Ch 1

ESSENTIALS OF GEOMETRY

- 1.1 Identify Points, Lines, and Planes
- 1.2 Use Segments and Congruence
- 1.3 Use Midpoint and Distance Formulas
- 1.4 Measure and Classify Angles
- 1.5 Describe Angle Pair Relationships
- 1.6 Classify Polygons
- 1.7 Find Perimeter, Circumference, and Area

Day 1

1.1 Identify Points, Lines, and Planes
1.2 Use Segments and Congruence

LEARNING OBJECTIVES

1. Before, you studied basic concepts of geometry. Now you will name and sketch geometry figures.
2. After you learn about points, lines, and planes, you will use segment postulates to identify congruent segments.

AGENDA

1. Pass Out Books
2. Syllabus / Outlook
3. Section Notes
4. Activity?
5. HW Time (Time Permitting)

Sect 1.1 IDENTIFY POINTS, LINES, & PLANES

THREE UNDEFINED TERMS :

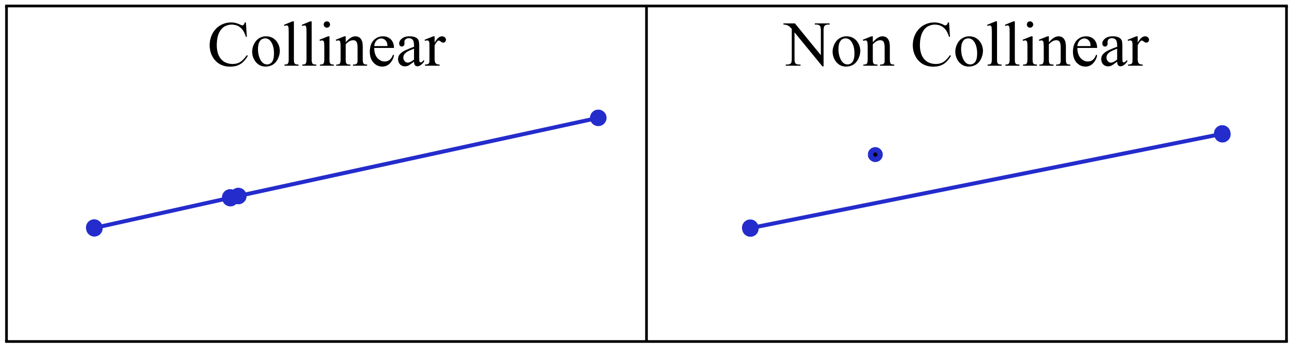
1. ___POINT___
- The basic unit of Geometry.
- It has no size, is infinitely small, and has only location.
- Named with ___A CAPITAL LETTER___.

2. ___LINE___
- A straight arrangement of points.
- There are infinitely many ___POINTS___ on a line.
- A line has infinite length but no thickness and extends forever in two directions.
- You name a line by ___TWO POINTS ON THE LINE, or lower case cursive letter___.

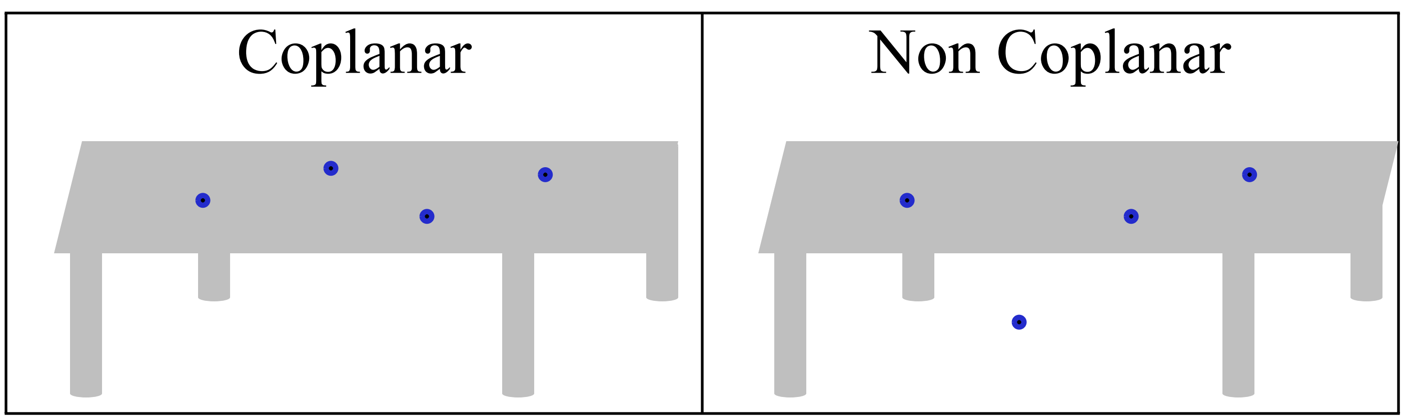
3. ___PLANE___
- A plane has length and width, but no ___THICKNESS___.
- It is a flat surface that ___EXTENDS FOREVER___.
- A plane is named by ___THREE POINTS OR capital cursive letter___.

IDENTIFY POINTS, LINES, & PLANES

DEF: **Collinear** means ON THE SAME LINE



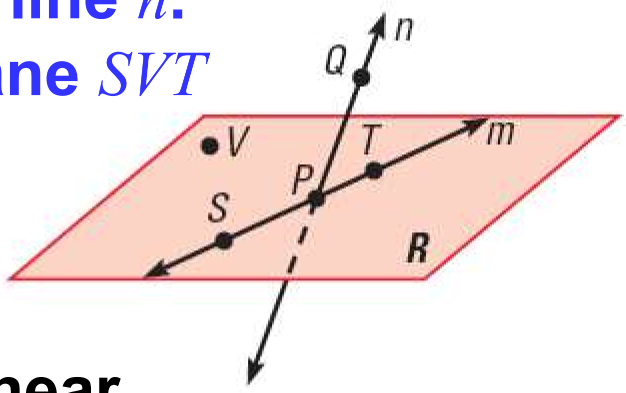
DEF: **Coplanar** means ON THE SAME PLANE



EXAMPLE 1 Name points, lines, and planes

a. Give two other names for $\overleftrightarrow{PQ}$ and for plane R.

a. Other names for $\overleftrightarrow{PQ}$ are $\overleftrightarrow{QP}$ and line n. Other names for plane R are plane SVT and plane PTV.



b. Name three points that are collinear. Name four points that are coplanar.

b. Points S, P, and T lie on the same line, so they are collinear. Points S, P, T,and V lie in the same plane, so they are coplanar.

Sect 1.1 IDENTIFY POINTS, LINES, & PLANES

DEFINED TERMS of Geometry – Can be described using known words such as *point* or *line*:

DEF: A **line segment (or segment)** consists of two points called the **endpoints** of the segment and all the points between them that are collinear with the two points.

EX:

Name:

DEF: A **ray** consists of the endpoint A and all points that line on the same side of A as B.

EX:

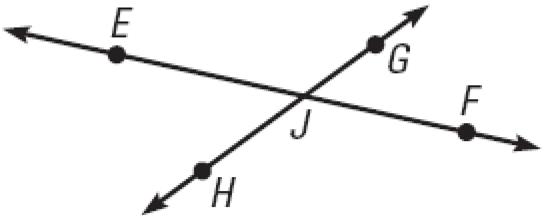
Name:

DEF: **Opposite rays** share the same endpoint and go in opposite directions along the same line.

EX:

Name:

EXAMPLE 2 Name segments, rays, and opposite rays



a. Give another name for $\overline{GH}$.

a. Another name for $\overline{GH}$ is $\overline{HG}$.

b. Name all rays with endpoint J .
Which of these rays are opposite rays?

b. The rays with endpoint J are $\overrightarrow{JE}$, $\overrightarrow{JG}$, $\overrightarrow{JF}$, and $\overrightarrow{JH}$.
The pairs of opposite rays with endpoint J are $\overrightarrow{JE}$ and $\overrightarrow{JF}$, and $\overrightarrow{JG}$ and $\overrightarrow{JH}$.

EXAMPLE 3

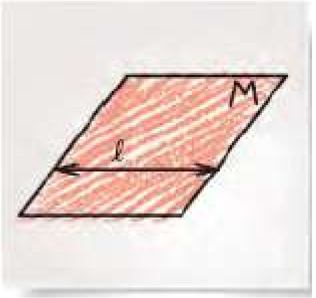
Sketch intersections of lines and planes

a. Sketch a plane and a line that is in the plane.

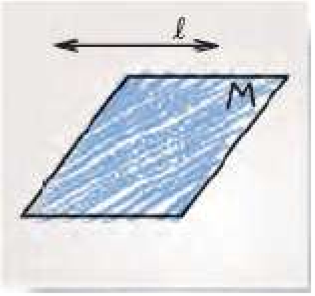
b. Sketch a plane and a line that does not intersect the plane.

c. Sketch a plane and a line that intersects the plane at a point.

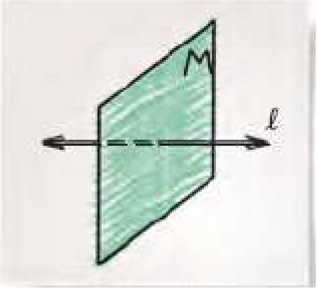
a.



b.



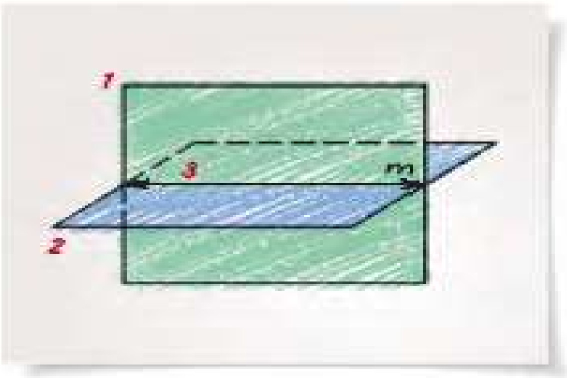
c.



EXAMPLE 4 Sketch intersections of planes

Sketch two planes that intersect in a line.

SOLUTION



STEP 1 Draw: a vertical plane. Shade the plane.

STEP 2 Draw: a second plane that is horizontal. Shade this plane a different color. Use dashed lines to show where one plane is hidden.

STEP 3 Draw: the line of intersection.

Sect 1.2 Use Segments and Congruence

- $\overline{AB}$ is used to name a line segment.
- $m\overline{AB}$ means the measure of segment AB and refers to a number.
- AB means the length of or distance from A to B and refers to a number.
- *Postulate* is a rule that is accepted without proof.

Segment Addition Postulate:

If B is between A and C, then **AB + BC = AC**.

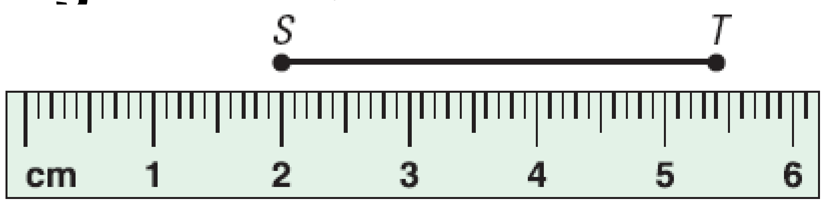
If AB + BC = AC, then B is **B is between A and C.**.

EXAMPLE 1 **Apply the Ruler Postulate**

Measure the length of $\overline{ST}$ to the nearest tenth of a centimeter.

SOLUTION

Align one mark of a metric ruler with S. Then estimate the coordinate of T. For example, if you align S with 2, T appears to align with 5.4.



$ST = |5.4 - 2| = 3.4$ **Use Ruler Postulate.**

ANSWER **The length of $\overline{ST}$ is about 3.4 centimeters.**

EXAMPLE 2 **Apply the the Segment Addition Postulate**

Maps

The cities shown on the map lie approximately in a straight line. Use the given distances to find the distance from Lubbock, Texas, to St. Louis, Missouri.

SOLUTION

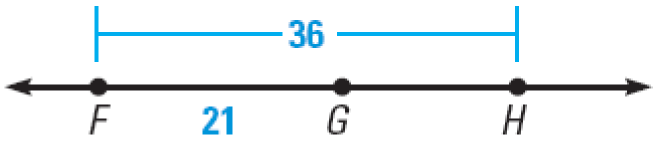
Because Tulsa, Oklahoma, lies between Lubbock and St. Louis, you can apply the Segment Addition Postulate.

$$LS = LT + TS = 380 + 360 = 740$$

ANSWER **The distance from Lubbock to St. Louis is about** 740 **miles.**

EXAMPLE 3 Find a length

Use the diagram to find GH.



SOLUTION

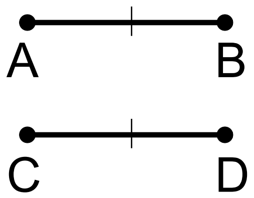
Use the Segment Addition Postulate to write an equation. Then solve the equation to find GH.

$FH = FG + GH$	Segment Addition Postulate.
$36 = 21 + GH$	Substitute 36 for FH and 21 for FG.
$15 = GH$	Subtract 21 from each side.

Sect 1.2 Use Segments and Congruence

DEF: Two segments are **congruent ($\cong$) segments**

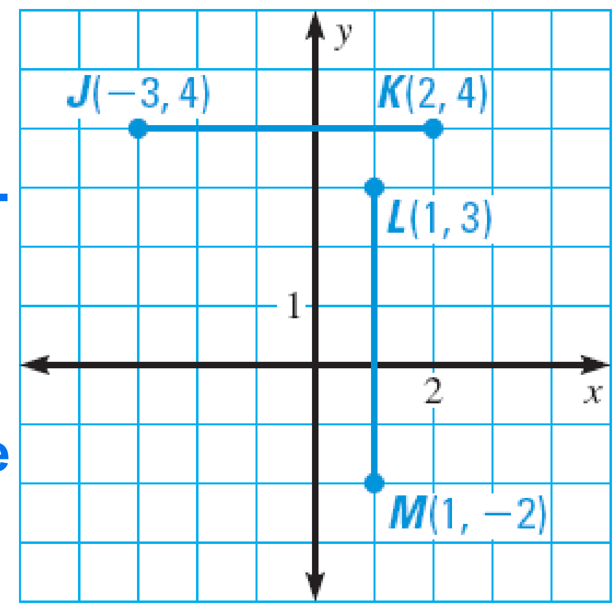
__If they have the same length__.

Example	Lengths are Equal	Segments are Congruent
	$AB = CD$	$\overline{AB} \cong \overline{CD}$
	"is equal to"	"is congruent to"

EXAMPLE 4 Compare segments for congruence

Plot $J(-3, 4)$, $K(2, 4)$, $L(1, 3)$, and $M(1, -2)$ in a coordinate plane. Then determine whether JK and LM are congruent.

SOLUTION



Find the length of a horizontal segment using the x-coordinates of the endpoints.

$JK = |2 - (-3)| = 5$ **Use Ruler Postulate.**

Find the length of a vertical segment using the y-coordinates of the endpoints.

$LM = |-2 - 3| = 5$ **Use Ruler Postulate**

ANSWER

$\overline{JK}$ **and** $\overline{LM}$ **have the same length. So,** $\overline{JK} \cong \overline{LM}$.

ASSIGNMENT

<u>HW 1.1</u> Pg 5 #5-14,15-23 odd

<u>HW 1.2</u> Pg 12 #1,3-11 odd,12-14,20-30

Ch 1 DAY 2

- 1.1 Identify Points, Lines, and Planes
- 1.2 Use Segments and Congruence
- 1.3 Use Midpoint and Distance Formulas
- 1.4 Measure and Classify Angles
- 1.5 Describe Angle Pair Relationships
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Day 2

•1.3 Use Midpoint and Distance Formulas

•1.4 Measure and Classify Angles

LEARNING OBJECTIVES

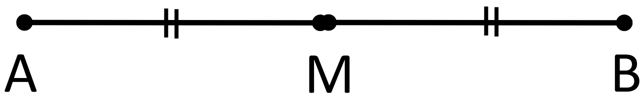
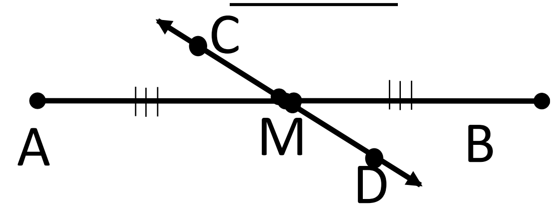
1. Before, you found the lengths of segments. Now you will find lengths of segments in the coordinate plane.
2. Also, you have named and measured line segments. Now you will name, measure, and classify angles.

AGENDA

1.
2.
3.
4.
5.

USE MIDPOINT AND DISTANCE FORMULA

DEF:The __MIDPOINT__ is the point on the segment that divides the segment into two congruent segments. A point, ray, line segment, or plane that intersects the segment at it's midpoint is a segment __BISECTOR__.

Midpoint	Bisector
	
__M__ is the midpoint of $\overline{AB}$.	$\overline{CD}$ is segment bisector of $\overline{AB}$.
So $\overline{AM} \cong \overline{MB}$ and $AM=MB$	So $\overline{AM} \cong \overline{MB}$ and $AM=MB$

EXAMPLE 1 Find segment lengths

Skateboard

In the skateboard design, $\overline{VW}$ bisects $\overline{XY}$ at point T, and $XT = 39.9$ cm. Find XY.

SOLUTION

Point T is the midpoint of $\overline{XY}$.
So, $XT = TY = 39.9$ cm.

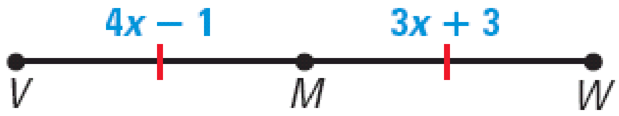
$XY = XT + TY$ Segment Addition Postulate

$= 39.9 + 39.9$ Substitute.

$= 79.8$ cm Add.

EXAMPLE 2 Use algebra with segment lengths

ALGEBRA Point M is the midpoint of $\overline{VW}$. Find the length of $\overline{VM}$.



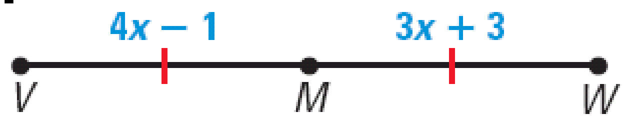
SOLUTION

STEP 1 Write and solve an equation. Use the fact that $VM = MW$.

$VM = MW$	Write equation.
$4x - 1 = 3x + 3$	Substitute.
$x - 1 = 3$	Subtract $3x$ from each side.
$x = 4$	Add 1 to each side.

EXAMPLE 2 Use algebra with segment lengths

STEP 2 **Evaluate the expression for VM when $x = 4$.**



$$VM = 4x - 1 = 4(4) - 1 = 15$$

So, the length of $\overline{VM}$ is 15.

Check: Because $VM = MW$, the length of $\overline{MW}$ should be 15. If you evaluate the expression for MW, you should find that $MW = 15$.

$$MW = 3x + 3 = 3(4) + 3 = 15 \checkmark$$

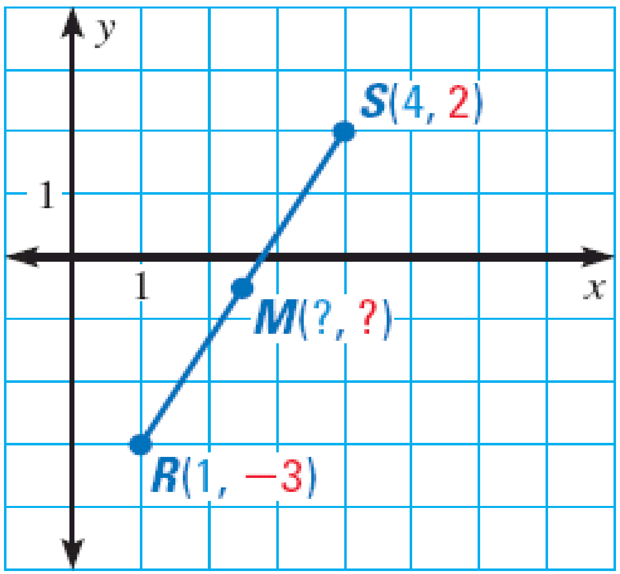
Coordinate Midpoint Formula

If (x_1, y_1) and (x_2, y_2) are the coordinates of the endpoints of a segment, then the coordinates of the midpoint are

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

EXAMPLE 3 Use the Midpoint Formula

a. **FIND MIDPOINT** The endpoints of $\overline{RS}$ are $R(1, -3)$ and $S(4, 2)$. Find the coordinates of the midpoint M.



EXAMPLE 3 Use the Midpoint Formula

SOLUTION

a. FIND MIDPOINT Use the Midpoint Formula.

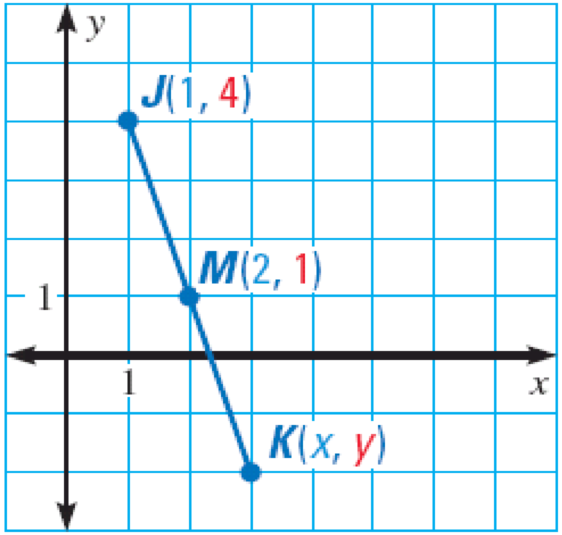
$$M\left(\frac{1+4}{2}, \frac{-3+2}{2}\right) = M\left(\frac{5}{2}, -\frac{1}{2}\right)$$

ANSWER

The coordinates of the midpoint M **are** $\left(\frac{5}{2}, -\frac{1}{2}\right)$

EXAMPLE 3 Use the Midpoint Formula

b. **FIND ENDPOINT** **The midpoint of** $\overline{JK}$ **is** $M(2, 1)$. **One endpoint is** $J(1, 4)$. **Find the coordinates of endpoint** K.



EXAMPLE 3 **Use the Midpoint Formula**

SOLUTION

FIND ENDPOINT Let (x, y) be the coordinates of endpoint K. Use the Midpoint Formula.

STEP 1 Find x.

$$\frac{1+x}{2} = 2$$

$$1 + x = 4$$

$$x = 3$$

STEP 2 Find y.

$$\frac{4+y}{2} = 1$$

$$4 + y = 2$$

$$y = -2$$

ANSWER The coordinates of endpoint K are $(3, -2)$.

USE MIDPOINT AND DISTANCE FORMULA

Distance Formula

is based on the Pythagorean Theorem.

Pythagorean Theorem

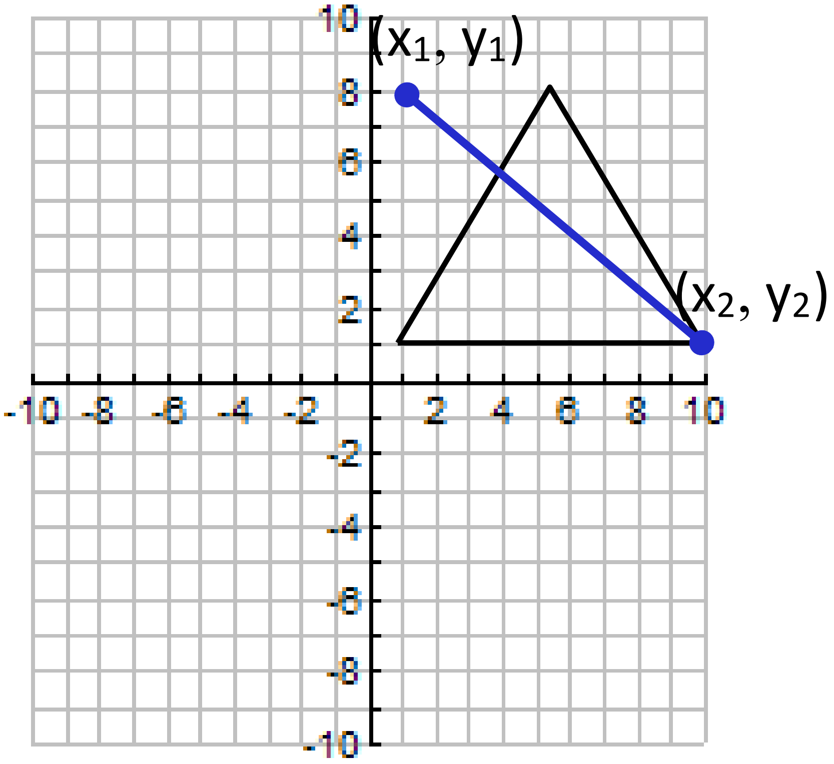
$c^2 = a^2 + b^2$

Distance Formula

$$d^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2$$

or

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



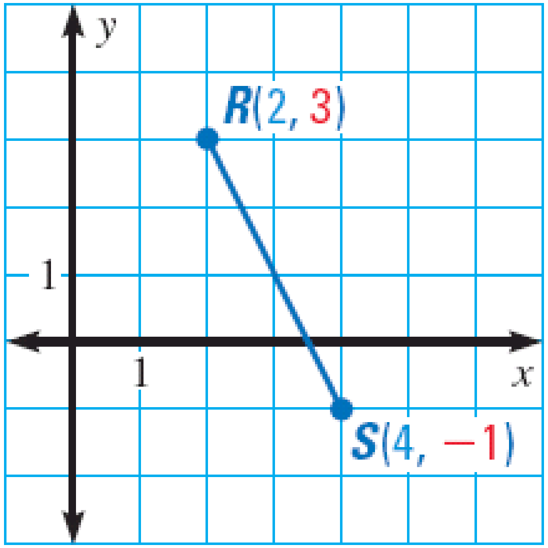
EXAMPLE 4 Standardized Test Practice

What is the approximate length of $\overline{RS}$ with endpoints $R(2, 3)$ and $S(4, -1)$?

Ⓐ 1.4 units Ⓑ 4.0 units Ⓒ 4.5 units Ⓓ 6 units

SOLUTION

Use the Distance Formula. You may find it helpful to draw a diagram.



EXAMPLE 4 **Standardized Test Practice**

$$RS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$ Distance Formula

$$= \sqrt{[(4 - 2)]^2 + [(-1) - 3]^2}$$ Substitute.

$$= \sqrt{(2)^2 + (-4)^2}$$ Subtract.

$$= \sqrt{4 + 16}$$ Evaluate powers.

$$= \sqrt{20}$$ Add.

$$\cong 4.47$$ Use a calculator to approximate the square root.

ANSWER The correct answer is *C*.

(A) (B) (C) (D)

Sect 1.3

USE MIDPOINT AND DISTANCE FORMULA

Def: An _**ANGLE**_ is two rays that share a common endpoint, provided that the two rays do not lie on the same line.

- The common endpoint of the two rays that make an angle is the _**VERTEX**_ of the angle.
- The two rays are called the _**SIDES**_ of the angle.

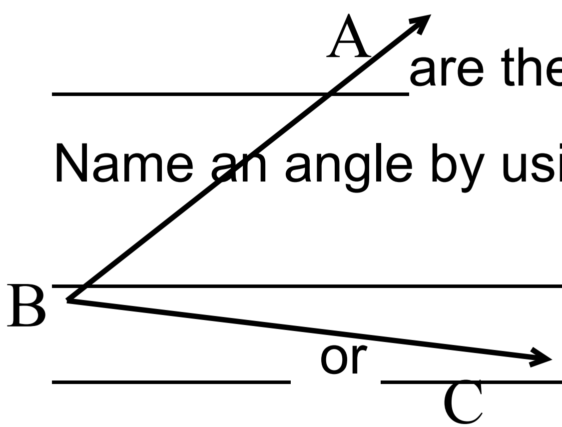
_____ is the vertex. **A**

____________ are the sides. $\overrightarrow{AB}$ and $\overrightarrow{BC}$

Name an angle by using __________ **THREE**

______________________________ **LETTERS, WITH VERTEX IN THE**

________ or ____________________ **MIDDLE** **VERTEX LETTER**



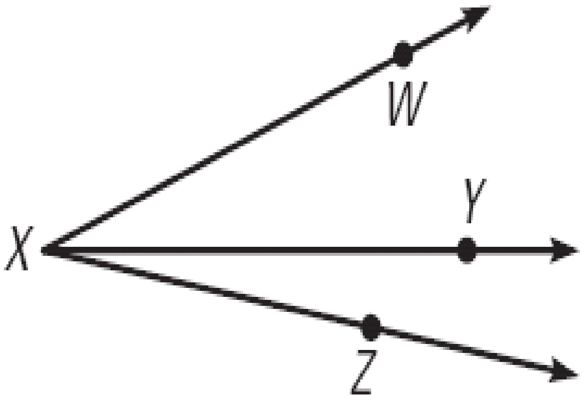
EXAMPLE 1 Name angles

Name the three angles in the diagram.

$\angle WXY$, or $\angle YXW$

$\angle YXZ$, or $\angle ZXY$

$\angle WXZ$, or $\angle ZXW$



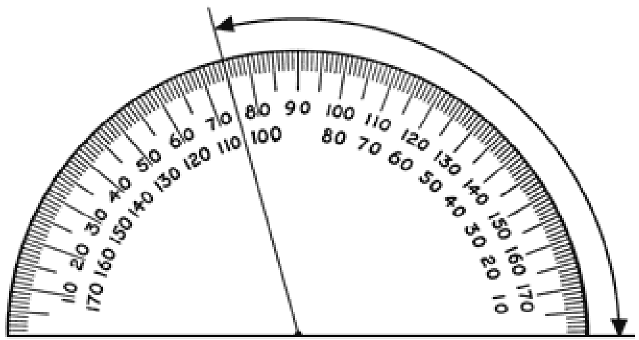
You should not name any of these angles $\angle X$ because all three angles have X as their vertex.

Sect 1.4

MEASURE AND CLASSIFY ANGLES

DEF: __DEGREES__ is the unit of measurement we will use to measure an angle.

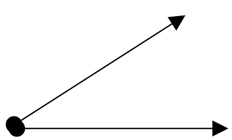
DEF:A __PROTRACTOR__ is used to measure angles.



$m\Sigma\ ABC=105^{o}$

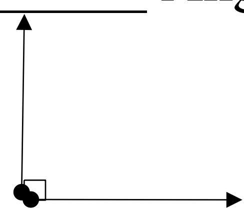
CLASSIFYING ANGLES

__ACUTE__ Angle



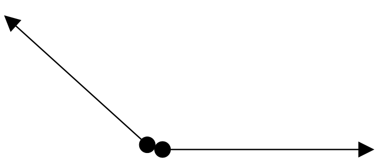
Angle < 90^{o}

__RIGHT__ Angle



Angle = 90^{o}

__OBTUSE__ Angle



Angle > 90^{o}

__STRAIGHT__ Angle

Angle = 180^{o}

FAMILY GUY :

SHAWSHANK REDEMPTION PARODY

(click here)

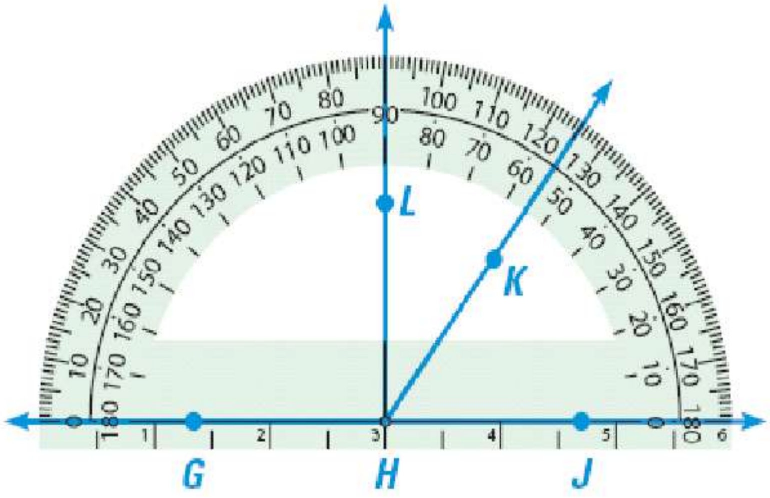
EXAMPLE 2 **Measure and classify angles**

Use the diagram to find the measure of the indicated angle. Then classify the angle.

a. $\angle KHJ$ **b.** $\angle GHK$ **c.** $\angle GHJ$ **d.** $\angle GHL$

SOLUTION

A protractor has an inner and an outer scale. When you measure an angle, check to see which scale to use.



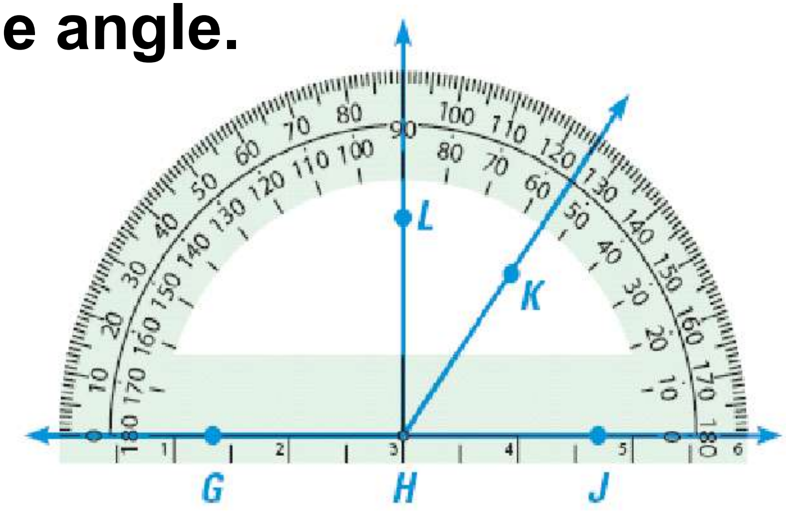
EXAMPLE 2 Measure and classify angles

a. $\overrightarrow{HJ}$ is lined up with the 0° on the inner scale of the protractor. $\overrightarrow{HK}$ passes through 55° on the inner scale. So, $m\angle KHJ = 55^\circ$. It is an acute angle.

b. $\overrightarrow{HG}$ is lined up with the 0° on the outer scale and $\overrightarrow{HK}$ passes through 125° on the outer scale. So, $m\angle GHK = 125^\circ$. It is an obtuse angle.

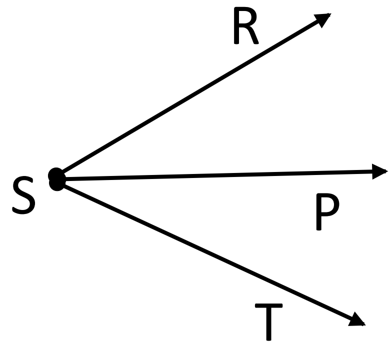
c. $m\angle GHJ = 180^\circ$.
It is a straight angle.

d. $m\angle GHL = 90^\circ$.
It is a right angle.



MEASURE AND CLASSIFY ANGLES

ANGLE ADDITION POSTULATE



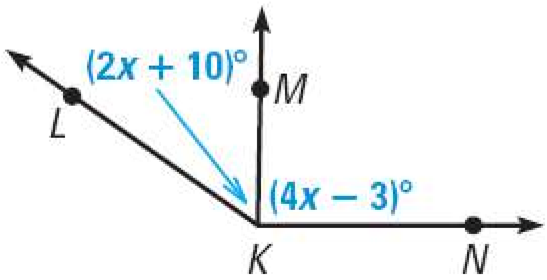
Words: If P is in the interior of P RST, then the measure of P RST is equal to the sum of the measures of P RSP and P PST.

Symbols: If P is in the interior of P RST, then

mP RST = mP RSP + mP PST .

EXAMPLE 3 **Find angle measures**

ALGEBRA **Given that** $m\angle LKN = 145^\circ$**, find** $m\angle LKM$ **and** $m\angle MKN$.



SOLUTION

STEP 1
Write and solve an equation to find the value of x.

$m\angle LKN = m\angle LKM + m\angle MKN$	**Angle Addition Postulate**
$145^\circ = (2x + 10)^\circ + (4x - 3)^\circ$	**Substitute angle measures.**
$145 = 6x + 7$	**Combine like terms.**
$138 = 6x$	**Subtract 7 from each side.**
$23 = x$	**Divide each side by 6.**

EXAMPLE 3

Find angle measures

STEP 2

Evaluate the given expressions when $x = 23$.

$$m\angle LKM = (2x + 10)^\circ = (2 \cdot 23 + 10)^\circ = 56^\circ$$

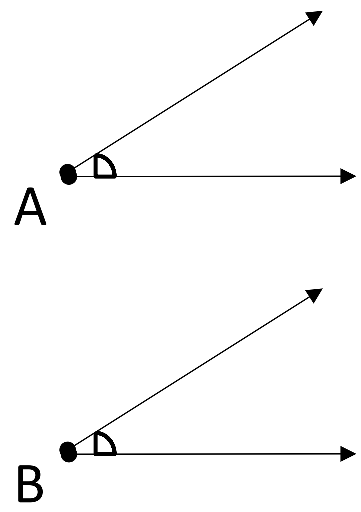
$$m\angle MKN = (4x - 3)^\circ = (4 \cdot 23 - 3)^\circ = 89^\circ$$

ANSWER

So, $m\angle LKM = 56^\circ$ **and** $m\angle MKN = 89^\circ$.

MEASURE AND CLASSIFY ANGLES

DEF: Two angles are **Congruent** if the have the same measure.



Angles are Equal	Angles are Congruent
$mP\,A = mP\,B$	$P\,A \cong P\,B$
"is equal to"	"is congruent to"

DEF: A **ANGLE BISECTOR** is a ray that divides an angle into two angles that are congruent.

EXAMPLE 4

Identify congruent angles

Trapeze The photograph shows some of the angles formed by the ropes in a trapeze apparatus. Identify the congruent angles. If $m\angle DEG = 157°$, what is $m\angle GKL$?

SOLUTION There are two pairs of congruent angles:

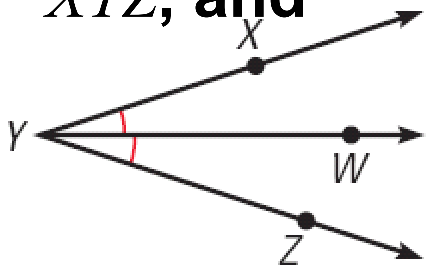
$\angle DEF \cong \angle JKL$ and $\angle DEG \cong \angle GKL$.

Because $\angle DEG \cong \angle GKL$, $\angle DEG = m\angle GKL$.

So, $m\angle GKL = 157°$.

EXAMPLE 5 Double an angle measure

In the diagram at the right, $\overrightarrow{YW}$ bisects $\angle XYZ$, and $m\angle XYW = 18$. Find $m\angle XYZ$.



SOLUTION

By the Angle Addition Postulate, $m\angle XYZ = m\angle XYW + m\angle WYZ$. Because $\overrightarrow{YW}$ bisects $\angle XYZ$ you know that $\angle XYW \cong \angle WYZ$.

So, $m\angle XYW = m\angle WYZ$, and you can write

$$m\angle XYZ = m\angle XYW + m\angle WYZ = 18° + 18° = 36°.$$

ASSIGNMENT

HW 1.3 Pg 19 #1, 2-22 even, 25-37 odd, 43

HW 1.4 Pg 28 #1, 2-20 even, 21, 24-27, 31, 33-38 odd, 40-44 even

Quiz #1 (1.1-1.3) Next Time

Ch 1 DAY 3

- 1.1 Identify Points, Lines, and Planes
- 1.2 Use Segments and Congruence
- 1.3 Use Midpoint and Distance Formulas
- 1.4 Measure and Classify Angles
- 1.5 Describe Angle Pair Relationships
- 1.6 Classify Polygons
- 1.7 Find Perimeter, Circumference, and Area

Day 3

•1.5 Describe Angle Pair Relationships

•1.6 Classify Polygons

LEARNING OBJECTIVES

1. Before, you used angle postulates to measure and classify angles. Now you will use special angle relationships to find angle measures.
2. Also, you classified angles. Now you will classify polygons.

AGENDA

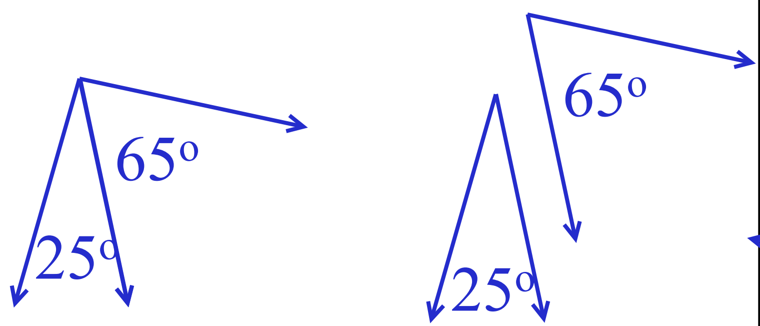
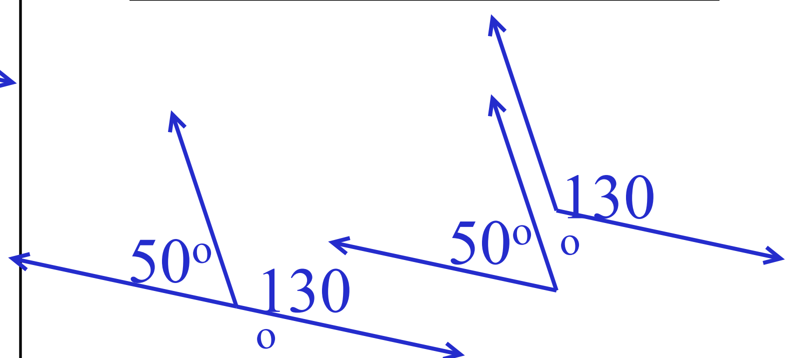
1. **Quiz #1 (1.1-1.3)**
2.
3.
4.
5.

Describe Angle Pair Relationships

DEF: Complementary Angles are two angles whose sum is 90°.

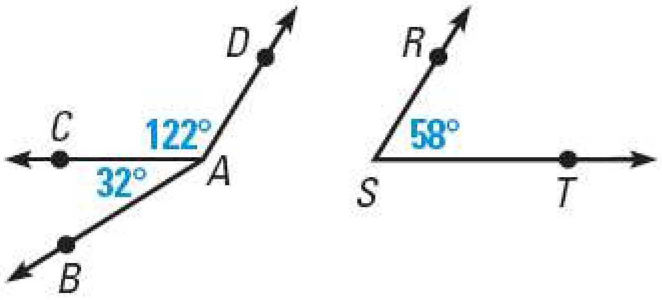
DEF: Supplementary Angles are two angles whose sum is 180°.

DEF: Adjacent Angles are two angles who share a common vertex and side.

Sketch Examples of Complementary Angles	Sketch Examples of Supplementary Angles
 Adjacent Non Adjacent	 Adjacent Non Adjacent

EXAMPLE 1 **Identify complements and supplements**

In the figure, name a pair of complementary angles, a pair of supplementary angles, and a pair of adjacent angles.



SOLUTION

Because $32° + 58° = 90°$, $\angle BAC$ **and** $\angle RST$ **are complementary angles.**

Because $122° + 58° = 180°$, $\angle CAD$ **and** $\angle RST$ **are supplementary angles.**

Because $\angle BAC$ **and** $\angle CAD$ **share a common vertex and side, they are adjacent.**

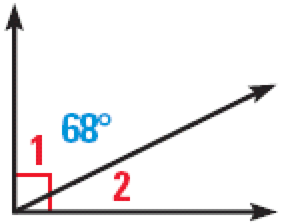
EXAMPLE 2 Find measures of a complement and a supplement

a. **Given that** $\angle 1$ **is a complement of** $\angle 2$ **and** $m\angle 1 = 68^\circ$, **find** $m\angle 2$.

SOLUTION

a. **You can draw a diagram with complementary adjacent angles to illustrate the relationship.**

$$m\angle 2 = 90^\circ - m\angle 1 = 90^\circ - 68^\circ = 22^\circ$$



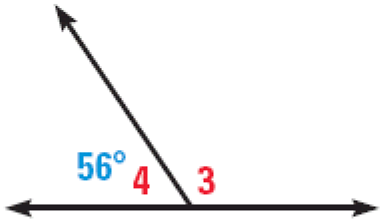
EXAMPLE 2 Find measures of a complement and a supplement

b. Given that $\angle 3$ is a supplement of $\angle 4$ and $m\angle 4 = 56^\circ$, find $m\angle 3$.

SOLUTION

b. You can draw a diagram with supplementary adjacent angles to illustrate the relationship

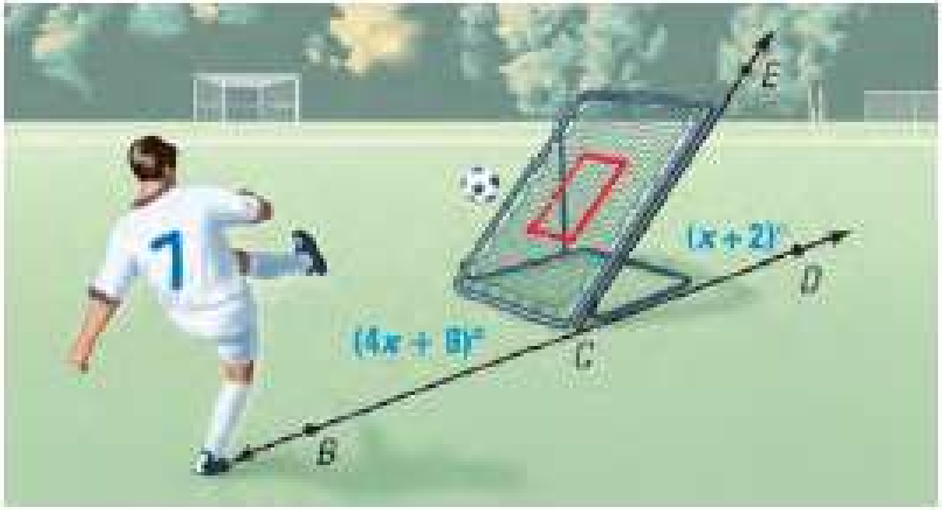
$$m\angle 3 = 180^\circ - m\angle 4 = 180^\circ - 56^\circ = 124^\circ$$



EXAMPLE 3 Find angle measures

Sports

When viewed from the side, the frame of a ball-return net forms a pair of supplementary angles with the ground. Find $m\angle BCE$ and $m\angle ECD$.



EXAMPLE 3 Find angle measures

SOLUTION

STEP 1 **Use the fact that the sum of the measures of supplementary angles is 180°.**

$m\angle BCE + m\angle ECD = 180^\circ$ **Write equation.**

$(4x + 8)^\circ + (x + 2)^\circ = 180^\circ$ **Substitute.**

$5x + 10 = 180$ **Combine like terms.**

$5x = 170$ **Subtract 10 from each side.**

$x = 34$ **Divide each side by 5.**

EXAMPLE 3 Find angle measures

SOLUTION

STEP 2

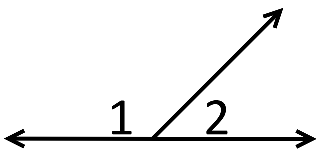
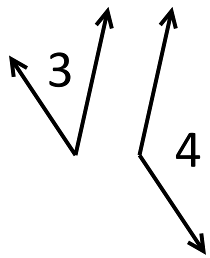
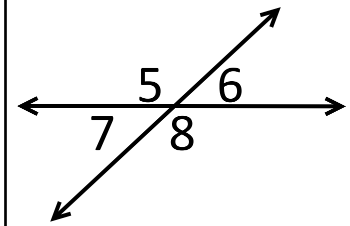
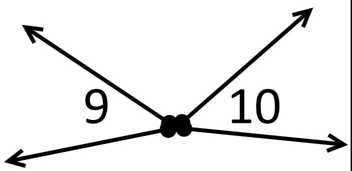
Evaluate: the original expressions when $x = 34$.

$$m\angle BCE = (4x + 8)^\circ = (4 \cdot 34 + 8)^\circ = 144^\circ$$

$$m\angle ECD = (x + 2)^\circ = (34 + 2)^\circ = 36^\circ$$

ANSWER **The angle measures are 144° and 36°.**

Sect 1.5 Describe Angle Pair Relationships

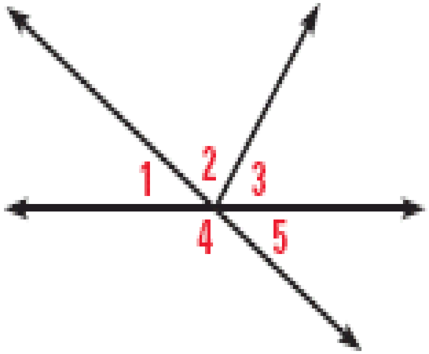
Linear Pair	Non Linear Pair	Vertical Pair	Non Vertical Pair
			
are linear	not linear	are vertical	not vertical

DEF: In your own words, write a definition of a **Linear Pair** of angles: **Two adjacent and supplementary angles whose noncommon sides are opposite rays.**

DEF: In your own words, write a definition of a **Vertical Pair** of angles: **Two angles whose sides form two pairs of opposite rays.**

EXAMPLE 4 Identify angle pairs

Identify all of the linear pairs and all of the vertical angles in the figure at the right.



SOLUTION

To find vertical angles, look or angles formed by intersecting lines.

ANSWER $\angle 1$ and $\angle 5$ are vertical angles.

To find linear pairs, look for adjacent angles whose noncommon sides are opposite rays.

ANSWER $\angle 1$ and $\angle 4$ are a linear pair. $\angle 4$ and $\angle 5$ are also a linear pair.

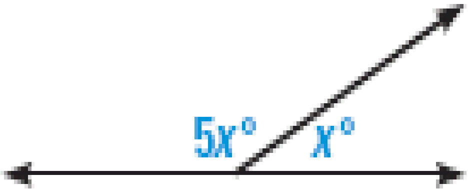
EXAMPLE 5 **Find angle measures in a linear pair**

ALGEBRA

Two angles form a linear pair. The measure of one angle is 5 times the measure of the other. Find the measure of each angle.

SOLUTION

Let $x°$ be the measure of one angle. The measure of the other angle is $5x°$. Then use the fact that the angles of a linear pair are supplementary to write an equation.



EXAMPLE 5

Find angle measures in a linear pair

$x^{o} + 5x^{o} = 180^{o}$ **Write an equation.**

$6x = 180$ **Combine like terms.**

$x = 30^{o}$ **Divide each side by 6.**

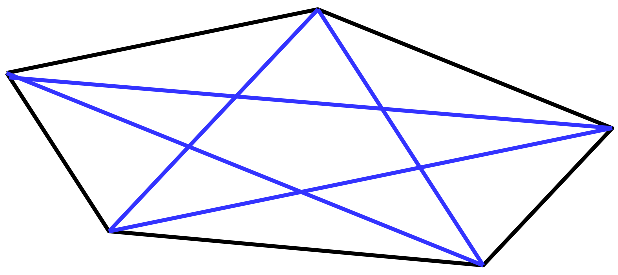
ANSWER **The measures of the angles are** 30^{o} **and** $5(30)^{o} = 150^{o}$**.**

Classify Polygons

DEF: A **polygon** is a closed figure in a plane, formed by connecting at least three line segments endpoint to endpoint with each segment intersecting exactly two others.

1. Each line seg. is called a **side**.
2. Each endpoint where the sides meet is called the **vertex**.

DEF: A **diagonal** is a segment connecting two nonconsecutive vertices.



Classify Polygons

2 types of polygons:

• Convex **Polygon** - a polygon in which no segment connecting two vertices is outside the polygon.

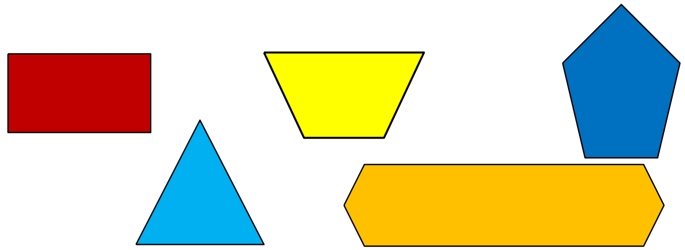
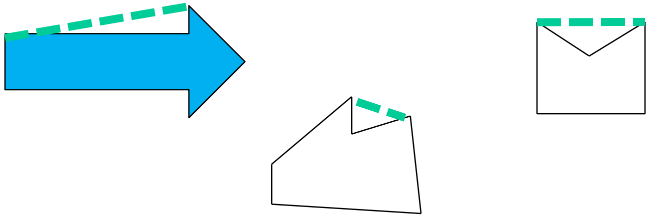
In a convex polygon:

Consecutive Vertices share a common side

Consecutive Sides share a common vertex

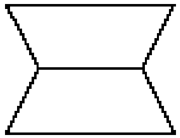
Consecutive Angles share a common side

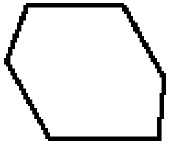
• Concave **Polygon -** a polygon in which at least one segment connecting two vertices is outside the polygon.

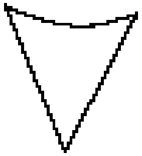
Convex Polygons	Concave Polygon
	

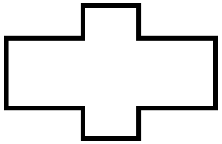
EXAMPLE 1 **Identify polygons**

Tell whether the figure is a polygon and whether it is *convex* or *concave*.

a. 

b. 

c. 

d. 

SOLUTION

a. Some segments intersect more than two segments, so it is not a polygon.

b. The figure is a convex polygon.

c. Part of the figure is not a segment, so it is not a polygon.

d. The figure is a concave polygon.

Sect 1.6

Classify Polygons

Number of Sides	Type of Polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon

Number of Sides	Type of Polygon
8	octagon
9	nonagon
10	decagon
12	dodecagon
n	n-gon

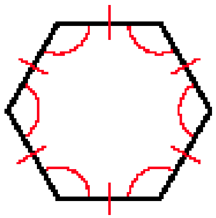
DEF:All sides are congruent in an __equilateral__ polygon. All angles are congruent in an __equiangular__ polygon.

DEF:A __regular__ polygon is a convex polygon that is both equilateral and equiangular.

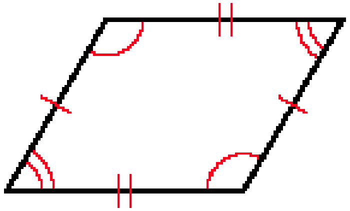
EXAMPLE 2 Classify polygons

Classify the polygon by the number of sides. Tell whether the polygon is equilateral, equiangular, or regular. Explain your reasoning.

a.



b.



SOLUTION

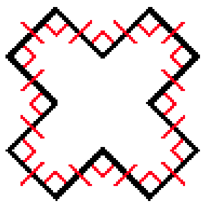
a. The polygon has 6 sides. It is equilateral and equiangular, so it is a regular hexagon.

b. The polygon has 4 sides, so it is a quadrilateral. It is not equilateral or equiangular, so it is not regular.

EXAMPLE 2 Classify polygons

Classify the polygon by the number of sides. Tell whether the polygon is equilateral, equiangular, or regular. Explain your reasoning.

c.



SOLUTION

c. **The polygon has 12 sides, so it is a dodecagon. The sides are congruent, so it is equilateral. The polygon is not convex, so it is not regular.**

EXAMPLE 3 Find side lengths

ALGEBRA A table is shaped like a regular hexagon.The expressions shown represent side lengths of the hexagonal table. Find the length of a side.

SOLUTION

First, write and solve an equation to find the value of x. Use the fact that the sides of a regular hexagon are congruent.

$3x + 6$	$=$	$4x - 2$	Write equation.
6	$=$	$x - 2$	Subtract $3x$ from each side.
8	$=$	x	Add 2 to each side.

EXAMPLE 3 Find side lengths

Then find a side length. Evaluate one of the expressions when $x = 8$.

$$3x + 6 = 3(8) + 6 = 30$$

ANSWER **The length of a side of the table is 30 inches.**

ASSIGNMENT

<u>HW 1.5</u> Pg 38 #1, 2-28 even, 32, 34-38, 39-43 odd

<u>HW 1.6</u> Pg 44 #3-13 odd, 18-23, 29, 30

<u>Quiz #2</u> (1.4-1.5) Next Time

Ch 1 DAY 4

- 1.1 Identify Points, Lines, and Planes
- 1.2 Use Segments and Congruence
- 1.3 Use Midpoint and Distance Formulas
- 1.4 Measure and Classify Angles
- 1.5 Describe Angle Pair Relationships
- 1.6 Classify Polygons
- 1.7 Find Perimeter, Circumference, and Area

Day 4

•1.7 Find Perimeter, Circumference, & Area

LEARNING OBJECTIVES

1. Before, you found the lengths of segments. Now you will find lengths of segments in the coordinate plane.
2. Also, you have named and measured line segments. Now you will name, measure, and classify angles.

AGENDA

1. **Quiz #2 (1.4-1.5)**
2.
3.
4.
5.

Classify Polygons

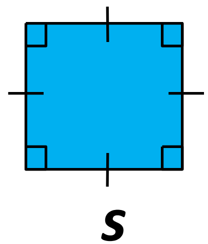
KEY CONCEPT – Formulas for Perimeter P, Area A, and Circumference C

Square

Side length *s*

$P = 4s$

$A = s^2$

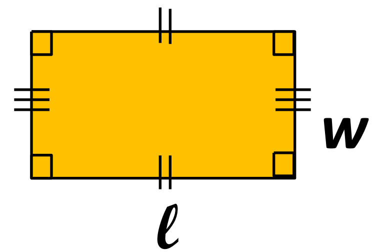


Rectangle

Length l and width *w*

$P = 2l + 2w$

$A = lw$



Triangle

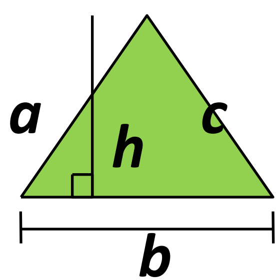
Side length *a*, *b*, and *c*

Base *b*

Height *h*

$P = a + b + c$

$A = \frac{1}{2}bh$

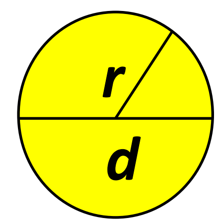


Circle

Diameter *d* Radius *r*

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

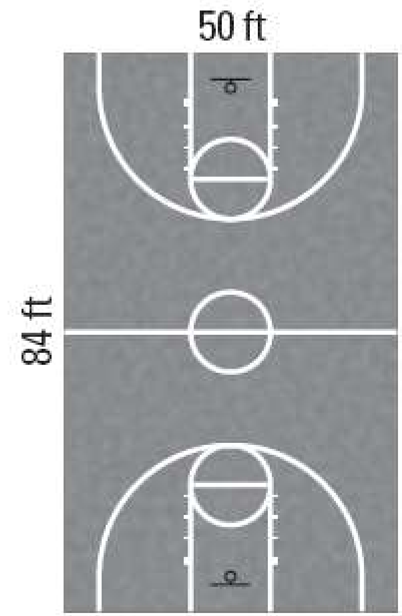
$A = \pi r^2$



EXAMPLE 1 Find the perimeter and area of a rectangle

Basketball

Find the perimeter and area of the rectangular basketball court shown.



SOLUTION

Perimeter

$$P = 2l + 2w$$
$$= 2(84) + 2(50)$$
$$= 268$$

Area

$$A = lw$$
$$= 84(50)$$
$$= 4200$$

ANSWER

The perimeter is 268 feet **and the area is** 4200 **square feet.**

EXAMPLE 2 **Find the circumference and area of a circle**

Team Patch

You are ordering circular cloth patches for your soccer team's uniforms. Find the approximate circumference and area of the patch shown.

SOLUTION

First find the radius. The diameter is 9 **centimeters, so the radius is** $\frac{1}{2}(9) = 4.5$ **centimeters.**
Then find the circumference and area.

Use 3.14 **to approximate the value of** π.

EXAMPLE 2 **Find the circumference and area of a circle**

$$C = 2\pi r \approx 2(3.14)(4.5) = 28.26$$

$$A = \pi r^2 \approx 3.14(4.5)^2 = 63.585$$

ANSWER

The circumference is about 28.3 cm^2**.**
The area is about 63.6 cm **.**

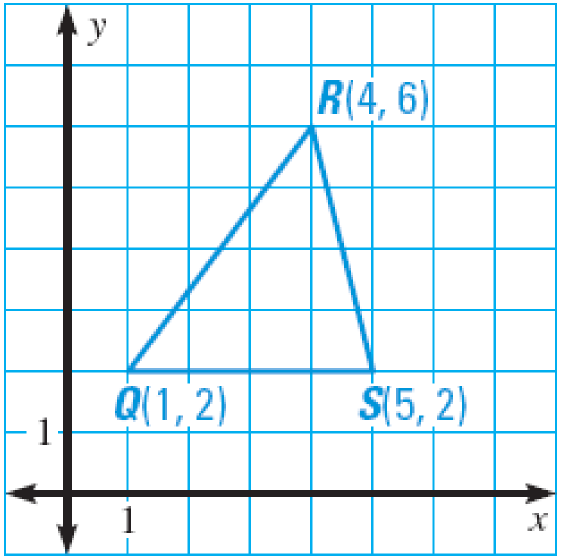
EXAMPLE 3 Standardized Test Practice

Triangle *QRS* has vertices *Q*(1, 2), *R*(4, 6), and *S*(5, 2). What is the approximate perimeter of triangle *QRS*?

Ⓐ 8 units Ⓑ 8.3 units Ⓒ 13.1 units Ⓓ 25.4 units

SOLUTION

First draw triangle *QRS* in a coordinate plane. Find the side lengths. Use the Distance Formula to find *QR* and *RS*.



EXAMPLE 3 Standardized Test Practice

$$QS = |5 - 1| = 4 \text{ units}$$

$$QR = \sqrt{(4-1)^2 + (6-2)^2} = \sqrt{25} = 5 \text{ units}$$

$$RS = \sqrt{(5-4)^2 + (2-6)^2} = \sqrt{17} \approx 4.1 \text{ units}$$

Then find the perimeter.

$$P = QS + QR + RS \approx 4 + 5 + 4.1 = 13.1 \text{ units}$$

ANSWER **The correct answer is C.** (A) (B) (C) (D)

EXAMPLE 4 **Solve a multi-step problem**

Skating Rink

An ice-resurfacing machine is used to smooth the surface of the ice at a skating rink. The machine can resurface about 270 **square yards of ice in one minute.**

About how many minutes does it take the machine to resurface a rectangular skating rink that is 200 feet **long and** 90 feet **wide?**

SOLUTION

The machine can resurface the ice at a rate of 270 square yards per minute**. So, the amount of time it takes to resurface the skating rink depends on its area.**

EXAMPLE 4 **Solve a multi-step problem**

STEP 1 **Find the area of the rectangular skating rink.**

Area $= lw = 200\,(90) = 18{,}000 \text{ ft}^2$

The resurfacing rate is in square yards per minute. Rewrite the area of the rink in square yards. There are 3 **feet in** 1 **yard, and** $3^2 = 9$ **square feet in** 1 **square yard.**

$$18{,}000 \text{ ft}^2 \cdot \frac{1 \text{ yd}^2}{9 \text{ ft}^2} = 2000 \text{ yd}^2$$

Use unit analysis.

EXAMPLE 4 Solve a multi-step problem

STEP 2

Write a verbal model to represent the situation. Then write and solve an equation based on the verbal model.

Let t represent the total time (in minutes) **needed to resurface the skating rink.**

Area of rink (yd^2) = Resurfacing rate (yd^2 per min) × Total time (min)

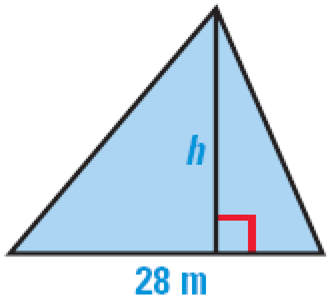
$2000 = 270 \cdot t$ — **Substitute.**

$7.4 \approx t$ — **Divide each side by 270.**

ANSWER **It takes the ice-resurfacing machine about 7 minutes to resurface the skating rink.**

EXAMPLE 5 Find unknown length

The base of a triangle is 28 meters. Its area is 308 square meters. Find the height of the triangle.



SOLUTION

$A = \frac{1}{2}bh$ — Write formula for the area of a triangle.

$308 = \frac{1}{2}(28)\,h$ — Substitute 308 for A and 28 for b.

$22 = h$ — Solve for h.

ANSWER **The height is 22 meters.**

ASSIGNMENT

HW 1.7 Pg 52 #2-18 even, 19, 27-32

Quiz #3 (1.6-1.7) Next Time

Ch 7 Test Review Next Time