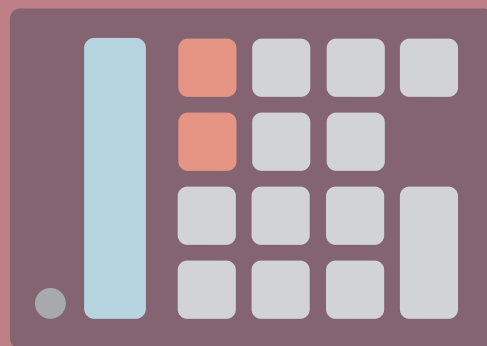




MATH

Student Book



► **5th Grade | Unit 9**

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MATH 509

GEOMETRY

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GEOMETRY

In this unit, you will be introduced to many geometry terms. You will learn about lines, rays, angles, and circles. You will learn about different polygons and their names. You will explore two types of polygons—triangles and quadrilaterals—more closely. You will find that there are several types of each figure, based on sides and angles. Then you will switch from two-dimensional figures to three-dimensional figures and explore different types of solid figures. You will discover that there are several attributes of solid figures in common with plane figures, such as vertices and sides. You will learn about prisms and pyramids, and cylinders, cones, and spheres. You will go back to two dimensions and learn about congruent and similar figures. You will explore these in the coordinate plane and find that plane figures can be moved in three ways and still be congruent. These transformations—translations, reflections, and rotations—all produce congruent figures. Finally, you will explore symmetry and find that some figures have line symmetry and/or rotational (point) symmetry. These types of symmetry are similar to reflections and rotations.

Objectives

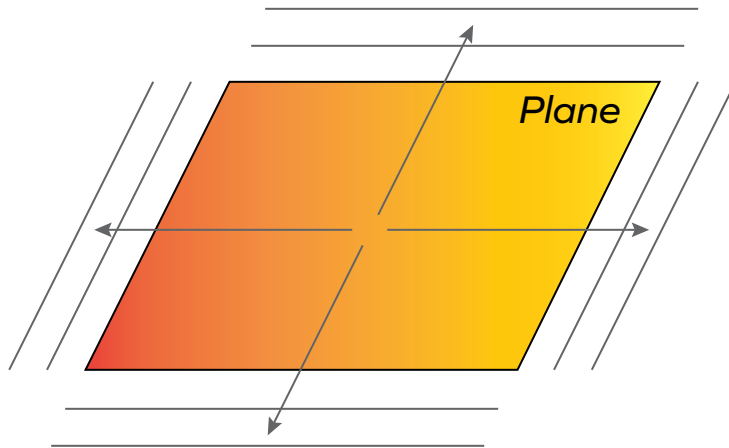
Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAAC. When you have finished this LIFEPAAC, you should be able to:

- Use geometry terms; identify parts of circles; measure and classify angles.
- Name and classify types of polygons.
- Name and classify solid figures; identify nets.
- Identify: similar and congruent figures, transformations, and symmetry.

1. GEOMETRY

Our study of geometry begins with two dimensions: length and width. Imagine a sheet of paper with no thickness, whose length and width go forever. This surface is called a **plane** in geometry. Everything that we will look at in this lesson will take place in the plane.

In this lesson, the terms and notation used in the study of two-dimensional geometry (often called plane geometry) will be introduced.



Objectives

Read these objectives. When you have completed this section, you should be able to:

- Use correct geometry terminology.
- Use definitions and correct notation to name.
- Describe angles using degrees.
- Measure angles using a protractor.
- Classify angles as right, acute, or obtuse.
- Estimate the measure of angles.
- Identify parts of a circle.

Vocabulary

Study these new words. Learning the meanings of these words is a good study habit and will improve your understanding of this LIFEPAK.

acute angle. An angle measuring less than 90° .

angle. Two rays with a common endpoint.

chord. A line segment that connects two points on a circle.

circle. A figure with all of its points the same distance from the center.

circumference. The distance around the outside of a circle.

degrees. The unit of angle measure.

diameter. A line segment that goes through the center of a circle to connect two points on the circle.

endpoint. A point that marks the end of a line segment or ray.

intersecting lines. Lines in the same plane that are not parallel.

line. An infinite set of points forming a straight path that continues in both directions.

line segment. A part of a line bounded by two endpoints.

obtuse angle. An angle measuring greater than 90° .

parallel lines. Lines in the same plane that do not intersect.

perpendicular lines. Lines that intersect and create right angles.

plane. A flat surface that continues in all directions.

point. A position in space.

protractor. A tool used to measure angles.

radius. A line segment from the center of a circle to any point on the circle.

ray. A part of a line that has one endpoint and continues in one direction.

right angle. An angle measuring 90° .

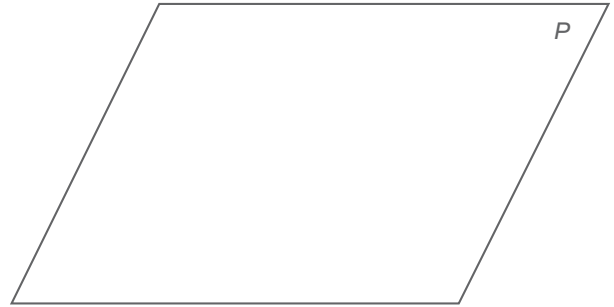
straight angle. An angle measuring 180° .

vertex. The point where two line segments, lines, or rays meet to form an angle.

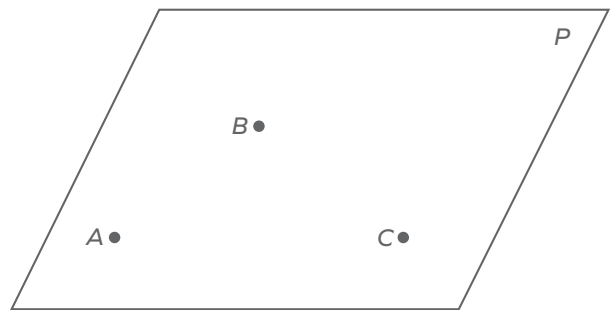
Note: All vocabulary words in this LIFEPAK appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

Geometry Terms

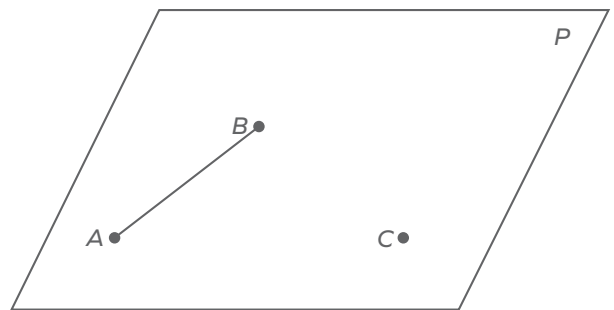
We'll begin our study of geometry by defining several terms and the notation used to identify them. A plane is identified by a capital letter, such as plane P :



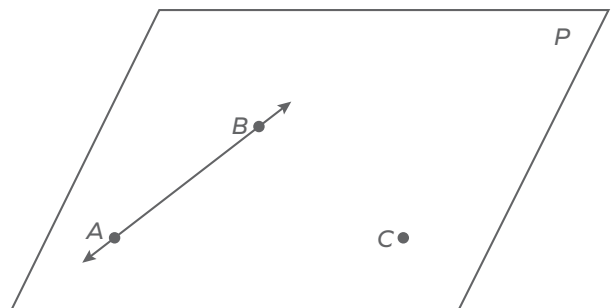
Any location in the plane is called a **point**. A point has no dimension or size. It is represented with a dot and named by a capital letter. In plane P we can see point A , point B , and point C .



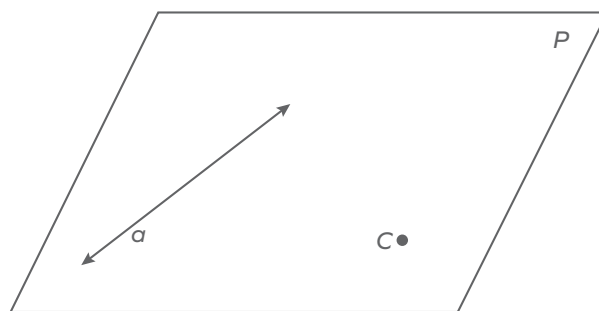
Two points in a plane that are connected form a **line segment**. The two points are called **endpoints** because each point is one end of the line segment. A line segment is identified by its endpoints, in either order, and is shown with a short line over the letters. In plane P , we can see \overline{AB} (or \overline{BA}).



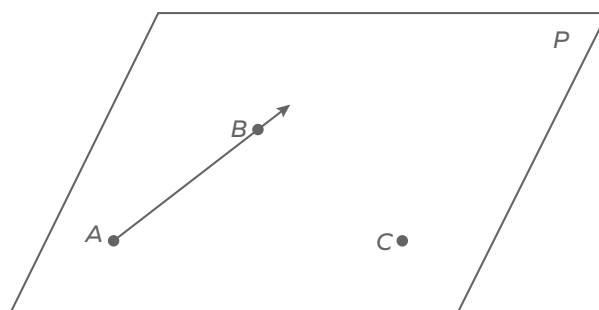
If the line segment keeps going in both directions, it is called a **line**. A line segment is actually a piece (or segment) of a line. A line is shown with arrows at both ends to indicate that it keeps going. It is identified the same as a line segment, but with a line with arrows above the letters. In plane P , we can see \overleftrightarrow{AB} (or \overleftrightarrow{BA}).



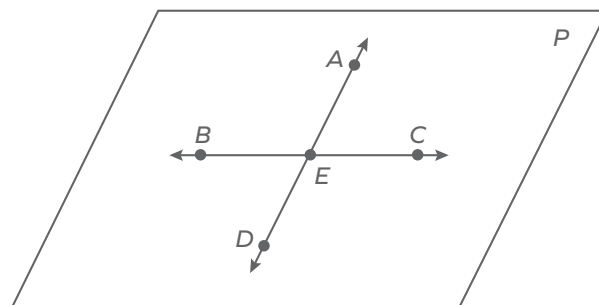
If there are no points to identify a line, it can be named by a single lowercase letter. In plane P , we can see line a .



If a line segment keeps going in only one direction, it is called a **ray**. A ray has one endpoint where the ray starts, and an arrow at the other end to indicate that it keeps going in that direction. It is identified the same way as a line segment, but with a ray above the letters and the endpoint shown first. In plane P , we can see \overrightarrow{AB} :



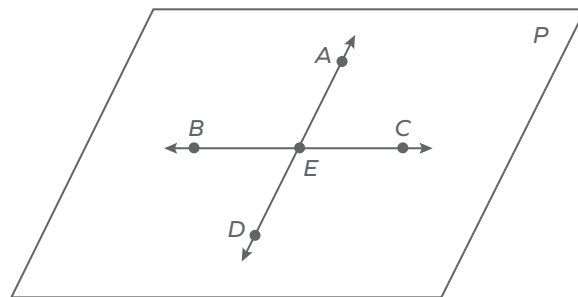
Two lines in the same plane that cross each other are called **intersecting lines**. The intersection will be a point and will create rays, line segments, and different ways to name the lines.



Using Definitions and Correct Notation to Name Terms

Example:

Identify line segments, lines, and rays in plane P .



Solution:

We will use the definitions to identify each term, and the correct notation to name them.

Line segments: Because any two connected points can be endpoints, there are lots of possibilities: \overline{BE} , \overline{EC} , \overline{DE} , \overline{AE} , \overline{BC} , and \overline{AD} .

Lines: Because all of the points shown in plane P are on lines, they can be used to name the lines. Any two points on a line will name it: \overleftrightarrow{BE} , \overleftrightarrow{EC} , and \overleftrightarrow{BC} all name the same line. \overleftrightarrow{DE} , \overleftrightarrow{AE} , and \overleftrightarrow{AD} name the other line.

Rays: Each point on either line can be the endpoint of a ray since the line continues in either direction: \overrightarrow{EA} , \overrightarrow{EB} , \overrightarrow{EC} , and \overrightarrow{ED} are all rays that have point E as the endpoint. There are several other rays, such as \overrightarrow{AD} and \overrightarrow{BC} .

Be careful!

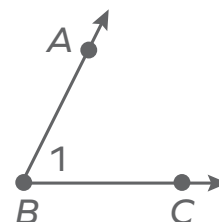
Although any two points in a plane can be the endpoints for a line segment, only connected points shown in the drawing can be named as line segments. So, points B and D do not define a line segment in this drawing.

Keep in mind...

Notice that \overrightarrow{AD} and \overrightarrow{DA} are not the same ray. They have different endpoints and move in opposite directions.

If two rays have a common endpoint, an **angle** is formed. The common endpoint is called the **vertex**. Whenever two lines intersect, angles are also formed. The symbol \angle is used to indicate an angle. Angles can be named three different ways:

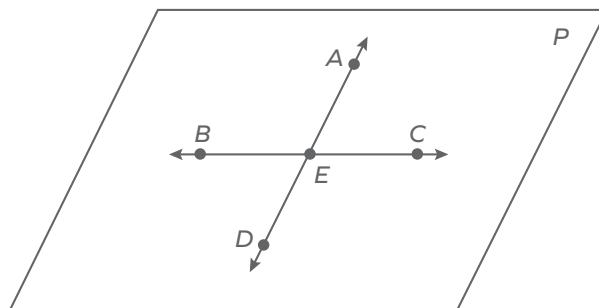
1. The angle can be named with three different points. The points, in order, are a point on one ray, the vertex, and a point on the other ray: $\angle ABC$ or $\angle CBA$.
2. The angle can be named with one point, using just the vertex, as long as it is the only angle in the drawing with that vertex: $\angle B$.
3. The angle can be named with a number. The number is written inside the two rays: $\angle 1$.



When two lines intersect, four angles are formed.

Example:

Name the four angles in plane P .



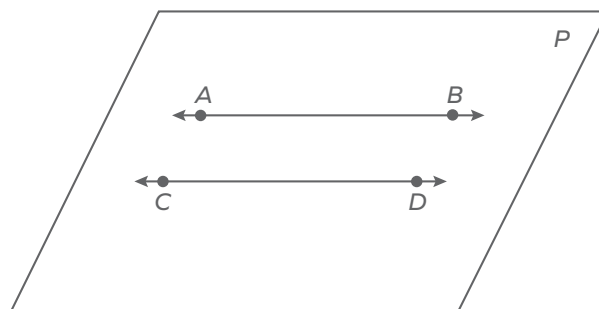
Solution:

Notice that the intersection point (point E) is the vertex of all four angles, so we can't name the angles with a single letter ($\angle E$).

There are no numbers to name the angles, so we will use three points to identify the angles, with the vertex, point E as the middle point: $\angle AEB$ (or $\angle BEA$), $\angle AEC$ (or $\angle CEA$), $\angle CED$ (or $\angle DEC$), and $\angle DEB$ (or $\angle BED$).

Two lines in the same plane will always intersect and form angles, unless they are parallel to each other. **Parallel lines** do not intersect. Two vertical lines (like this: $||$) are used to indicate parallel lines.

We would say line AB is parallel to line CD :
 $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$.



Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ All the terms introduced in the lesson are contained in a plane.
- ✓ Points define a position in the plane, as well as helping to name line segments, lines, rays, and angles.



Complete this activity.

1.1

Match the terms with their definitions.

- | | |
|-----------------------------|--|
| a. _____ angle | 1. a part of a line that has one endpoint and continues in one direction |
| b. _____ endpoint | 2. lines in the same plane that are not parallel |
| c. _____ intersecting lines | 3. an infinite set of points forming a straight path that continues in both directions |
| d. _____ line | 4. the point where two line segments, lines, or rays meet to form an angle |
| e. _____ line segment | 5. a point that marks the end of a line segment or ray |
| f. _____ parallel lines | 6. a position in space |
| g. _____ plane | 7. a part of a line bounded by two endpoints |
| h. _____ point | 8. a flat surface that continues in all directions |
| i. _____ ray | 9. lines in the same plane that do not intersect |
| j. _____ vertex | 10. two rays with a common endpoint |



1.2

Circle each correct letter and answer.

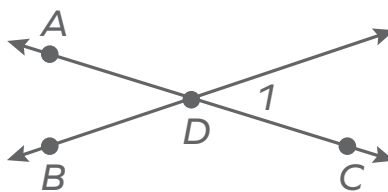
What dimensions does a plane use? (There may be more than one correct answer.)

- a. height b. length c. width d. depth

1.3

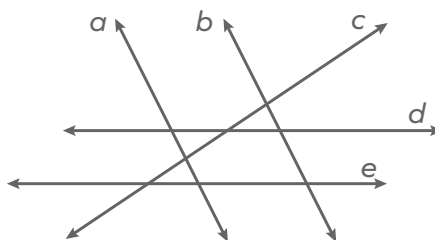
Which of the following angles are shown in this drawing? (There may be more than one correct answer.)

- a. $\angle ADB$
 b. $\angle D$
 c. $\angle CBD$
 d. $\angle 1$



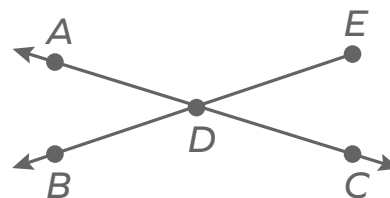
- 1.4** Which of the following lines are parallel? (There may be more than one correct answer.)

- a. line a and line b
- b. line b and line c
- c. line c and line d
- d. line d and line e



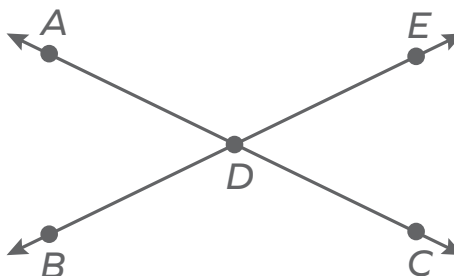
- 1.5** Which of the following points can be used to name a line segment, a line, and a ray? (There may be more than one correct answer.)

- a. point A and point C
- b. point D and point A
- c. point B and point C
- d. point E and point A



- 1.6** Which of the following are line segments shown in this drawing? (There may be more than one correct answer.)

- a. \overline{AD}
- b. \overline{AE}
- c. \overline{BE}
- d. \overline{DE}



- 1.7** Which of the following are rays shown in the drawing from Exercise 1.6? (There may be more than one correct answer.)

- a. \overrightarrow{AB}
- b. \overrightarrow{AC}
- c. \overrightarrow{BD}
- d. \overrightarrow{CD}

- 1.8** Which of the following are lines shown in the drawing from Exercise 1.6? (There may be more than one correct answer.)

- a. \overleftrightarrow{BC}
- b. \overleftrightarrow{DC}
- c. \overleftrightarrow{ED}
- d. \overleftrightarrow{DA}

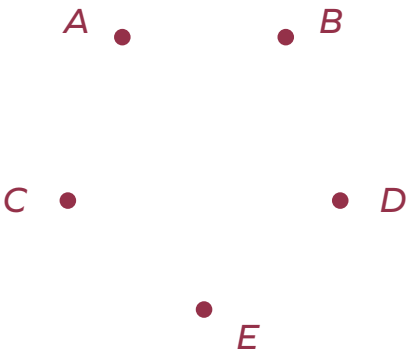
- 1.9** Which points are on the same line as point E , in the drawing from Exercise 1.6? (There may be more than one correct answer.)

- a. point A
- b. point B
- c. point C
- d. point D

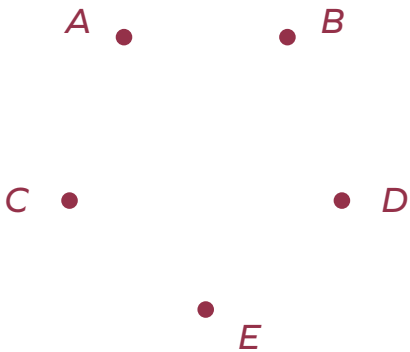


Correctly draw the line segment, line, or ray. Be sure to include arrows where necessary.

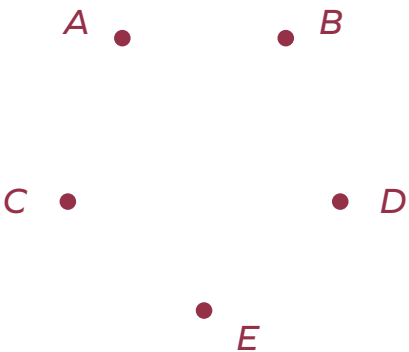
1.10 Draw \overrightarrow{AD} .



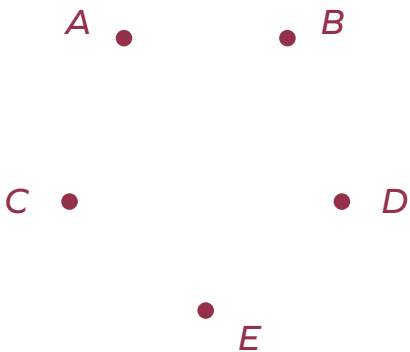
1.11 Draw \overleftrightarrow{CE} .



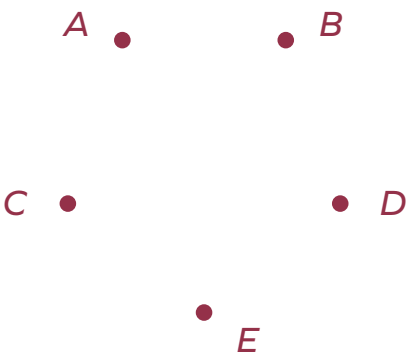
1.12 Draw \overline{BE} .



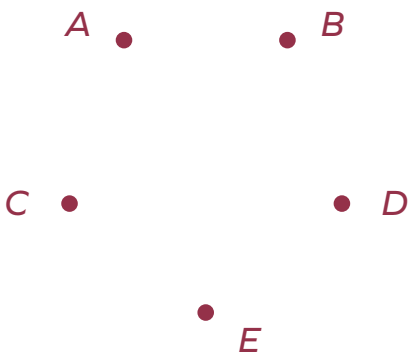
1.13 Draw \overrightarrow{AC} .



1.14 Draw \overleftrightarrow{BD} .



1.15 Draw \overline{AE} .



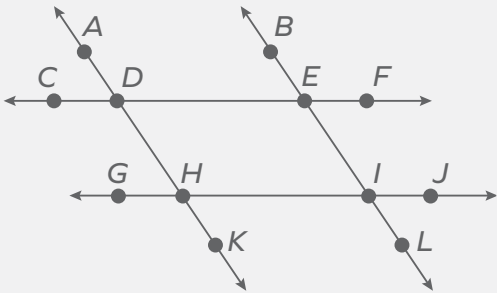
SELF TEST 1: GEOMETRY

Each numbered question = 6 points

Circle each correct letter and answer.

1.01 Which of the following line segments are shown in this diagram? (There may be more than one correct answer.)

- a. \overline{ED}
- b. \overline{EH}
- c. \overline{DH}
- d. \overline{CD}



1.02 Use the diagram from Question 1.01. Which of the following rays are shown? (There may be more than one correct answer.)

- a. \overrightarrow{CG}
- b. \overrightarrow{DH}
- c. \overrightarrow{BF}
- d. \overrightarrow{FE}
- e. \overrightarrow{BL}

1.03 Use the diagram from Question 1.01. Which of the following lines are shown? (There may be more than one correct answer.)

- a. \overleftrightarrow{BE}
- b. \overleftrightarrow{CJ}
- c. \overleftrightarrow{LI}
- d. \overleftrightarrow{FA}
- e. \overleftrightarrow{GJ}

1.04 Use the diagram from Question 1.01. Which lines shown are parallel? (There may be more than one correct answer.)

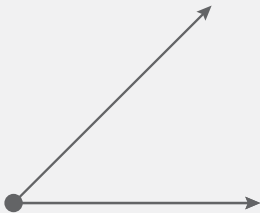
- a. \overleftrightarrow{EI} and \overleftrightarrow{EF}
- b. \overleftrightarrow{HK} and \overleftrightarrow{BE}
- c. \overleftrightarrow{CE} and \overleftrightarrow{HJ}
- d. \overleftrightarrow{AK} and \overleftrightarrow{GI}

1.05 Use the diagram from Question 1.01. Which of the following angles are shown? (There may be more than one correct answer.)

- a. $\angle ADG$
- b. $\angle CEL$
- c. $\angle LIJ$
- d. $\angle BDE$

1.06 What type of angle is shown here?

- a. obtuse
- b. acute
- c. straight
- d. right

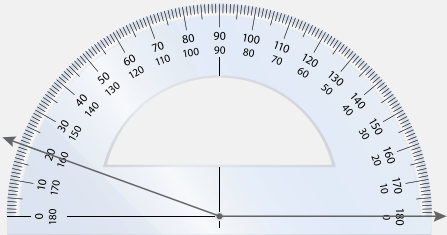


1.07 Estimate the measure of the angle from Question 1.06.

- a. 25°
- b. 45°
- c. 85°
- d. 135°

1.08 What is the measure of angle shown here?

- a. 20°
- b. 60°
- c. 120°
- d. 160°



1.09 Which angle measure is the measure of an obtuse angle?

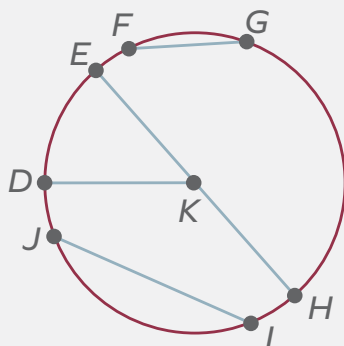
- a. 15° b. 90° c. 125° d. 85°

1.010 You measure an obtuse angle and one ray of the angle points at 120° and 60° . The angle measures 60° .

- a. true b. false

1.011 Which line segment(s) is/are a radius of $\odot K$? (There may be more than one correct answer.)

- a. \overline{DK}
b. \overline{FG}
c. \overline{EH}
d. \overline{KH}



1.012 Use the diagram from Question 1.011. Which line segment(s) is/are a chord of $\odot K$? (There may be more than one correct answer.)

- a. \overline{FG} b. \overline{DK} c. \overline{IJ} d. \overline{HE}

1.013 Use the diagram from Question 1.011. Which line segment is a diameter of $\odot K$?

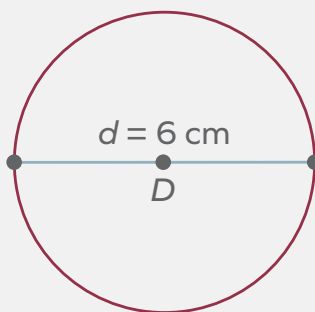
- a. \overline{GF} b. \overline{IF} c. \overline{EK} d. \overline{EH}

1.014 Which circle will have the largest radius?

- a. $\odot A$, $C = 16$ cm b. $\odot B$, $C = 18$ cm
c. $\odot C$, $r = 21$ cm d. $\odot D$, $r = 20$ cm

1.015 What is the radius of $\odot D$?

- a. 3 cm
b. 6 cm
c. 12 cm
d. 24 cm

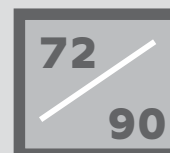


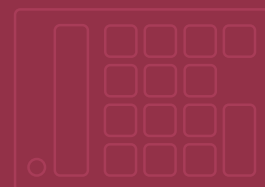
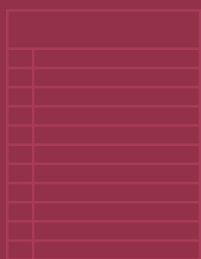
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