the sides of ∠6.

c. What is another name for ∠*AJK*?

d. Name a point in the interior of ∠*ECG*.

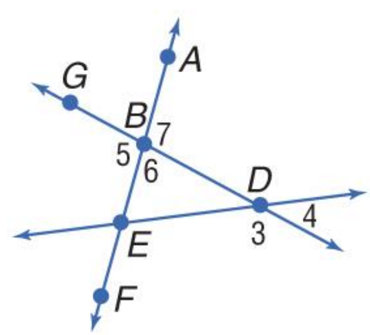


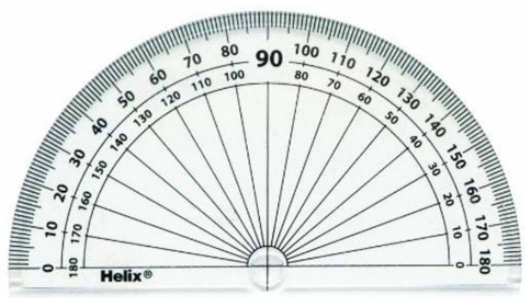
Example 1-4-1-ii: Angles and their Parts

Use the image on the right.

a. Name the sides of ∠5.

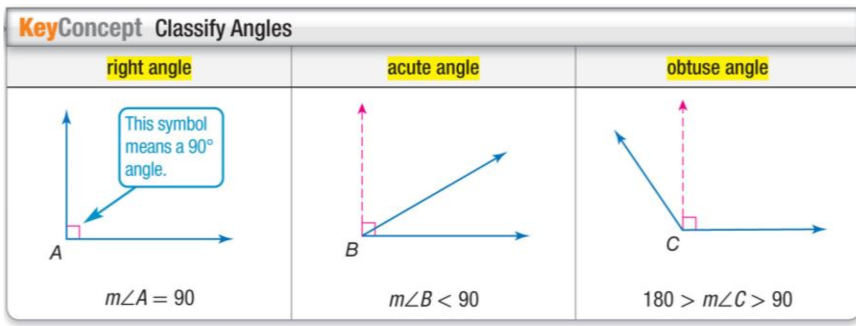
b. What is another name for ∠7?

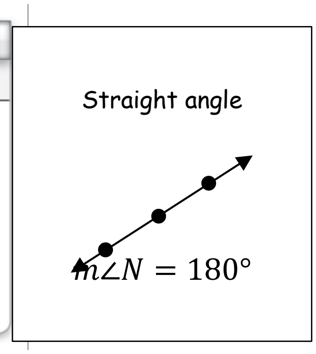




Angles are measured with degrees. 4 types of angles. Think about the type of angle when measuring, then you will know how to read the protractor.

<u>Protractor Postulate</u>: Given any angle, the measure can be put into one-to-one correspondence with real numbers between 0 and 180.





<u>Example 1-4-2: Measure and Classify Angles</u>

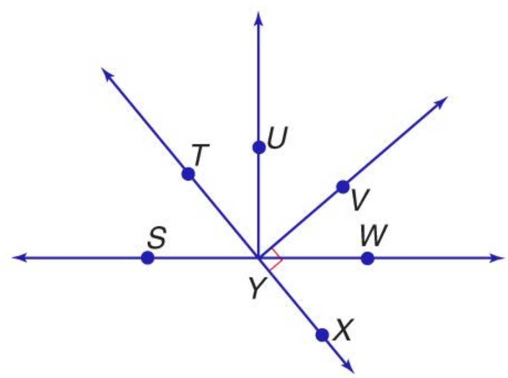
Classify each angle as *right*, *acute*, *obtuse, or straight*. Then use a protractor to measure the angle to the nearest degree. You may need to extend each ray.

a. ***∠TYV***

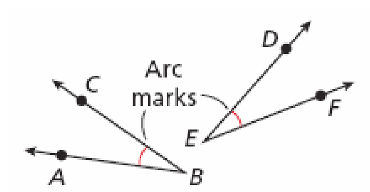
b. ***∠WYT***

c. ***∠TYU***

d. ***∠SYW***



Congruent Angles → angles that have the same measure
Arc Marks → put them on angles to show congruence



$m\angle ABC = m\angle DEF$
(read: *the* ____________________ *of angle ABC is equal to the* ____________________ *of angle DEF*)

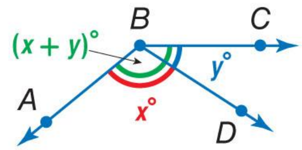
$\angle ABC \cong \angle DEF$
(read: *angle ABC is* ______________________ *to angle DEF*)

Angles have the same ____________________ if and only if the angles are ________________________.

A ray that divides an angle into two congruent angles is called an **angle bisector.**

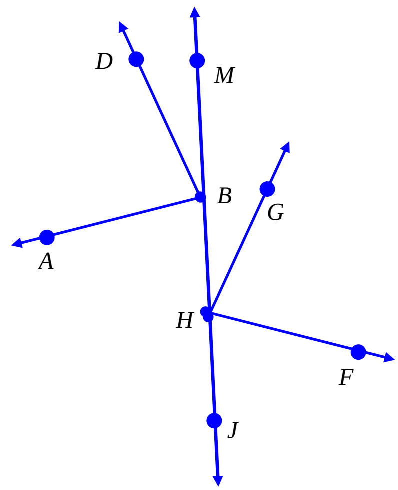
Postulate 2.11 Angle Addition Postulate

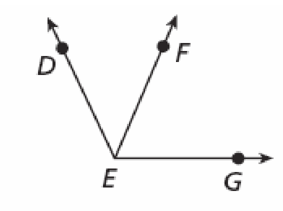
D is in the interior of $\angle ABC$ if and only if
$m\angle ABD + m\angle DBC = m\angle ABC$.



Example 1-4-4: Angle Sums

In the figure, $\angle ABD \cong \angle FHG$. If $m\angle ABD = 3x + 6$ and $m\angle FHG = x + 26$, find the measures of $\angle ABD$ and $\angle FHG$.

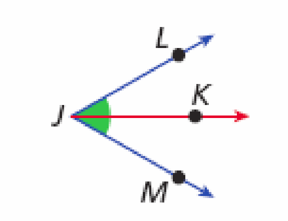




Example 1-4-5: Angle Sums

If $m\angle DEF = 48°$ and $m\angle FEG = 67°$, find $m\angle DEG$.

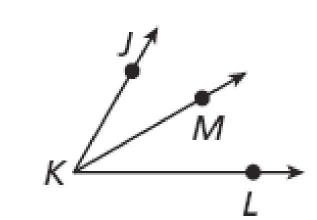
Angle bisector → a ray that divides an angle into two congruent angles



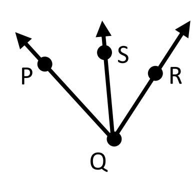
Example: $\overrightarrow{JK}$ bisects $\angle LJM$; therefore,

Example 1-4-6: Angle Bisectors

A. $\overrightarrow{KM}$ bisects $\angle JKL, m\angle JKM = (4x + 6)°$ and $m\angle MKL = (7x - 12)°$. Find $m\angle JKM$.



B. $\overrightarrow{QS}$ bisects $\angle PQR, m\angle PQS = (5y - 1)°$ and $m\angle PQR = (8y + 12)°$. Find $m\angle PQS$.



1.5 Angle Relationships

Objective: 1) Identify and use special pairs of angles; 2) identify perpendicular lines

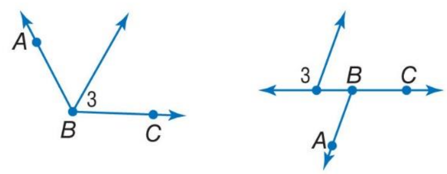
Day 1: Many pairs of angles have special relationships…either because of the measurements of the angles in the pair OR because of the positions of the angles in the pair.

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.

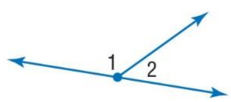
Examples ∠1 and ∠2 are adjacent angles.

Nonexamples ∠3 and ∠*ABC* are nonadjacent angles

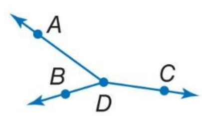


A **linear pair** is a pair of adjacent angles with noncommon sides that are opposite rays.

Example ∠1 and ∠2

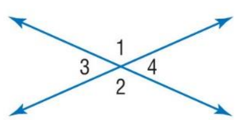


Nonexample ∠*ADB* and ∠*ADC*

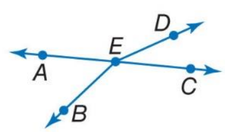


Vertical angles are two nonadjacent angles formed by two intersecting lines.

Examples ∠1 and ∠2; ∠3 and ∠4



Nonexample ∠*AEB* and ∠*DEC*



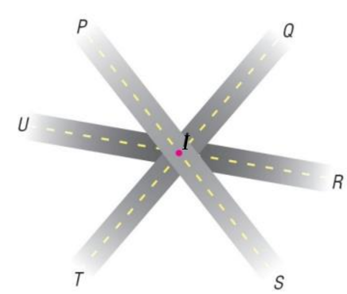
Can you draw an example when two angles would have a:

A. common vertex but not be adjacent?

B. common side but not adjacent?

Example 1-5-1-i: Identify Angle Pairs

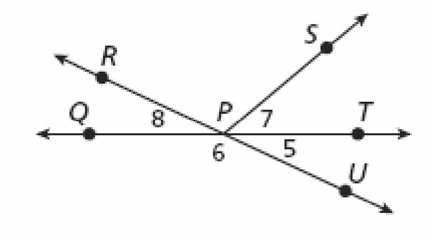
A. Name an angle pair that satisfies the condition *two angles that form a linear pair.*



B. Name an angle pair that satisfies the condition *two acute vertical angles.*

Example 1-5-1-ii: Identify Angle Pairs

Tell whether the angles are only adjacent, adjacent and form a linear pair, or not adjacent.

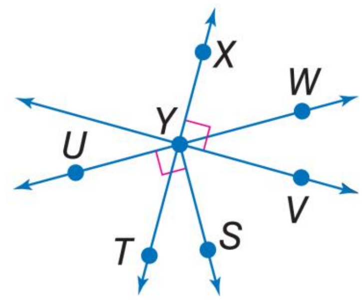


A. ∠5 and ∠6 B. ∠7 and ∠SPU

C. ∠7 and ∠8 D. ∠7 and ∠5

Example 1-5-2: Interpreting Diagrams

Determine whether each statement can be assumed from the figure. Explain.



a. ∠VYW and ∠TYS are adjacent angles.

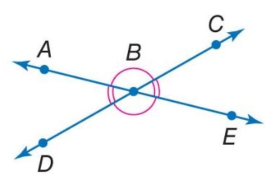
b. $m\angle VYT = 90°$

Day 2:

KeyConcept Angle Pair Relationships

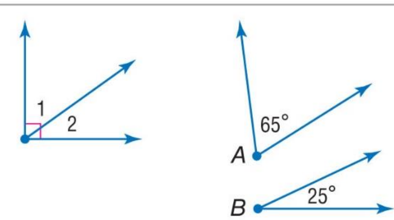
Vertical angles are congruent.

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



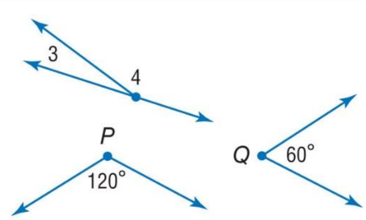
Complementary angles are two angles with measures that have a sum of 90.

Examples ∠1 and ∠2 are complementary.
∠A is complementary to ∠B.



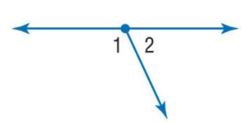
Supplementary angles are two angles with measures that have a sum of 180.

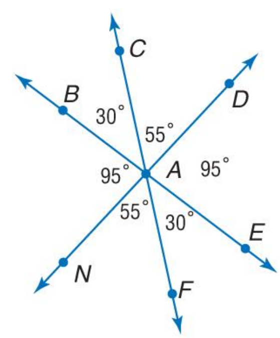
Examples ∠3 and ∠4 are supplementary.
∠P and ∠Q are supplementary.



The angles in a linear pair are supplementary.

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



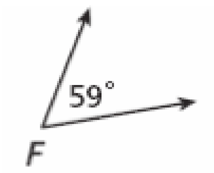


Supplement of an angle → 180° minus the angle is its supplement

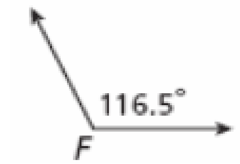
Complement of an angle → 90° minus the angle is its complement

Example 1-5-3-i: Angle Measures

A. Find the complement of $\angle F$.



B. Find the supplement of $\angle F$.



Example 1-5-3-ii: Angle Measur

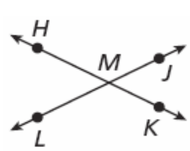
A. An angle is 10 degrees more than 3 times the measure of its complement. F the angle and its complement.

B. Find the measures of two supplementary angles if the difference in the measures of the two angles is 32 degrees.

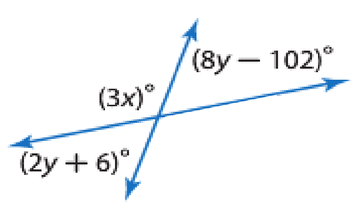
C. Find the measures of two supplementary angles if the measure of one angle is 6 less than five times the measure of the other angle.

Example 1-5-4: Vertical Angles

A. Name the pairs of vertical angles.

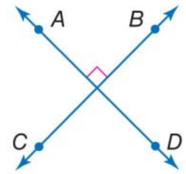


B. Find the value of each variable.



KeyConcept Perpendicular Lines

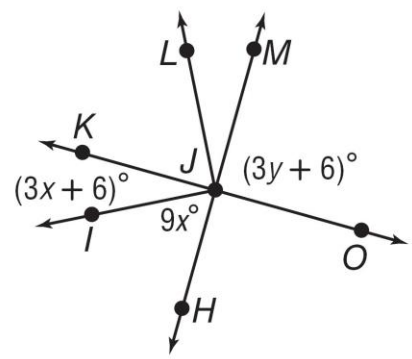
- Perpendicular lines intersect to form four right angles.
- Perpendicular lines intersect to form congruent adjacent angles.
- Segments and rays can be perpendicular to lines or other line segments and rays.
- The right angle symbol in the figure indicates that the lines are perpendicular.



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

<u>Example 1-5-5: Perpendicular Lines</u>

Find *x* and *y* so that $\overleftrightarrow{HM}$ and $\overleftrightarrow{KO}$ are perpendicular.

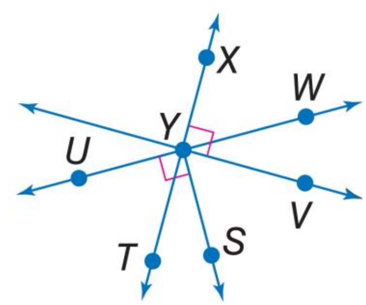


<u>Example 1-5-6: Interpreting Diagrams</u>

Determine whether each statement can be assumed from the figure. If so, explain. If not, why not?

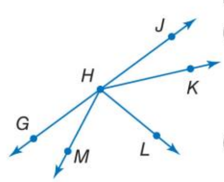
a. $\angle TYW$ and ∠WYV are complementary.

b. $\angle TYW$ and ∠TYU are supplementary.



KeyConcept Interpreting Diagrams

CAN be Assumed	CANNOT be Assumed
All points shown are coplanar.	Perpendicular lines: $\overrightarrow{HM} \perp \overrightarrow{HL}$
G, *H*, and *J* are collinear.	Congruent angles: $\angle JHK \cong \angle GHM$
$\overrightarrow{HM}$, $\overrightarrow{HL}$, $\overrightarrow{HK}$, and $\overleftrightarrow{GJ}$ intersect at *H*.	$\angle JHK \cong \angle KHL$
H is between *G* and *J*.	$\angle KHL \cong \angle LHM$
L is in the interior of $\angle MHK$.	Congruent segments: $\overline{GH} \cong \overline{HJ}$
$\angle GHM$ and $\angle MHL$ are adjacent angles.	$\overline{HJ} \cong \overline{HK}$
$\angle GHL$ and $\angle LHJ$ are a linear pair.	$\overline{HK} \cong \overline{HL}$
$\angle JHK$ and $\angle KHG$ are supplementary.	$\overline{HL} \cong \overline{HG}$



Thinking Questions

1. Supplementary angles are *always, sometimes, or never* linear pairs.

2. Are there angles that do not have a complement? Explain.

3. Describe at least three different ways you can determine that an angle is a right angle.