Section 1.1 – Nets and Drawings for Visualizing Geometry

Students will be able to:

• make nets and drawings of three-dimensional figures.

Key Vocabulary:

• net

• isometric drawing

• orthographic drawing

Section 1.1 – Nets and Drawings for Visualizing Geometry

Section 1.1 – Nets and Drawings for Visualizing Geometry

In the Solve It, you had to “see” the projection of one side of an object onto a flat surface. Visualizing figures is a key skill that you will develop in geometry.

Section 1.1 – Nets and Drawings for Visualizing Geometry

You can represent a three dimensional object with a two-dimensional figure using special drawing techniques.

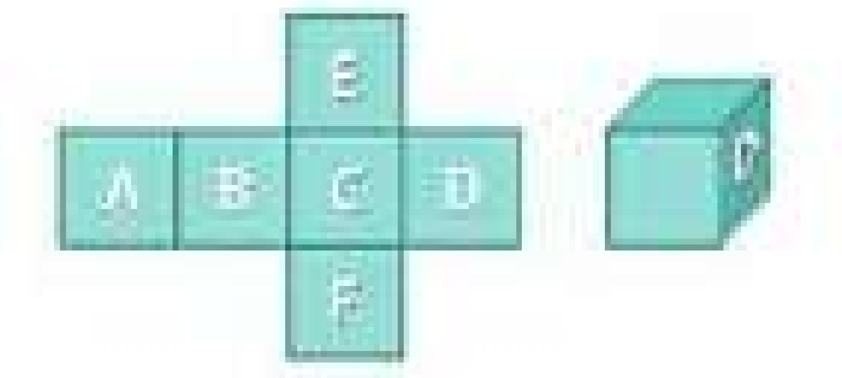
A **NET** is a two-dimensional diagram that you can fold to form a three-dimensional figure. A net shows all of the surfaces of a figure in one view.

Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 1:

The net at the right folds into the cube shown beside it. Which letters will be on the top and front of the cube?

How can you see the 3-D figure? Visualize folding the net at the seams so that the edges join together. Track the letter positions by seeing one surface move in relation to another.

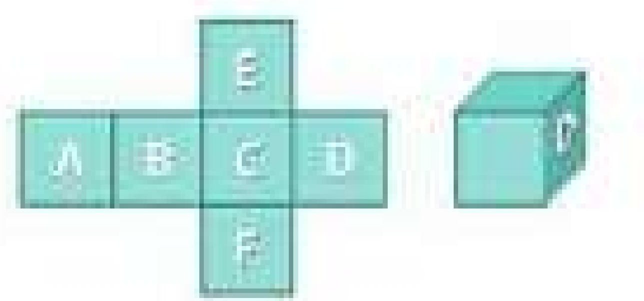


Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 1:

How can you determine by looking at the net that surface E and surface F will be opposite one another in the cube?

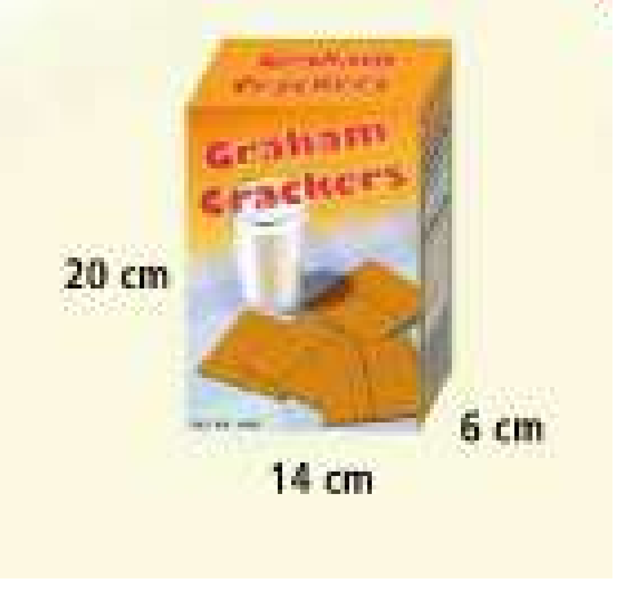
If the cube were turned one quarter-turn counterclockwise without lifting the bottom surface, which surface would be at the front of the cube?



Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 2:

What is the net for the graham cracker box to the right? Label the net with its dimensions.



Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 2:

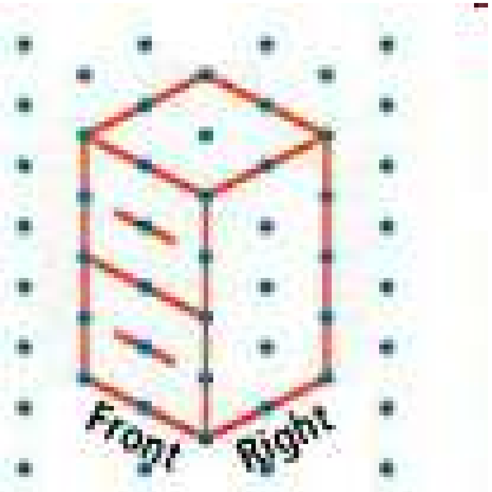
What is a net for the figure at the right? Label the net with its dimensions.

Is there another possible net for the figure?

Section 1.1 – Nets and Drawings for Visualizing Geometry

An **ISOMETRIC DRAWING** shows a corner view of a three dimensional figure. It allows you to see the top, front, and side of the figure. You can draw an isometric drawing on isometric dot paper. The simple drawing of a file cabinet at the right is an isometric drawing.

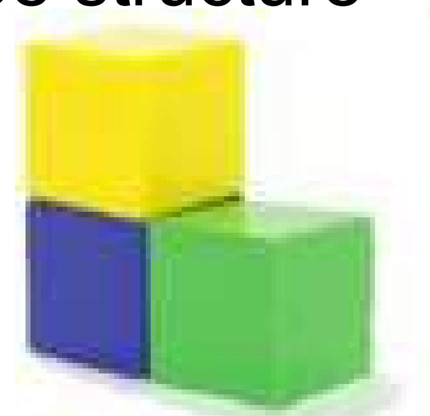
A **net** shows a 3-D figure as a folded out flat surface. An **isometric drawing** shows a 3-D figure using slanted lines to represent depth.



Section 1.1 – Nets and Drawings for Visualizing Geometry

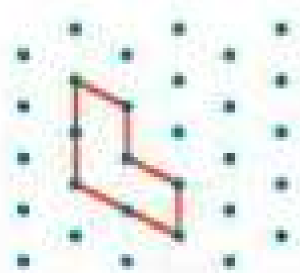
Problem 3:

What is an isometric drawing of the cube structure at the right?



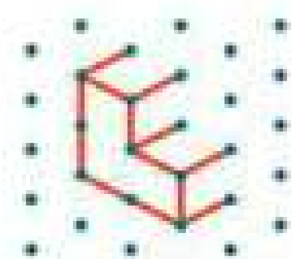
Step 1

Draw the front edges.



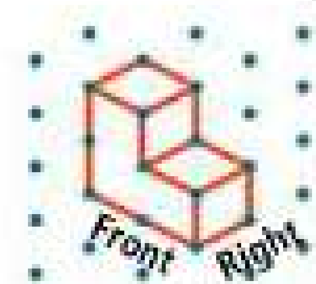
Step 2

Draw the right edges.



Step 3

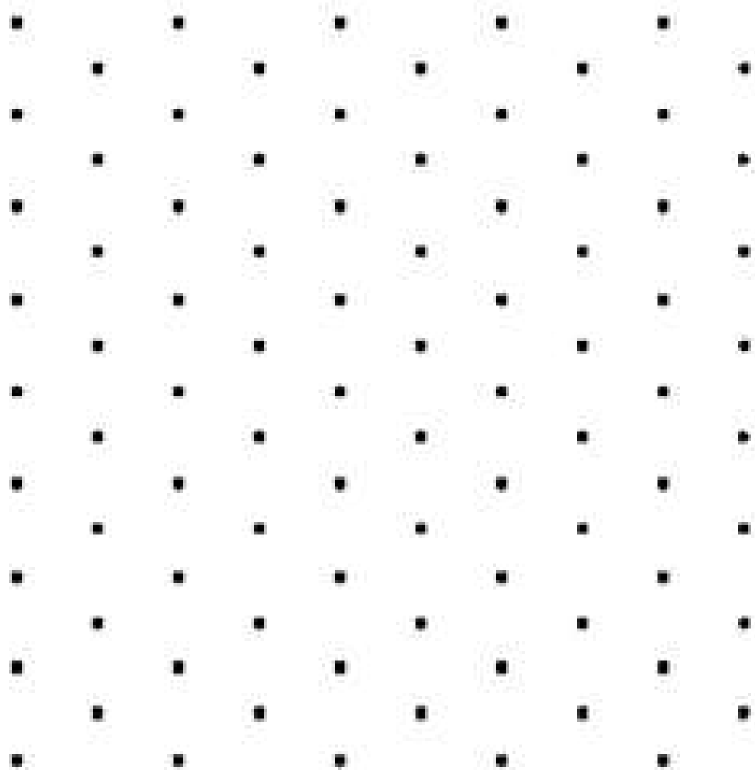
Draw the back edges.

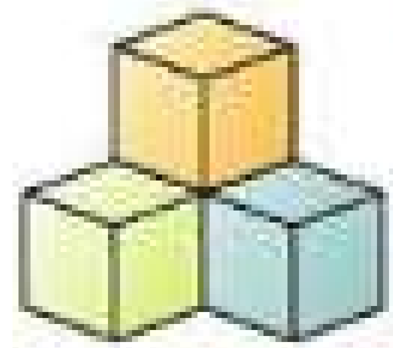


Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 3:

What is an isometric drawing of the cube structure at the right?





Section 1.1 – Nets and Drawings for Visualizing Geometry

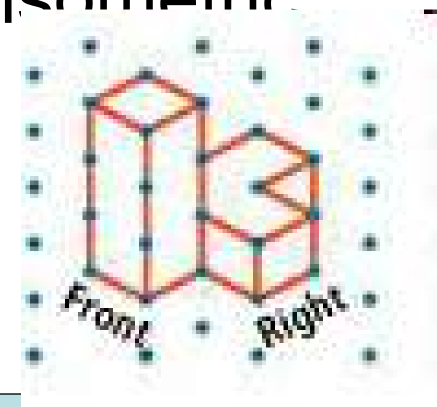
An orthographic drawing is another way to represent a 3-D figure. An **orthographic drawing** shows three separate views, a top view, a front view, and a right-side view.

Although an orthographic drawing may take more time to analyze, it provides unique information about the shape of a structure.

Section 1.1 – Nets and Drawings for Visualizing Geometry

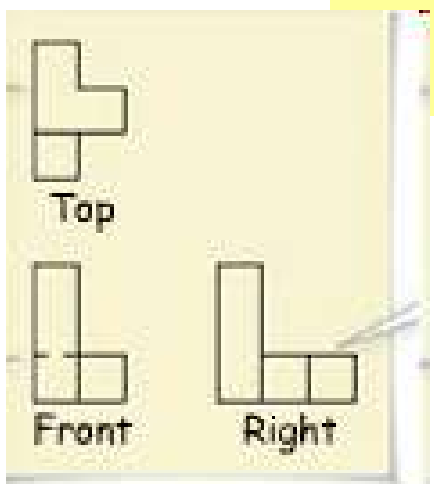
Problem 4:

What is the orthographic drawing for the isometric drawing at the right?



Solid lines show visible edges.

Dashed lines show hidden edges.

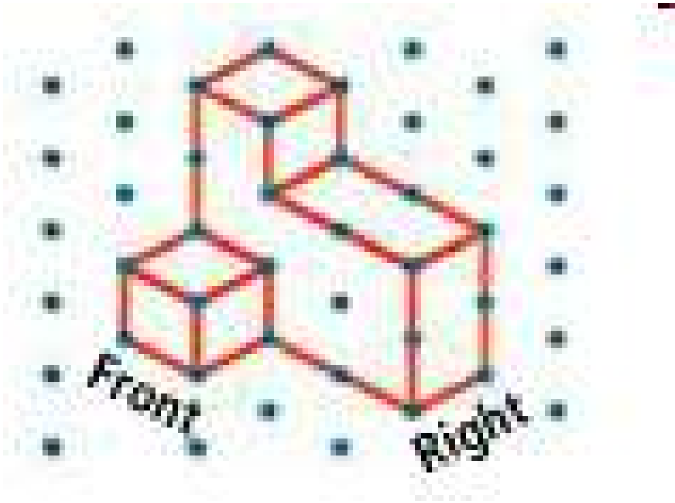


An isometric drawing shows the same three views.

Section 1.1 – Nets and Drawings for Visualizing Geometry

Problem 4:

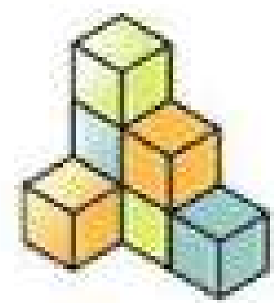
What is the orthographic drawing for the isometric drawing at the right?



Section 1.1 – Nets and Drawings for Visualizing Geometry

1. What is a net for the figure below? Label the net with its dimensions.

2. What is an isometric drawing of the cube structure?



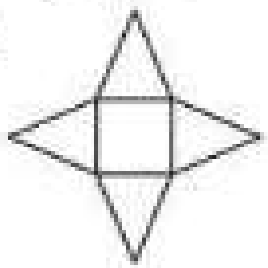
3. What is the orthographic drawing of the isometric drawing at the right? Assume there are no hidden cubes.

Section 1.1 – Nets and Drawings for Visualizing Geometry

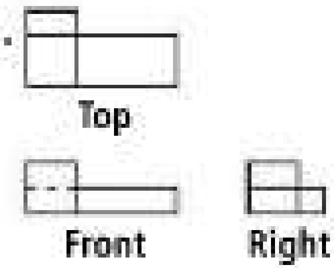
Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Vocabulary** Tell whether each drawing is *isometric*, *orthographic*, a *net*, or *none*.

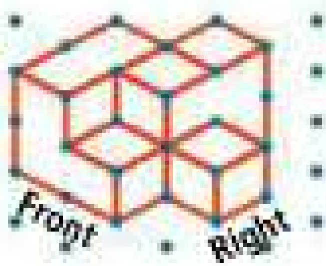
a.



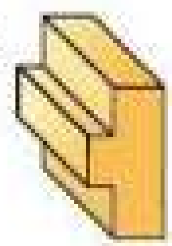
b.



c.



d.



5. **Compare and Contrast** What are the differences and similarities between an isometric drawing and an orthographic drawing? Explain.

Section 1.2 – Points, Lines, and Planes

Students will be able to:

- Understand basic terms and postulates of geometry.

Key Vocabulary

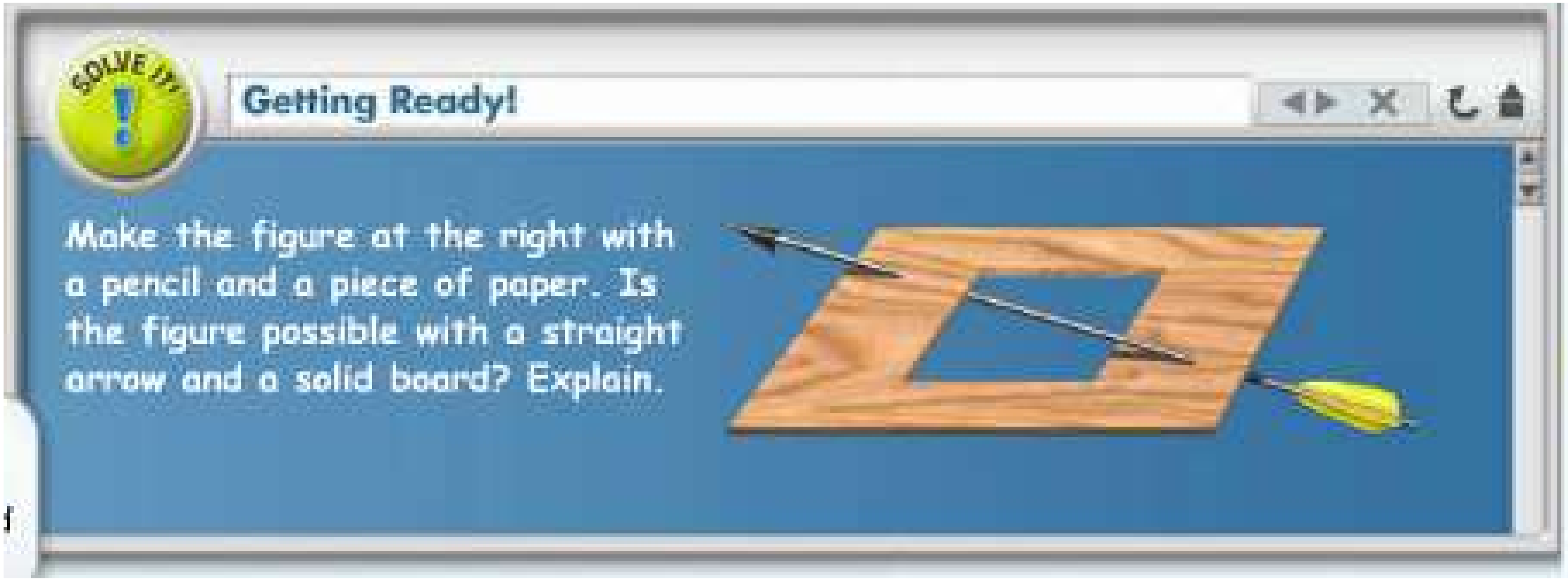
point coplanar opposite rays

linespacepostulate

planesegmentaxiom

Collinear pointsrayintersection

Section 1.2 – Points, Lines, and Planes



Section 1.2 – Points, Lines, and Planes

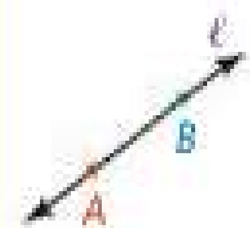
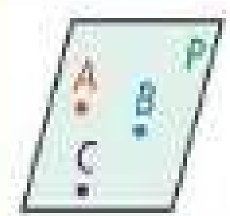
Geometry is a mathematical system built on accepted facts, basic terms, and definitions.

In geometry, some words such as point, line, and plane are undefined. **Undefined terms** are the basic ideas that you can use to build the definitions of all other figures in geometry. Although you can not define undefined terms, it is important to have a general description of their meanings.

Section 1.2 – Points, Lines, and Planes

take note

Key Concept Undefined Terms

Term Description	How to Name It	Diagram
A **point** indicates a location and has no size.	You can represent a point by a dot and name it by a capital letter, such as A.	
A **line** is represented by a straight path that extends in two opposite directions without end and has no thickness. A line contains infinitely many points.	You can name a line by any two points on the line, such as $\overleftrightarrow{AB}$ (read "line AB") or $\overleftrightarrow{BA}$, or by a single lowercase letter, such as line ℓ.	
A **plane** is represented by a flat surface that extends without end and has no thickness. A plane contains infinitely many lines.	You can name a plane by a capital letter, such as plane P, or by at least three points in the plane that do not all lie on the same line, such as plane ABC.	

Section 1.2 – Points, Lines, and Planes

Points that lie on the same line are **collinear points**.

Points and lines that lie in the same plane are **coplanar**.

All the points of a line are coplanar.

Section 1.2 – Points, Lines, and Planes

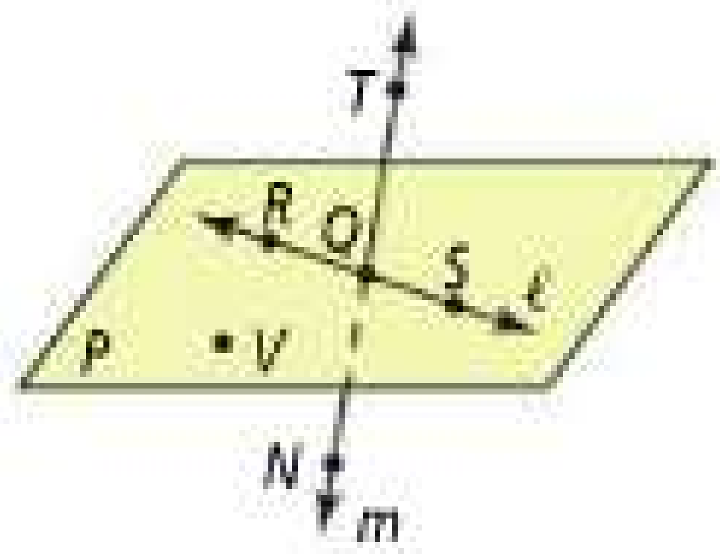
Problem 1:

What are two other ways to name $\overleftrightarrow{QT}$?

What are two other ways to name plane P?

What are the names of thee collinear points?

What are the names of four coplanar points?



Section 1.2 – Points, Lines, and Planes

The terms *point, line*, and *plane* are not defined because their definitions would require terms that also need defining. You can, however, used undefined terms to define other terms.

A geometric figure is a set of points.

Space is the set of all points in three dimensions.

Section 1.2 – Points, Lines, and Planes

take note

Key Concept Defined Terms

Definition	How to Name It	Diagram
A **segment** is part of a line that consists of two endpoints and all points between them.	You can name a segment by its two endpoints, such as $\overline{AB}$ (read "segment AB") or $\overline{BA}$.	
A **ray** is part of a line that consists of one endpoint and all the points of the line on one side of the endpoint.	You can name a ray by its endpoint and another point on the ray, such as $\overrightarrow{AB}$ (read "ray AB"). The order of points indicates the ray's direction.	
Opposite rays are two rays that share the same endpoint and form a line.	You can name opposite rays by their shared endpoint and any other point on each ray, such as $\overrightarrow{CA}$ and $\overrightarrow{CB}$.	

Section 1.2 – Points, Lines, and Planes

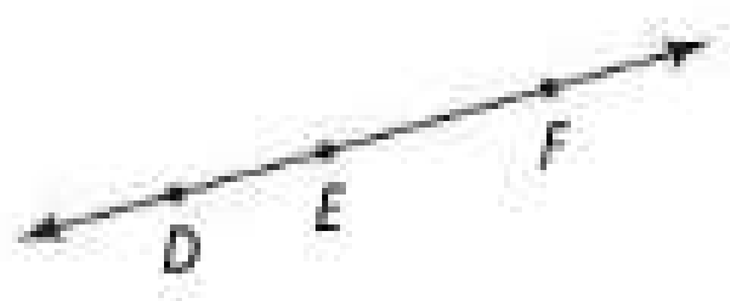
Problem 2:

What are the names of the segments in the figure at the right?

What are the names of the rays in the figure?

Which of the rays in part (b)
are opposite rays?

Ray EF and Ray FE form a line.
Are they opposite rays?



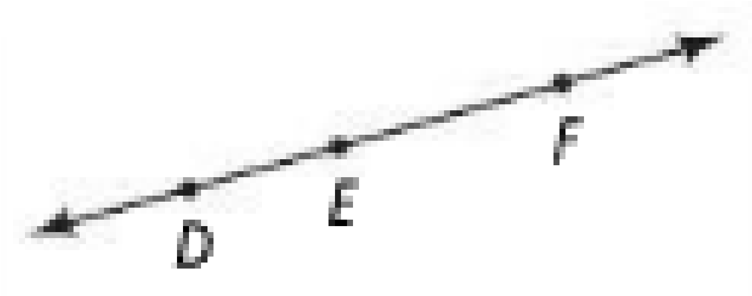
Section 1.2 – Points, Lines, and Planes

Problem 2:

Do the names $\overline{DE}$ and $\overline{ED}$ represent different segments?

Can the three points shown on the line be used to name a plane?

How are segments $\overline{DE}$, $\overline{EF}$, and $\overline{DF}$ related to each other?



Section 1.2 – Points, Lines, and Planes

A ***postulate*** or ***axiom*** is an accepted statement of fact.

Postulates, like undefined terms, are basic building blocks of the logical system of geometry.

You will use logical reasoning to prove general concepts in this book.

Section 1.2 – Points, Lines, and Planes

take note

Postulate 1-1

Through any two points there is exactly one line.

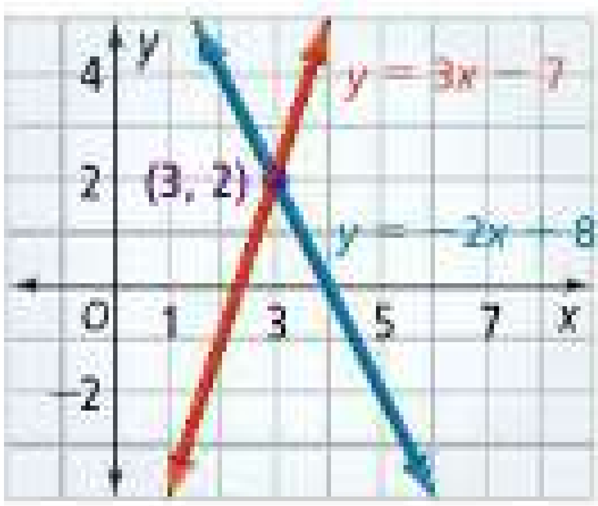
Line *t* passes through points *A* and *B*. Line *t* is the only line that passes through both points.

You used Postulate 1-1 when you graphed equations such as $y = 2x + 8$. You graphed two points and drew a line through the two points.

Section 1.2 – Points, Lines, and Planes

When you have two or more geometric figures, their **intersection** is the set of points the figures have in common.

In algebra, one way to solve a system of two equations is to graph them like on the right. This uses Postulate 1-2.



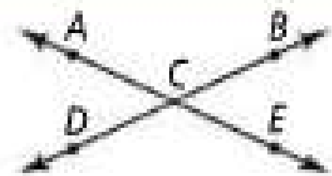
Section 1.2 – Points, Lines, and Planes

take note

Postulate 1-2

If two distinct lines intersect, then they intersect in exactly one point.

$\overleftrightarrow{AE}$ and $\overleftrightarrow{DB}$ intersect in point *C*.

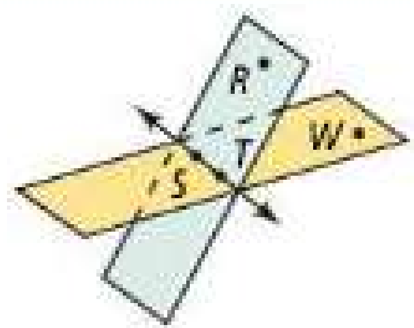


take note

Postulate 1-3

If two distinct planes intersect, then they intersect in exactly one line.

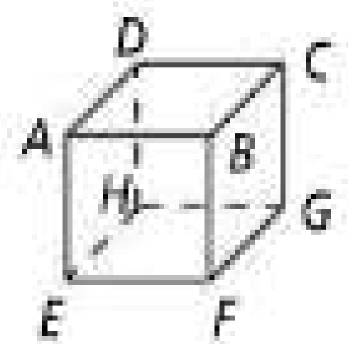
Plane *RST* and plane *WST* intersect in $\overleftrightarrow{ST}$.



Section 1.2 – Points, Lines, and Planes

Problem 3:

Each surface of the box at the right represents part of a plane. What is the intersection of plane ADC and plane BFG?

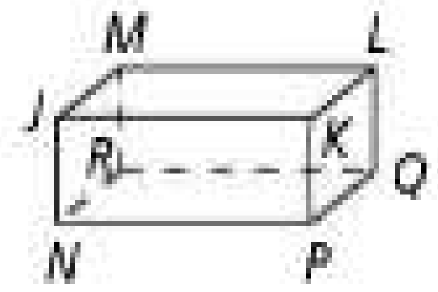


What are the names of the to planes that intersect at $\overleftrightarrow{BF}$?

Section 1.2 – Points, Lines, and Planes

Problem 4:

What plane contains points N, P, and Q? Shade the plane.



What plane contains points

J, M, and Q? Shade the plane.

What planes contains points L, M, and N?

Shade the plane.

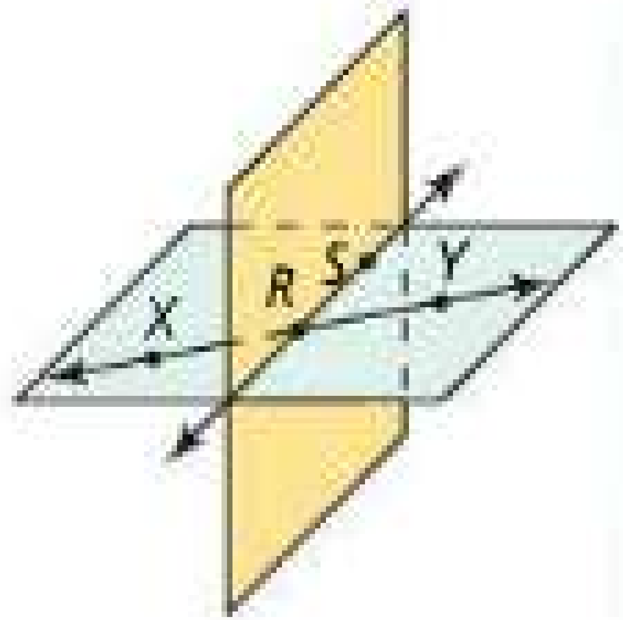
Section 1.2 – Points, Lines, and Planes

Lesson Check

Do you know HOW?

Use the figure at the right.

1. What are two other names for $\overleftrightarrow{XY}$?
2. What are the opposite rays?
3. What is the intersection of the two planes?



Section 1.2 – Points, Lines, and Planes

Lesson Check

Do you UNDERSTAND?

MATHEMATICAL PRACTICES

4. **Vocabulary** A segment has endpoints *R* and *S*. What are two names for the segment?

5. Are $\overrightarrow{AB}$ and $\overrightarrow{BA}$ the same ray? Explain.

6. **Reasoning** Why do you use two arrowheads when drawing or naming a line such as $\overleftrightarrow{EF}$?

7. **Compare and Contrast** How is naming a ray similar to naming a line? How is it different?

Section 1.3 – Measuring Segments

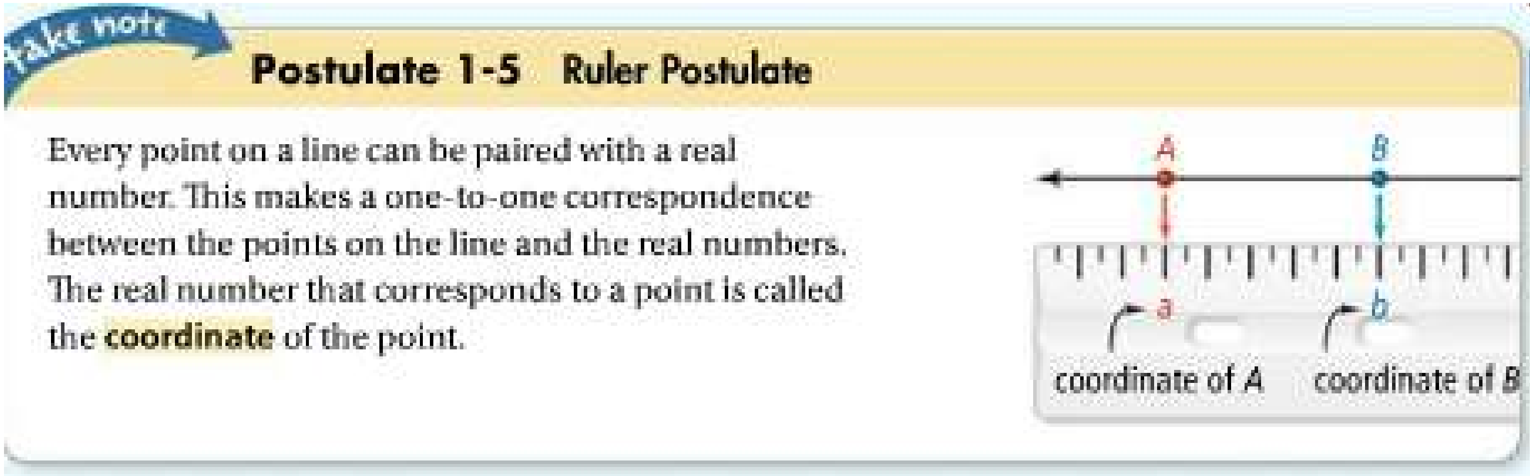
Students will be able to:

- find and compare lengths of segments

Key Vocabulary

- coordinate
- distance
- congruent segments
- midpoint
- S=segment bisector

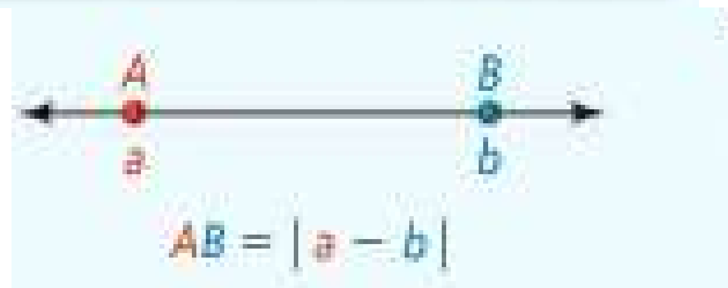
Section 1.3 – Measuring Segments



take note

Postulate 1-5 **Ruler Postulate**

Every point on a line can be paired with a real number. This makes a one-to-one correspondence between the points on the line and the real numbers. The real number that corresponds to a point is called the **coordinate** of the point.



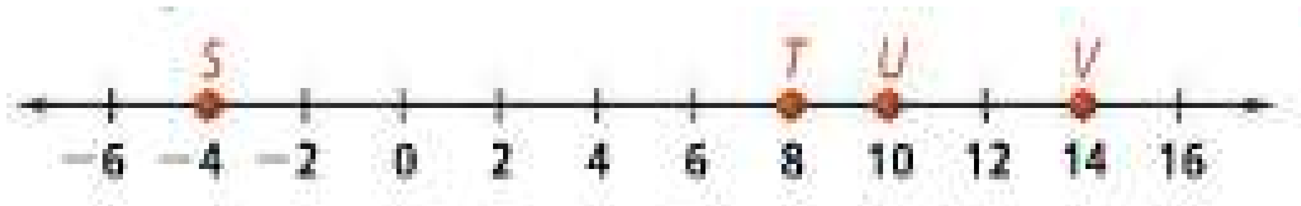
The distance between points A and B is the absolute value of the difference of their coordinates,

or |a – b|.

This value is also AB, or the length between A and B.

Section 1.3 – Measuring Segments

Problem 1:



What is ST?

What is UV?

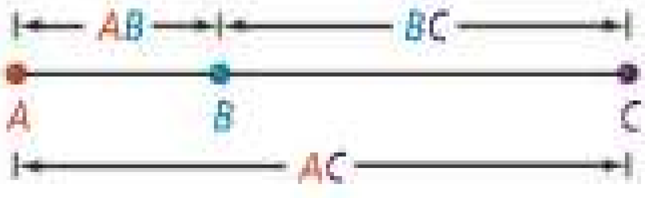
What is SV?

Section 1.3 – Measuring Segments

take note

Postulate 1-6 Segment Addition Postulate

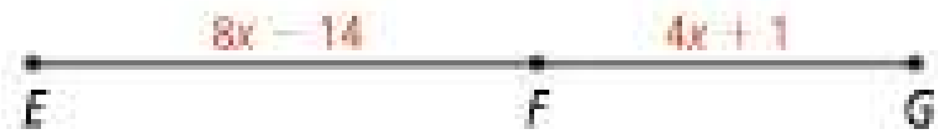
If three points A, B, and C are collinear and B is between A and C, then $AB + BC = AC$.



Section 1.3 – Measuring Segments

Problem 2:

If EG = 59, what are EF and FG?



What algebraic expression represents EG?

What is the numeric value given for EG?

How should you check to make sure that the segment lengths are correct?

Section 1.3 – Measuring Segments

When numerical expressions have the same value, you say that they are equal (=).

Similarly, if two segments have the same length, then the segments are **congruent segments.**

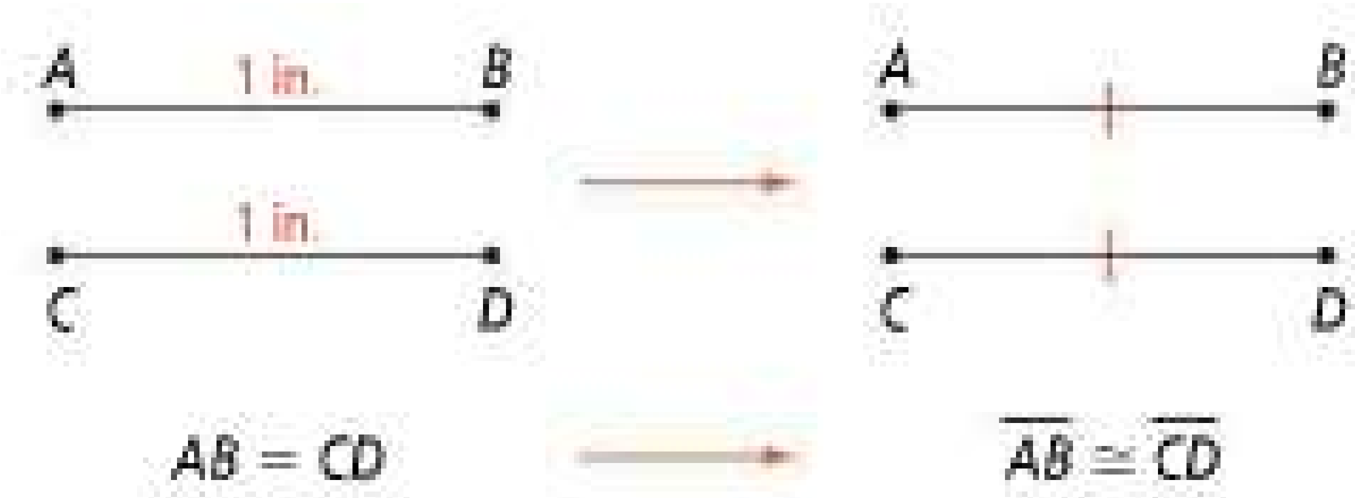
The symbol for congruent is _______________.

Section 1.3 – Measuring Segments

This means if AB = CD, then $\overline{AB} \cong \overline{CD}$.

You can also say that if $\overline{AB} \cong \overline{CD}$,

then AB = CD.



Section 1.3 – Measuring Segments

Problem 3:

Are $\overline{AC}$ and $\overline{BD}$ congruent?

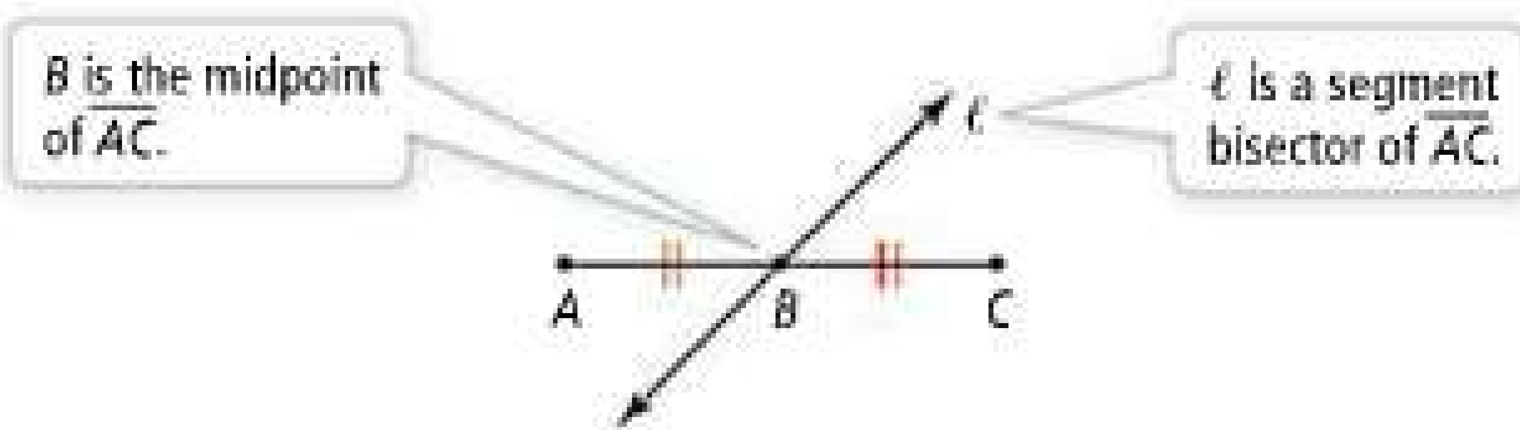
Is Segment AB congruent to Segment DE?

Section 1.3 – Measuring Segments

The **midpoint** of a segment is a point that divides the segment into two congruent segments.

A point, line, ray, or other segment that intersects a segment at its midpoint is said to ***bisect*** the segment.

That point, line, ray, or segment is called a **segment bisector**.

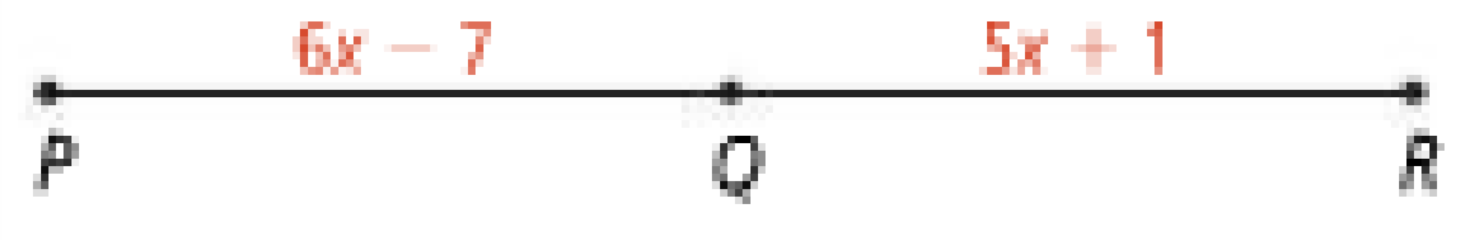


Section 1.3 – Measuring Segments

Problem 4:

Q is the midpoint of $\overline{PR}$.

What are PQ, QR, and PR?



Section 1.3 – Measuring Segments

Problem 4(b):

U is the midpoint of $\overline{TV}$.

What are TU, UV, and TV?

Section 1.3 – Measuring Segments

Lesson Check

Do you know HOW?

Name each of the following.

1. The point on $\overrightarrow{DA}$ that is 2 units from D
2. Two points that are 3 units from D
3. The coordinate of the midpoint of $\overline{AG}$
4. A segment congruent to $\overline{AC}$

Section 1.3 – Measuring Segments

Lesson Check

Do you UNDERSTAND? MATHEMATICAL PRACTICES

5. **Vocabulary** Name two segment bisectors of $\overline{PR}$.

6. **Compare and Contrast** Describe the difference between saying that two segments are *congruent* and saying that two segments have *equal length*. When would you use each phrase?

7. **Error Analysis** You and your friend live 5 mi apart. He says that it is 5 mi from his house to your house and −5 mi from your house to his house. What is the error in his argument?

Section 1.4 – Measuring Angles

Students will be able to:

- find and compare measures of angles

Key Vocabulary

angleright angle

sides of an angleobtuse angle

vertex of an anglestraight angle

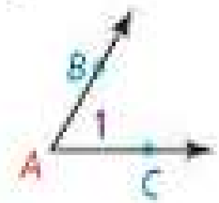
measure of an anglecongruent angles

acute angle

Section 1.4 – Measuring Angles

take note

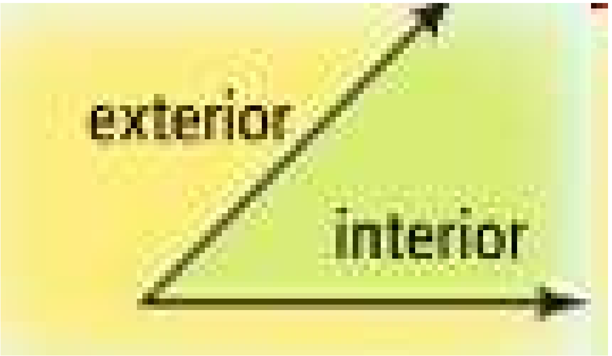
Key Concept **Angle**

Definition	How to Name It	Diagram
An **angle** is formed by two rays with the same endpoint. The rays are the **sides** of the angle. The endpoint is the **vertex** of the angle.	You can name an angle by • its vertex, $\angle A$ • a point on each ray and the vertex, $\angle BAC$ or $\angle CAB$ • a number, $\angle 1$	 The sides of the angle are $\overrightarrow{AB}$ and $\overrightarrow{AC}$. The vertex is A.

When you name angles using three points, the vertex MUST go in the middle.

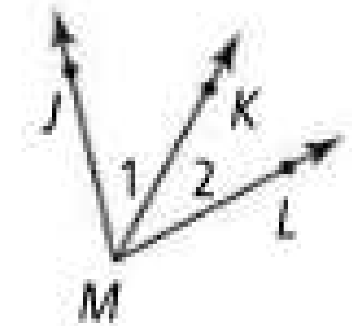
Section 1.4 – Measuring Angles

The interior of an angle is the region containing all of the points between the two sides of the angle. The exterior of an angle is the region containing all of the points outside of the angle.



Section 1.4 – Measuring Angles

Problem 1:



What are the two other names for <1?

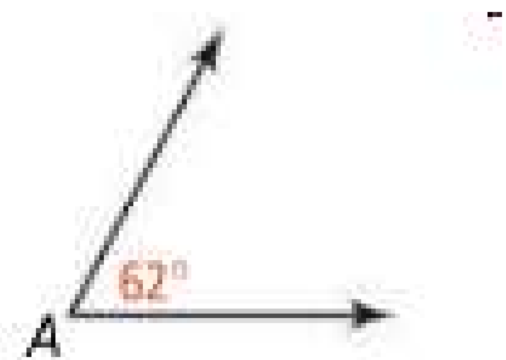
What are the two other names for <KML?

Would it be correct to name any of the angles <M? Explain!!

Section 1.4 – Measuring Angles

One way to measure the size of an angle is in degrees. To indicate the measure of an angle, write a lowercase *m* in front of the angle symbol.

In the diagram, the measure of <A is 62. You write this as *m*<A = 62.



Section 1.4 – Measuring Angles

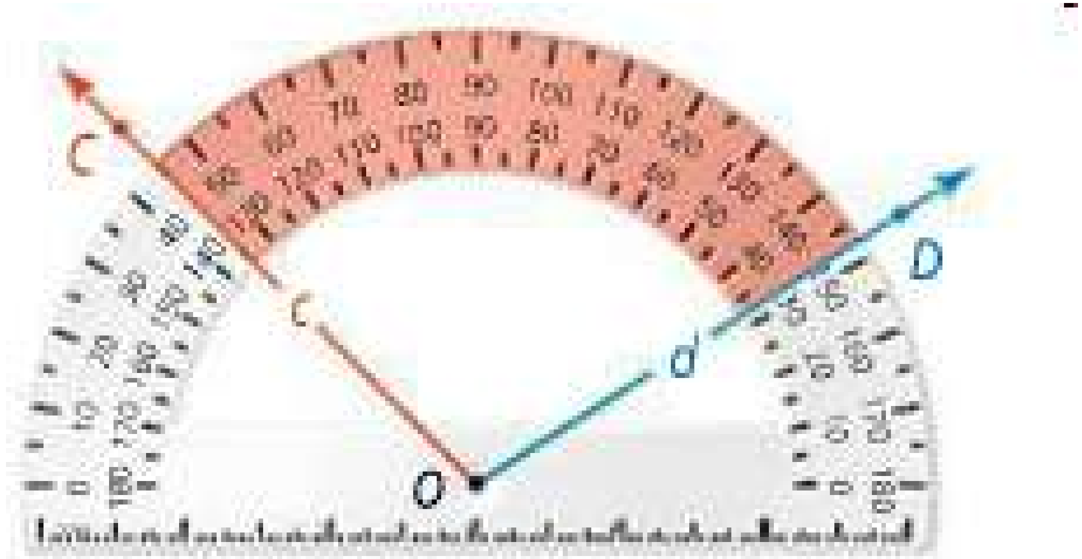
The Protractor Postulate allows you to find the measure of an angle.

Postulate 1-7 Protractor Postulate

Consider $\overrightarrow{OB}$ and a point A on one side of $\overrightarrow{OB}$. Every ray of the form $\overrightarrow{OA}$ can be paired one to one with a real number from 0 to 180.

Section 1.4 – Measuring Angles

The **measure** of <COD is the *absolute value* of the *difference* of the real numbers paired with Ray OC and Ray OD.



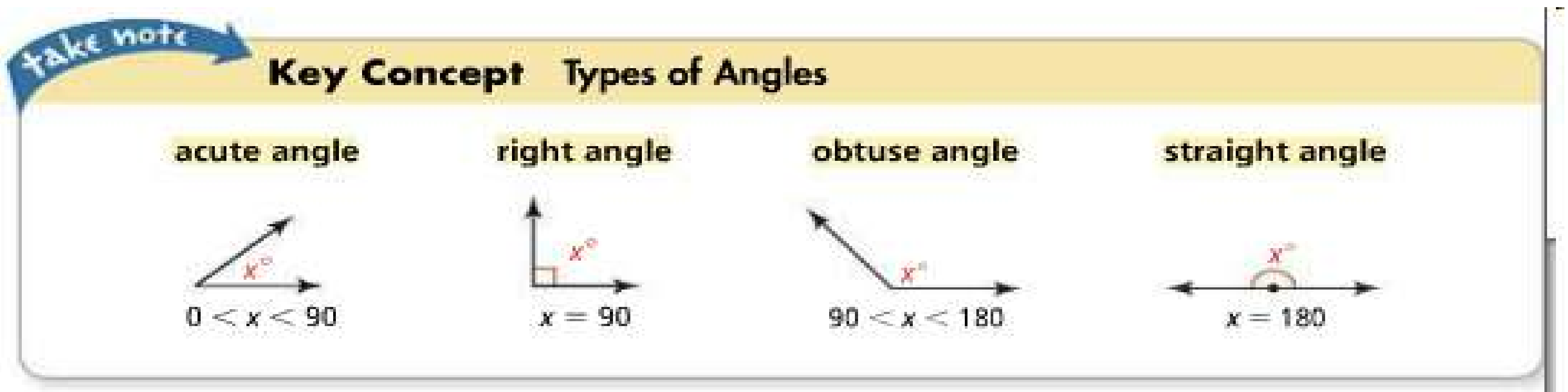
Section 1.4 – Measuring Angles

Classifying Angles:

You tell me:

ACUTE RIGHT

OBTUSESTRAIGHT



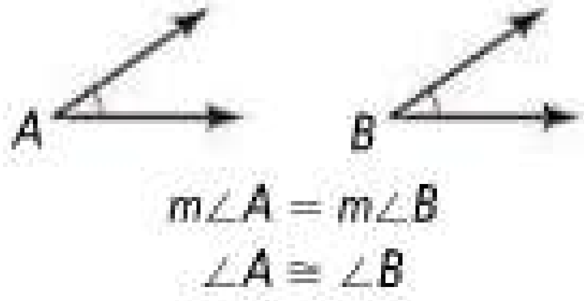
Section 1.4 – Measuring Angles

Problem 2:

What are the measures of <LKN, JKL, and JKN? Classify each angle as acute, right, obtuse, or straight.

Section 1.4 – Measuring Angles

Angles with the same measure are **congruent angles**. This means that if m<A = m<B, then <A ≅ <B.

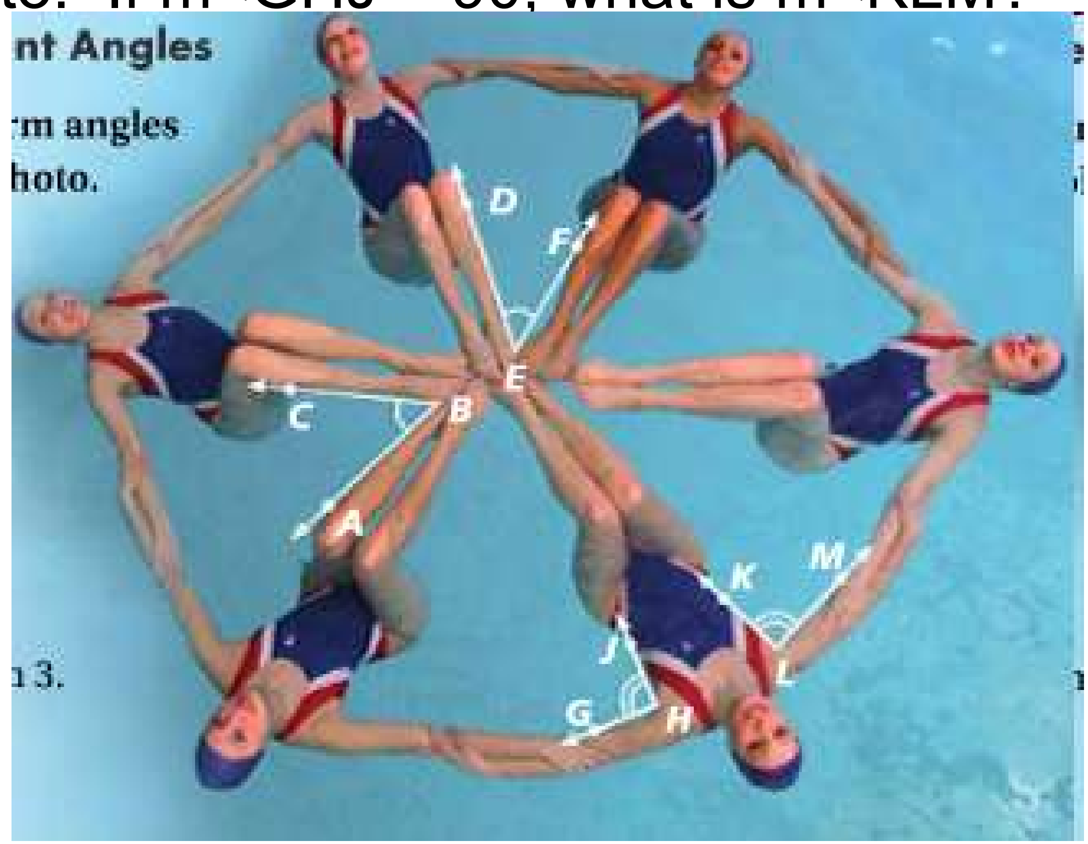


You can mark angles with arcs to show that they are congruent. If there is more than one set of congruent angles, each set is marked with the same number of arcs.

Section 1.4 – Measuring Angles

Problem 3:

Synchronized swimmers form angles with their bodies, as show in the photo. If m<GHJ = 90, what is m<KLM?

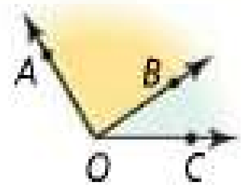


Section 1.4 – Measuring Angles

take note

Postulate 1-8 Angle Addition Postulate

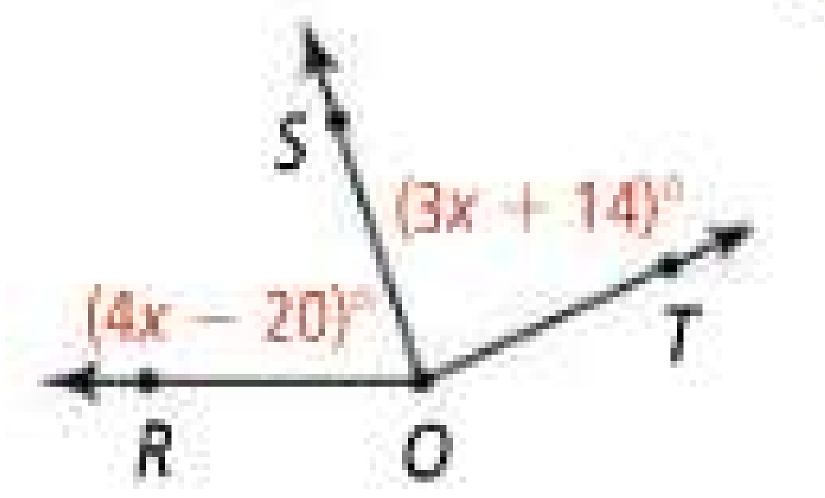
If point B is in the interior of $\angle AOC$, then $m\angle AOB + m\angle BOC = m\angle AOC$.



Section 1.4 – Measuring Angles

Problem 4:

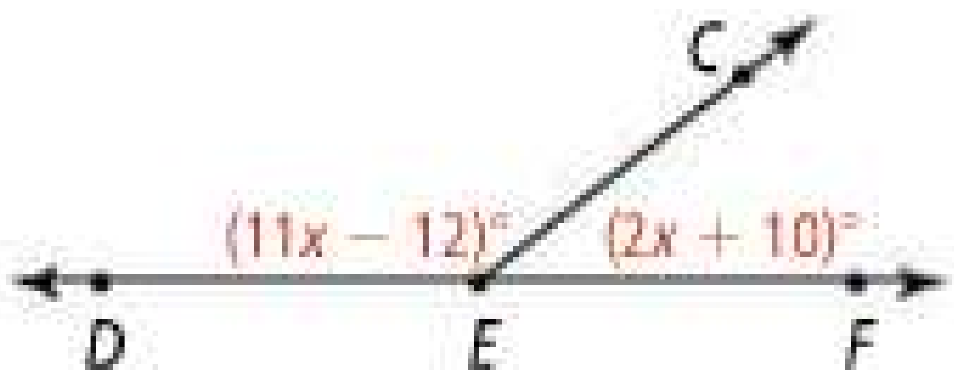
If m<RQT = 155, what are m<RQS and m<TQS?



Section 1.4 – Measuring Angles

Problem 5:

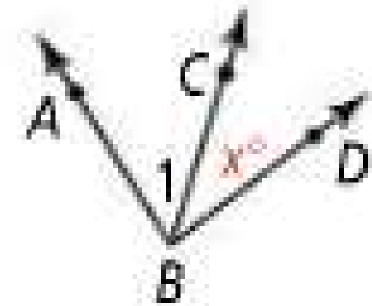
<DEF is a straight angle. What are m<DEC and m<CEF?



Section 1.4 – Measuring Angles

Do you know HOW?

Use the diagram for Exercises 1–3.



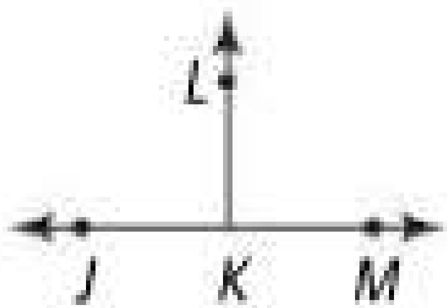
1. What are two other names for $\angle 1$?
2. **Algebra** If $m\angle ABD = 85$, what is an expression to represent $m\angle ABC$?
3. Classify $\angle ABC$.

Section 1.4 – Measuring Angles

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Vocabulary** How many sides can two congruent angles share? Explain.

5. **Error Analysis** Your classmate concludes from the diagram below that $\angle JKL \cong \angle LKM$. Is your classmate correct? Explain.



Section 1.5 – Exploring Angle Pairs

Students will be able to:

- identify special angle pairs and use their relationships to find angle measures

Key Vocabulary

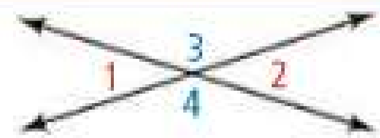
adjacent angles   vertical angles

complementary angles   supplementary angles

linear pair   angle bisector

Section 1.5 – Exploring Angle Pairs

Special angle pairs can help you identify geometric relationships. You can use these angle pairs to find angle measures

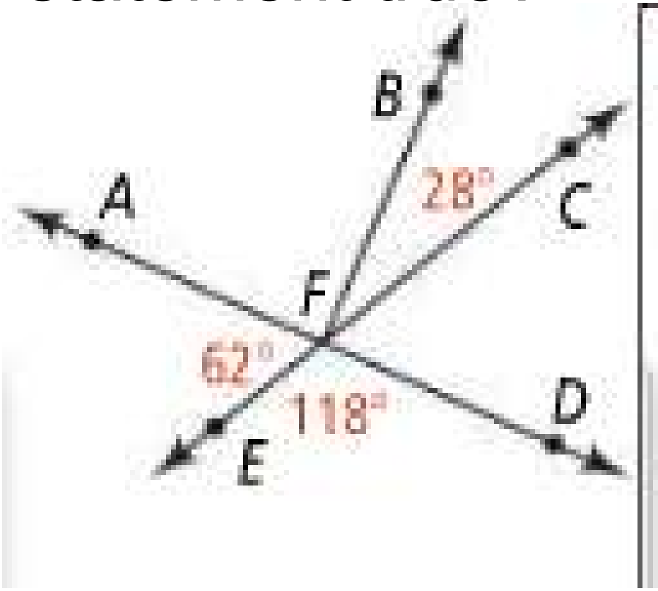
Adjacent angles are two coplanar angles with a common side, a common vertex, and no common interior points.	∠1 and ∠2, ∠3 and ∠4 
Vertical angles are two angles whose sides are opposite rays.	∠1 and ∠2, ∠3 and ∠4 
Complementary angles are two angles whose measures have a sum of 90. Each angle is called the *complement* of the other.	∠1 and ∠2, ∠A and ∠B 
Supplementary angles are two angles whose measures have a sum of 180. Each angle is called the *supplement* of the other.	∠3 and ∠4, ∠B and ∠C 

Section 1.5 – Exploring Angle Pairs

Problem 1:

Use the diagram at the right. Is the statement true? Explain

- <BFD and <CFD are adjacent angles.
- <AFB and <EFD are vertical angles
- <AFE and <BFC are complementary.



Section 1.5 – Exploring Angle Pairs

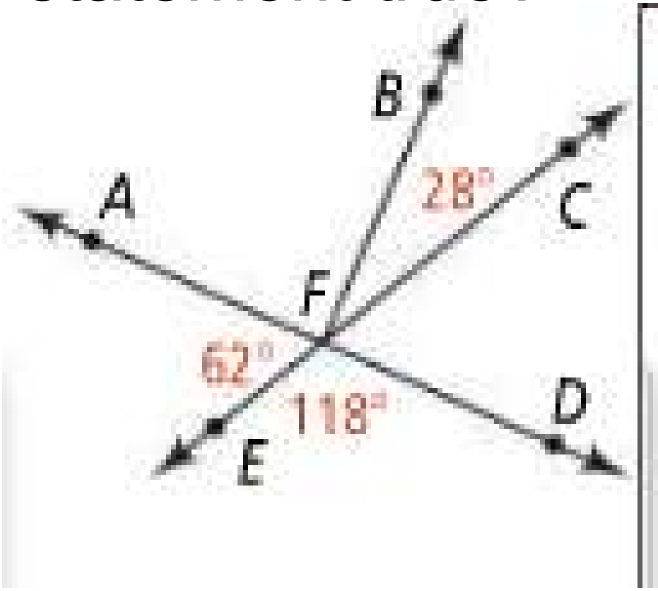
Problem 1b:

Use the diagram at the right. Is the statement true? Explain

- <AFE and <CFD are vertical angles.

b. <BFC and <DFE are supplementary.

c. <BFD and <AFB are adjacent angles.



Section 1.5 – Exploring Angle Pairs

take note

Concept Summary Finding Information From a Diagram

There are some relationships you can assume to be true from a diagram that has no marks or measures. There are other relationships you cannot assume directly. For example, you *can* conclude the following from an unmarked diagram.

- Angles are adjacent.
- Angles are adjacent and supplementary.
- Angles are vertical angles.

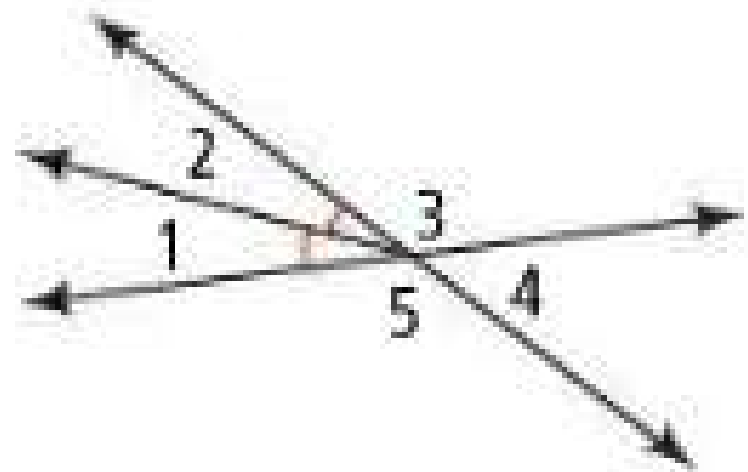
You *cannot* conclude the following from an unmarked diagram.

- Angles or segments are congruent.
- An angle is a right angle.
- Angles are complementary.

Section 1.5 – Exploring Angle Pairs

Problem 2:

What can you conclude from the information in the diagram?

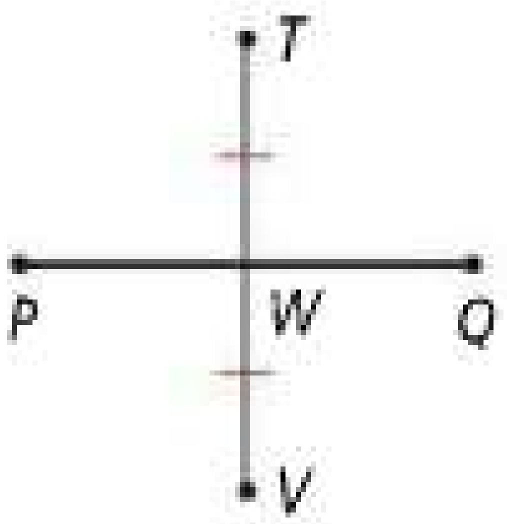


Section 1.5 – Exploring Angle Pairs

Problem 2b:

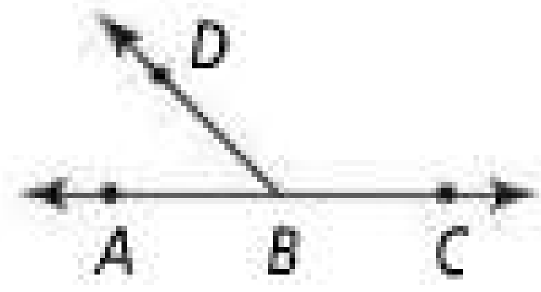
Can you make each conclusion from the information in the diagram? Explain.

- Segment TW is congruent to Segment WV
- Segment PW is congruent to Segment WQ
- <TWQ is a right angle
- Segment TV bisects Segment PQ



Section 1.5 – Exploring Angle Pairs

A **linear pair** is a pair of adjacent angles whose noncommon sides are opposite rays. The angles of a linear pair form a straight angle



take note

Postulate 1-9 Linear Pair Postulate

If two angles form a linear pair, then they are supplementary.

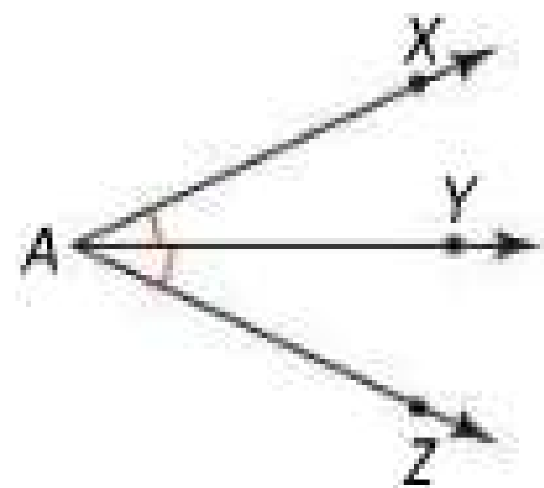
Section 1.5 – Exploring Angle Pairs

Problem 3:

<KPL and <JPL are a linear pair, m<KPL = 2x + 24, and m<JPL = 4x + 36. What are the measures of <KPL and <JPL?

Section 1.5 – Exploring Angle Pairs

An **angle bisector** is a ray that divides an angle into two congruent angles. Its endpoint is a the angle vertex. Within the ray, a segment with the same endpoint is also an angle bisector. The ray or segment bisects the angle. In the diagram, Ray AY is the angle bisector of <XAZ, so m<XAY = m<YAZ.



Section 1.5 – Exploring Angle Pairs

Problem 4:

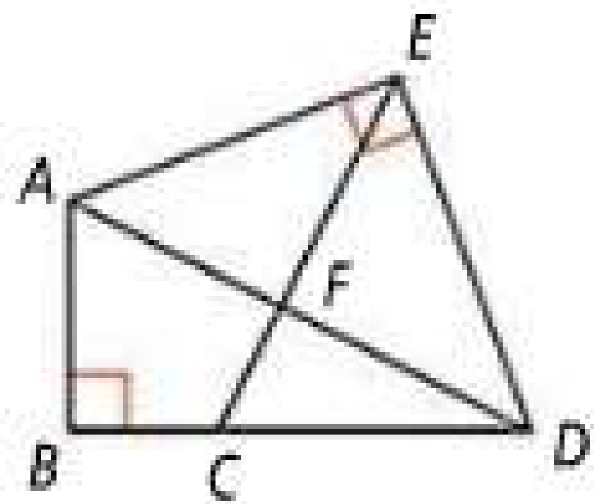
Ray AC bisects <DAB. If m<DAC = 58, what is m<DAB?

Section 1.5 – Exploring Angle Pairs

Lesson Check

Do you know HOW?

Name a pair of the following types of angle pairs.



1. vertical angles
2. complementary angles
3. linear pair
4. $\overrightarrow{PB}$ bisects $\angle RPT$ so that $m\angle RPB = x + 2$ and $m\angle TPB = 2x - 6$. What is $m\angle RPT$?

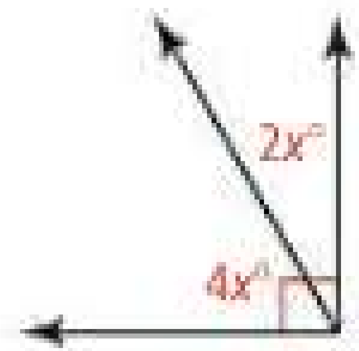
Section 1.5 – Exploring Angle Pairs

Lesson Check

Do you UNDERSTAND? MATHEMATICAL PRACTICES

5. Vocabulary How does the term *linear pair* describe how the angle pair looks?

6. Error Analysis Your friend calculated the value of x below. What is her error?



$$4x + 2x = 180$$
$$6x = 180$$
$$x = 30$$

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Students will be able to:

- find the midpoint of a segment
- find the distance between two points in the coordinate plane

Section 1.7 – Midpoint and Distance in the Coordinate Plane

What do you think we mean
by the word "midpoint"?

Ideas on how to find it on a number line?

Ideas on how to find it on a coordinate plane?

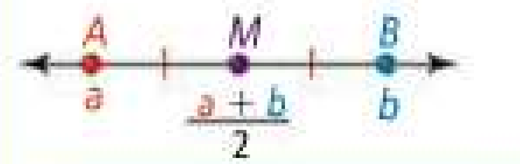
Section 1.7 – Midpoint and Distance in the Coordinate Plane

You can use formulas to find the **midpoint** and length of any segment in the coordinate plane.

On a Number Line

The coordinate of the midpoint is the *average* or *mean* of the coordinates of the endpoints.

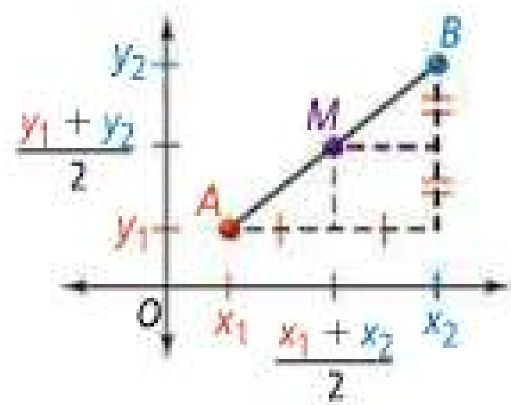
The coordinate of the midpoint M of $\overline{AB}$ is $\frac{a+b}{2}$.



In the Coordinate Plane

The coordinates of the midpoint are the average of the x-coordinates and the average of the y-coordinates of the endpoints.

Given $\overline{AB}$ where $A(x_1, y_1)$ and $B(x_2, y_2)$, the coordinates of the midpoint of $\overline{AB}$ are $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.



Section 1.7 – Midpoint and Distance in the Coordinate Plane

Problem 1:

Segment AB has endpoints at -4 and 9. What is the coordinate of its midpoint?

Segment JK has endpoints at -12 and 4 on a number line. What is the coordinate of its midpoint?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Problem 1b:

Segment EF has endpoints E(7, 5) and F(2, -4). What are the coordinates of its midpoint M?

Segment RS has endpoints at R(5, -10) and S(3, 6). What are the coordinates of its midpoint M?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Problem 2:

The midpoint of Segment CD is M(2, -1). One endpoint is C(-5, 7). What are the coordinates of the other endpoint D?

The midpoint of Segment AB is M(4, -9). One endpoint is A(-3, -5). What are the coordinates of the other endpoint B?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

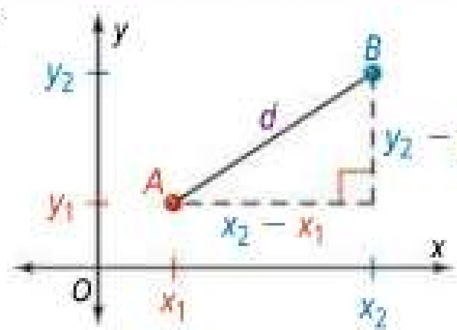
To find the distance between any two points in a coordinate plane, you can use the **Distance Formula.**

take note

Key Concept Distance Formula

The distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is

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



Do you remember any other way to find the distance between to coordinate points in a plane?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Problem 3:

What is the distance between U(-7, 5) and V(4, -3)? Round to the nearest tenth.

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Problem 3:

Segment SR has endpoints S(-2, 14) and R(3, -1). What is SR to the nearest tenth?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Lesson Check

Do you know HOW?

1. $\overline{RS}$ has endpoints $R(2, 4)$ and $S(-1, 7)$. What are the coordinates of its midpoint M?

2. The midpoint of $\overline{BC}$ is $(5, -2)$. One endpoint is $B(3, 4)$. What are the coordinates of endpoint C?

3. What is the distance between points $K(-9, 8)$ and $L(-6, 0)$?

Section 1.7 – Midpoint and Distance in the Coordinate Plane

Lesson Check

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. Reasoning How does the Distance Formula ensure that the distance between two different points is positive?

5. Error Analysis Your friend calculates the distance between points $Q(1, 5)$ and $R(3, 8)$. What is his error?

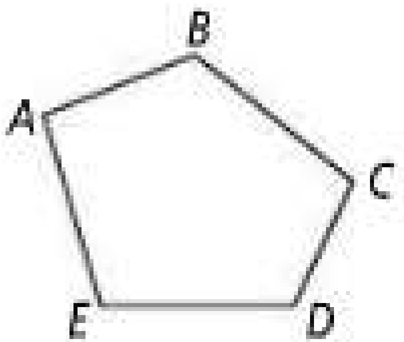
$$d = \sqrt{(1-8)^2 + (5-3)^2}$$
$$= \sqrt{(-7)^2 + 2^2}$$
$$= \sqrt{49 + 4}$$
$$= \sqrt{53} \approx 7.3$$

Classifying Polygons

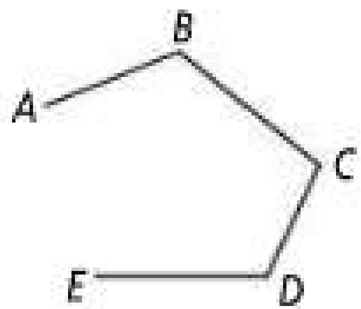
In geometry, a figure that lies in a plane is called a **plane figure**.

A **polygon** is a closed plane figure formed by three or more segments. Each segment intersects exactly two other segments at their endpoints. No two segments with a a common endpoint or collinear. Each segment is called a side. Each endpoint is called a vertex.

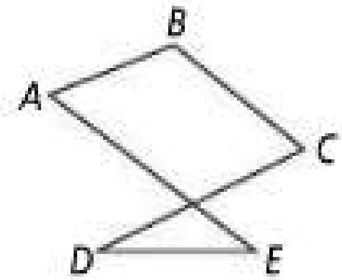
Classifying Polygons



A polygon



Not a polygon;
not a closed figure

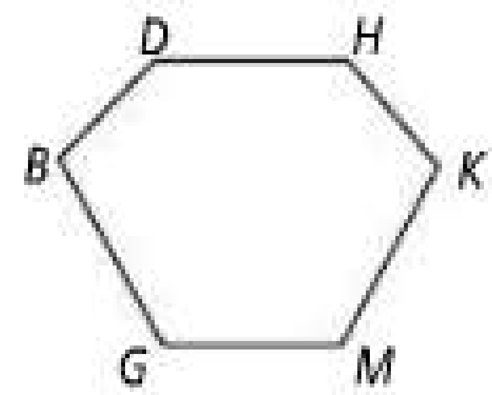


Not a polygon;
two sides intersect
between endpoints.

Classifying Polygons

To name a polygon, start at any vertex and list the vertices consecutively in a clockwise or counterclockwise direction.

Two names for this polygon are DHKMGB and MKHDBG.



Classifying Polygons

You can classify a polygon by its number of sides. The tables below show the names of some common polygons.

Names of Common Polygons

Sides	Name
3	Triangle, or trigon
4	Quadrilateral, or tetragon
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon

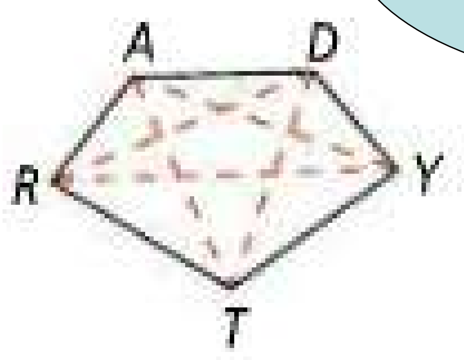
Sides	Name
9	Nonagon, or enneagon
10	Decagon
11	Hendecagon
12	Dodecagon
⋮	⋮
n	*n*-gon

Classifying Polygons

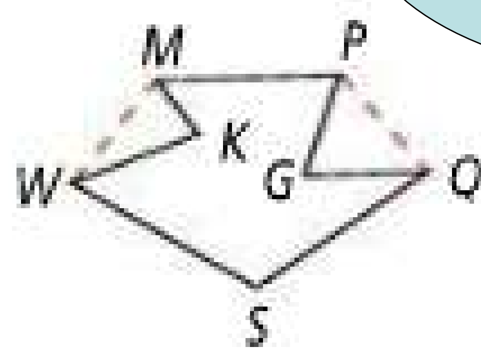
You can also classify a polygon as concave or convex, using the diagonals of the polygon.

A **diagonal** is a segment that connects two NONconsecutive vertices.

A **Convex** polygon has no diagonal with points outside of the polygon



A **Concave** polygon has at least one diagonal with points outside of the polygon

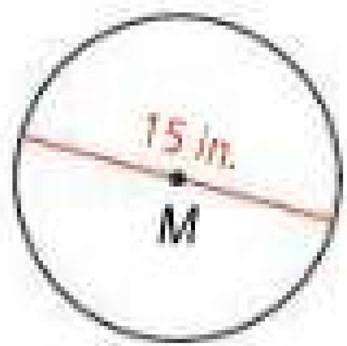


Section 1.8 – Perimeter, Circumference, and Area

Problem 2:

What is the circumference of the circle in terms of pi? What is the circumference of the circle to the nearest tenth?

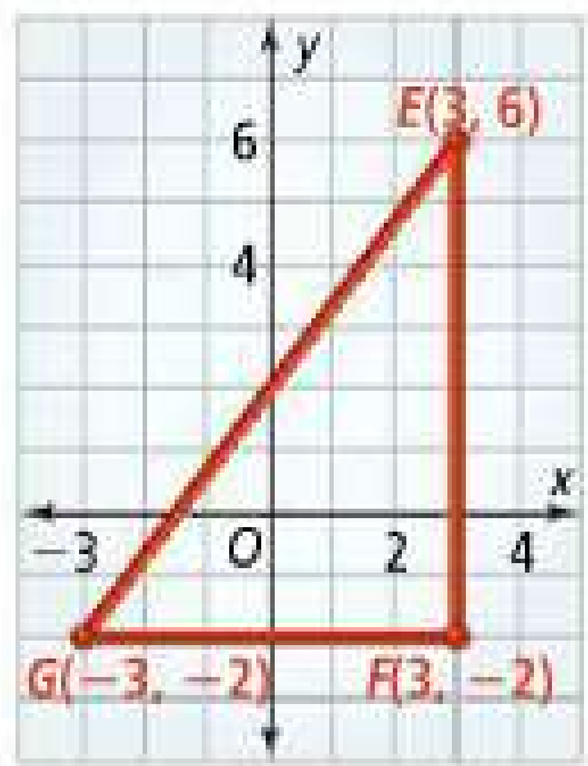
a. b.



Section 1.8 – Perimeter, Circumference, and Area

Problem 3:

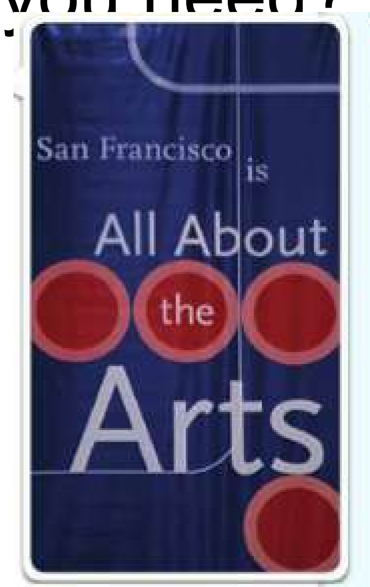
What is the perimeter of Triangle EFG?



Section 1.8 – Perimeter, Circumference, and Area

Problem 4:

You want to make a rectangular banner similar to the one at the right. The banner shown is 2.5 feet wide and 5 feet high. To the nearest square yard, how much material do you need?



Section 1.8 – Perimeter, Circumference, and Area

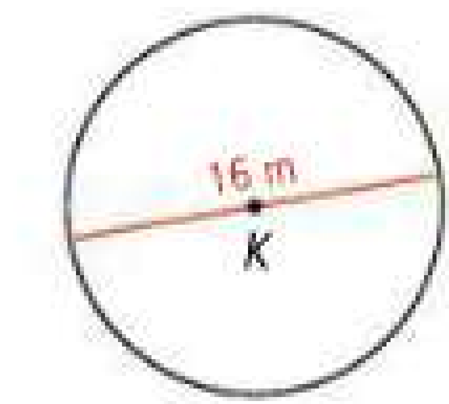
Problem 4:

You are designing a poster that will be 3 yard wide and 8 feet high. How much paper do you need to make the poster. Give your answer in square feet.

Section 1.8 – Perimeter, Circumference, and Area

Problem 5:

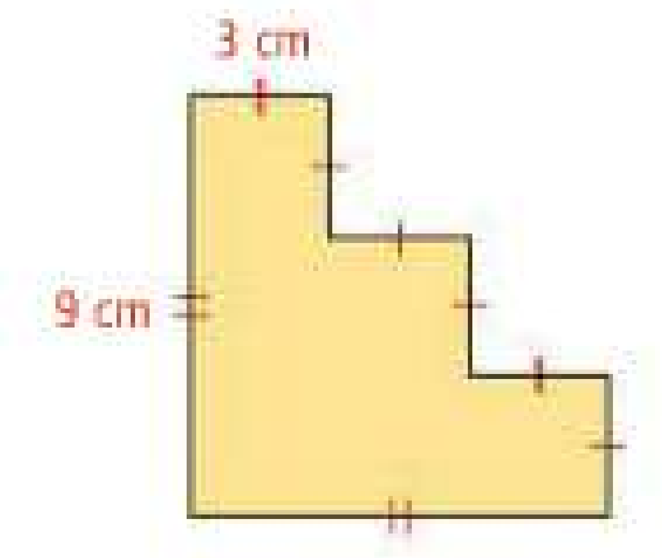
What is the area of Circle K in terms of pi? Then round your answer to the nearest hundredth.



Section 1.8 – Perimeter, Circumference, and Area

Problem 6:

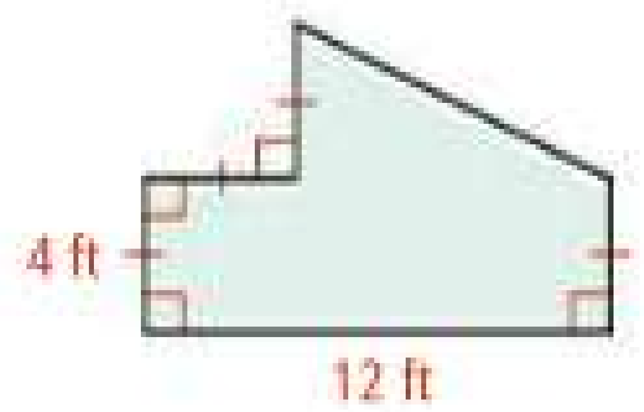
What is the area of the figure at the right?



Section 1.8 – Perimeter, Circumference, and Area

Problem 6:

What is the area of the figure at the right?



Section 1.8 – Perimeter, Circumference, and Area

Lesson Check

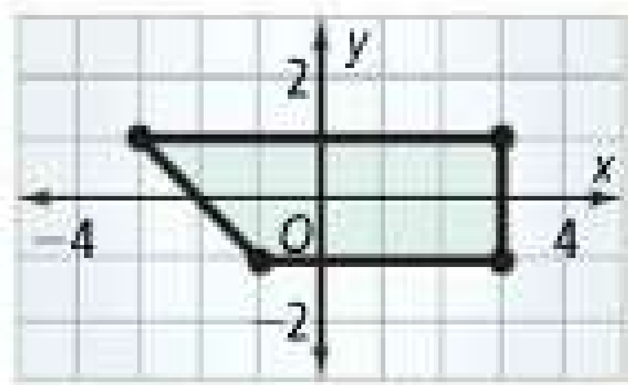
Do you know HOW?

1. What is the perimeter and area of a rectangle with base 3 in. and height 7 in.?

2. What is the circumference and area of each circle to the nearest tenth?

   a. $r = 9$ in. b. $d = 7.3$ m

3. What is the perimeter and area of the figure at the right?



Section 1.8 – Perimeter, Circumference, and Area

Lesson Check

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Writing** Describe a real-world situation in which you would need to find a perimeter. Then describe a situation in which you would need to find an area.

5. **Compare and Contrast** Your friend can't remember whether $2\pi r$ computes the circumference or the area of a circle. How would you help your friend? Explain.

6. **Error Analysis** A classmate finds the area of a circle with radius 30 in. to be 900 in.^{2}. What error did your classmate make?