In this lesson you will

- Learn about **points, lines, and planes** and how to represent them
- Learn definitions of **collinear, coplanar, line segment, congruent segments, midpoint, and ray**
- Learn **geometric notation** for lines, line segments, rays, and congruence

**Points, lines, and planes** are the building blocks of geometry. Read about these three concepts on page 28 of your book.

A **definition** is a statement that explains the meaning of a word or phrase. It is impossible to define **point, line, and plane** without using other words that need to be defined. For this reason, these terms remain undefined. Using these three undefined terms, you can define all other geometric figures and terms.

Keep a list of definitions in your notebook. Each time you encounter a new geometric definition, add it to your list. Illustrate each definition with a sketch. Begin your list with the definitions of **collinear, coplanar, and line segment** given on pages 29–30 of your book.

Make sure you understand the two ways to express the length of a segment. For example, to express the fact that the length of segment $FG$ is 12 units, you can write either $FG = 12$ or $mFG = 12$.

Two segments with equal measures, or lengths, are said to be **congruent**. The symbol for congruence is $\equiv$. It is important to remember that the equals symbol, $=$, is used between equal numbers or measures, while the congruence symbol, $\equiv$, is used between congruent figures.

In geometric drawings, congruent segments are marked with identical symbols. In the figure at right, $\overline{AB}$ is congruent to $\overline{DC}$. You can indicate that these segments have the same length in any of the following ways: $\overline{AB} \equiv \overline{DC}$, $\overline{AB} = \overline{DC}$, $m\overline{AB} = m\overline{DC}$.

The **midpoint** of a segment is a point that divides the segment into two congruent segments. Work through the example in your book, which gives you practice identifying midpoints and congruent segments and using geometric notation. Below is another example.

**EXAMPLE**

Study the diagrams at right.

a. Name each midpoint and the segment it bisects.

b. Name all the congruent segments. Use the congruence symbol to write your answer.

**Solution**

a. $P$ is the midpoint of both $\overline{AB}$ and $\overline{CD}$. $Q$ is the midpoint of $\overline{GH}$.

b. $AP \equiv PB$, $CP \equiv PD$, $GQ \equiv QH$
Lesson 1.1 • Building Blocks of Geometry (continued)

A ray is a part of a line that begins at a point and extends infinitely in one direction. A ray is named with two letters. The first letter is the endpoint, and the second letter is any other point on the ray. So ray $AB$, abbreviated $\overrightarrow{AB}$, is the part of line $AB$ that contains point $A$ and all the points on $\overline{AB}$ that are on the same side of point $A$ as point $B$.

Now look back through Lesson 1.1 in your book and make sure you have recorded all the new definitions in your notebook.

Investigation: Mathematical Models

In your book, use the photograph and the figure at the beginning of the investigation to identify examples of real-world and mathematical models for each of the following terms: point, line, plane, line segment, congruent segments, midpoint of a segment, and ray. For example, a line segment can be modeled by the top edge of a window in the photograph, and a point is modeled by the dot labeled $A$ in the figure.

Now explain in your own words what each of these terms means.
In this lesson you will

- Learn about angles and how to measure them
- Identify congruent angles and angle bisectors
- Use your knowledge of angles to solve problems involving pool

An angle is two rays with a common endpoint, provided the two rays do not lie on the same line. The two rays are the sides of the angle, and the common endpoint is the vertex. In your book, read the text before Example A, which explains how to name angles. Then work through Example A.

The measure of an angle is the smallest amount of rotation about the vertex from one ray to the other. The reflex measure of an angle is the largest amount of rotation less than 360° between the two rays. In this course, angles are measured in degrees. Read the text about angle measures in your book, paying close attention to the instructions for using a protractor. Then use your protractor to measure the angles in Example B.

Two angles are congruent if and only if they have equal measures. A ray is the angle bisector if it contains the vertex and divides the angle into two congruent angles. In the diagram at right, FH bisects ∠EFG, so ∠EFH ≅ ∠GFH. Identical markings are used to show that two angles are congruent.

Work through Example C in your book. Here is another example.

**EXAMPLE** Look for angle bisectors and congruent angles in the diagrams below.

a. Name each angle bisector and the angle it bisects.

b. Name all the congruent angles.

**Solution**

a. US bisects ∠RUT. UR bisects ∠QUS.

b. ∠SUT ≅ ∠RUS ≅ ∠QUR and ∠QUS ≅ ∠RUT

(continued)
Lesson 1.2 • Poolroom Math (continued)

Investigation: Virtual Pool

Billiards, or pool, is a game of angles. Read about incoming angles and outgoing angles in your book.

Look at the diagram of the pool table on page 42 of your book. Imagine that the ball is shot toward point C. The incoming angle is $\angle 1$. Use your protractor to find the measure of $\angle 1$.

The measure of the outgoing angle must equal the measure of the incoming angle. Measure $\angle BCP$ and $\angle ACP$. Which of these angles is the outgoing angle? Which point will the ball hit, point A or point B?

Now imagine you want to hit the ball against cushion $\overline{WA}$ so that the ball bounces off and hits the 8-ball. Which point—W, X, or Y—should you hit? One way to find the answer is to measure each possible incoming angle and then check whether the ray for the congruent outgoing angle passes through the 8-ball.

Now think about how you would have to hit the ball against cushion $\overline{CP}$ so that it would bounce back and pass over its starting point. If you don’t know, try experimenting with several different incoming angles. Each time, think about how you can adjust the angle to make the ball pass closer to its starting point.

Suppose you want to hit the ball so that it bounces off the cushions at least three times but never touches cushion $\overline{CP}$. Again, if you don’t know, experiment. Try different incoming angles and different cushions until you start to see a pattern.
In this lesson you will

- Learn how to write a good definition
- Write definitions for geometric terms
- Test definitions by looking for counterexamples

In geometry, it is very important to be able to write clear, precise definitions. The text on page 47 of your book discusses how to write a good definition. Read this text carefully. Then work through Example A. Here is another example.

**EXAMPLE A**

Consider this “definition” of rectangle: “A rectangle is a figure with two pairs of congruent sides.”

a. Sketch a counterexample. That is, sketch a figure with two pairs of congruent sides that is not a rectangle.

b. Write a better definition for rectangle.

**Solution**

a. Here are two counterexamples.

b. One better definition is “A rectangle is a 4-sided figure in which opposite sides are congruent and all angles measure 90°.”

Read the “Beginning Steps to Creating a Good Definition” in your book, and make sure you understand them. Look at the symbols for parallel, perpendicular, and 90°. Now work through Example B, which asks you to write definitions for parallel lines and perpendicular lines.

**Investigation: Defining Angles**

In this investigation you will write definitions for some important terms related to angles.

On page 49 of your book, look at the examples of right angles and of angles that are not right angles. What do the right angles have in common? What characteristics do the right angles have that the other angles do not have? You should notice that all the right angles measure 90°. The angles in the other group have measures less than or greater than 90°. Based on this information, you could write the following definition for right angle.

A right angle is an angle that measures 90°.

(continued)
Lesson 1.3 • What’s a Widget? (continued)

Now look at the acute angles and the angles that are not acute. Try to use the examples to write a definition for acute angle. When you have written your definition, test it by trying to come up with a counterexample. When you are satisfied with your definition, look at the next set of examples, and write a definition for obtuse angle.

The remaining sets of examples show angle pairs. Look at the pairs of vertical angles and the pairs of angles that are not vertical angles. What do you notice? You should see that each pair of vertical angles is formed by two intersecting lines. You might start with the following definition.

Two angles are a pair of vertical angles if they are formed by two intersecting lines.

However, \( \angle 1 \) and \( \angle 2 \) in the “not pairs of vertical angles” group are also formed by two intersecting lines. What makes the angle pairs in the “vertical angles” group different from this pair? When you know the answer, try completing this definition.

Two angles are a pair of vertical angles if they are formed by two intersecting lines and ________________.

Now look at the linear pairs of angles and the pairs of angles that are not linear pairs. Write a definition for linear pair of angles. Be sure to test your definition by looking for a counterexample. Here is one possible definition. You may have written a different definition.

Two angles are a linear pair of angles if they share a side and their other sides form a straight line.

Repeat this process to define pair of complementary angles and pair of supplementary angles. Think carefully about the difference between a supplementary pair and a linear pair. Make sure your definitions account for the difference.

A labeled figure can often be helpful when writing a geometric definition. Work through Example C in your book. Here is another example.

**EXAMPLE B**

Use a labeled figure to define a vertical pair of angles.

**Solution** \( \angle AOC \) and \( \angle BOD \) are a pair of vertical angles if \( \overline{AB} \) and \( \overline{CD} \) intersect at point \( O \), and point \( O \) is between points \( A \) and \( B \) and also between points \( C \) and \( D \).

In the definition, is it necessary to state that point \( O \) is between the other two points on each line? Sketch a counterexample that shows why this part of the definition is necessary.

Add definitions for all the new terms in this lesson to your definition list. Be sure to include a sketch with each definition.
In this lesson you will

- Learn the definition of **polygon**
- Learn the meaning of terms associated with polygons, such as **concave**, **convex**, **equilateral**, **equiangular**, and **regular**
- Identify **congruent polygons**

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

Look closely at the examples of “polygons” and “not polygons” on page 54 of your book. Check that each figure in the “polygons” group fits the definition. Then try to explain why each figure in the “not polygons” group is not a polygon.

Each line segment in a polygon is a **side** of a polygon. Each endpoint where the sides meet is a **vertex** of the polygon.

Polygons are classified by the number of sides they have. The chart on page 54 of your book gives the names of polygons with different numbers of sides.

You name a polygon by listing the vertices in consecutive order. It does not matter which vertex you start with. For example, you could name this polygon quadrilateral **PQRS** or **RQPS**, but not **PRQS**. When you name a triangle, you can use the △ symbol. For example, △**XYZ** means triangle **XYZ**.

A **diagonal** of a polygon is a line segment that connects two **nonconsecutive** vertices. A polygon is **convex** if no diagonal is outside the polygon. A polygon is **concave** if at least one diagonal is outside the polygon. See page 54 of your book for more examples of convex and concave polygons.

Two polygons are **congruent polygons** if and only if they are exactly the same size and shape. If two polygons are congruent, then their corresponding angles and sides are congruent. For example, triangle **ABC** is congruent to triangle **EFG**, so their three pairs of corresponding angles and three pairs of corresponding sides are also congruent.

\[ \angle A \cong \angle E \quad \angle B \cong \angle F \quad \angle C \cong \angle G \]
\[ AB \cong EF \quad BC \cong FG \quad CA \cong GE \]

When you write a statement of congruence, always write the letters of the corresponding vertices in an order that shows the correspondence. For example, when referring to the triangles at right, the statements △**ABC** \( \cong \) △**EFG** and △**CAB** \( \cong \) △**GEF** are correct, but △**ABC** \( \cong \) △**FEG** is incorrect.
Lesson 1.4 • Polygons (continued)

**EXAMPLE**

Which polygon is congruent to $TUVW$?

![Diagram of polygons](image)

**Solution**

Polygon $TUVW \cong$ polygon $BCDA$. You could also say $TUVW \cong ADCB$.

The **perimeter** of a polygon is the sum of the lengths of its sides. The perimeter of the polygon at right is 28 cm.

**Investigation: Special Polygons**

In this investigation you will write definitions for three special polygons.

In your book, look at the polygons that are equilateral and the polygons that are not equilateral. What characteristics do the equilateral polygons have that the other polygons don’t have? You should notice that in each equilateral polygon all sides have equal length, whereas in a polygon that is not equilateral, not all sides have equal length. From this observation you could write the following definition:

An equilateral polygon is a polygon in which all sides have equal length.

Now look at the polygons that are equiangular and the polygons that are not equiangular. Use the examples to write a definition of **equiangular polygon**.

Finally, look at the polygons that are regular polygons and the ones that are not regular polygons. Decide which characteristics separate the polygons into the two groups and write a definition of **regular polygon**. Your definition might be in this form:

A regular polygon is a polygon that is both _________ and ___________.

Add definitions for all the new terms in this lesson to your definition list. Be sure to include a sketch with each definition.
In this lesson you will

- Learn how to interpret geometric diagrams
- Write definitions for types of triangles

When you look at a geometric diagram, you must be careful not to assume too much from it. For example, you should not assume that two segments that appear to be the same length actually are the same length, unless they are marked as congruent.

You may assume

- that lines are straight and if two lines intersect they intersect at one point.
- that all points on a line are collinear and all points on a diagram are coplanar unless planes are drawn to show they are noncoplanar.

You may not assume

- that lines are parallel unless they are marked as parallel.
- that lines are perpendicular unless they are marked as perpendicular.
- that pairs of angles, segments, or polygons are congruent unless they are marked with information that tells you they are congruent.

**EXAMPLE**

In the figure below, which pairs of lines are parallel? Which pairs of lines are perpendicular? Which pairs of triangles are congruent?

![Diagram of lines and triangles](image)

**Solution**

Lines $IJ$ and $EG$ are parallel. Lines $BF$ and $AC$ are perpendicular. Triangles $IDE$ and $KHG$ are congruent.

(continued)
Lesson 1.5 • Triangles (continued)

Investigation: Triangles

In this investigation, you will write definitions for types of triangles.

In your book, look at the right triangles and the figures that are not right triangles. What do the right triangles have in common? What characteristics do the right triangles have that the other triangles do not have? You should notice that all the right triangles have a right angle (an angle that measures 90°). None of the other triangles have a right angle. Based on this information, you could write the following definition for a right triangle.

A right triangle is a triangle with one right angle.

Now, look at the acute triangles and the triangles that are not acute.

Use the examples to write a definition for acute triangle. When you have written your definition, test it by trying to come up with a counterexample. When you are satisfied with your definition, look at the next set of examples, and write a definition for obtuse triangle.

Look back at your definitions of right triangle, acute triangle, and obtuse triangle. If you have written correct definitions, any triangle you are given will fit one and only one of these definitions. Check that each triangle below fits one and only one of your definitions. If not, go back and refine your definitions.

In an isosceles triangle, the angle between the two sides of equal length is called the vertex angle. The side opposite the vertex angle is called the base of the isosceles triangle. The two angles opposite the two sides of equal length are called base angles of the isosceles triangle.

Add the definition for each type of triangle to your definition list. Be sure to include a labeled drawing with each definition.
In this lesson you will

- Write definitions for special types of quadrilaterals

All of the quadrilaterals in this lesson can be made by attaching two congruent triangles along a corresponding side. Depending on the type of triangles you join, the quadrilaterals have different properties. In the following investigation you will define different types of special quadrilaterals based on relationships of their sides and angles.

Investigation: Special Quadrilaterals

On page 64 of your book, look at the figures that are trapezoids and the figures that are not trapezoids. What differentiates the trapezoids from the nontrapezoids? Each trapezoid is a figure with a pair of parallel sides. So, you might start with this definition.

A trapezoid is a figure with a pair of parallel sides.

However, two of the figures in the “not trapezoids” group also have a pair of parallel sides. One of these figures has two pairs of parallel sides, while all the trapezoids have only one pair. So, you could refine the definition like this.

A trapezoid is a figure with exactly one pair of parallel sides.

This definition is better, but one of the nontrapezoids satisfies it. Notice, though, that this nontrapezoid has five sides, while each trapezoid has four sides. You can refine the definition once again.

A trapezoid is a quadrilateral with exactly one pair of parallel sides.

This definition fits all the trapezoids and none of the nontrapezoids.

Now write definitions for the next two terms, kite and parallelogram. Note that these figures have some things in common, but there are also important differences between them. Make sure your definitions account for these differences.

Move on to write definitions for rhombus, rectangle, and square. There are several correct definitions for each of these terms. Once you define a term, you can use it in the definition for another term. For example, a rhombus is a special type of parallelogram, so your definition might be in this form.

A rhombus is a parallelogram with ________________.

A square is a special type of rhombus and a special type of rectangle, so your definition might be in one of the following forms.

A square is a rhombus with ________________.

A square is a rectangle with ________________.

Here is another possible definition.

A square is a rhombus that is also a rectangle.

(continued)
Lesson 1.6 • Special Quadrilaterals (continued)

Add the definition for each type of quadrilateral to your definition list. Be sure to include a labeled drawing with each definition.

**EXAMPLE**

Look carefully at the quadrilaterals. Classify each figure as a trapezoid, kite, rhombus, rectangle, or square. Explain your thinking.

**Solution**

Quadrilateral $ABCD$ is a kite because two pairs of adjacent sides are congruent. Quadrilateral $EFGH$ is a trapezoid because it has only one pair of parallel sides. Quadrilateral $IJKL$ is a rhombus because it is a parallelogram and all of its sides have equal length. Quadrilateral $MNOP$ is a rectangle because it is a parallelogram and all of its angles have equal measures.
In this lesson you will

- Learn the definition of circle
- Write definitions for chord, diameter, and tangent
- Learn about three types of arcs and how they are measured

A circle is the set of all points in a plane that are a given distance from a given point. The given distance is called the radius and the given point is called the center. The word radius is also used to refer to a segment from the center to a point on the circle. You name a circle by its center. The circle below is circle \( P \).

![Diagram of a circle with center \( P \) and radius](image)

The diameter of a circle is a line segment containing the center, with its endpoints on the circle. The word diameter is also used to refer to the length of this segment.

![Diagram of a circle with diameter](image)

**Investigation: Defining Circle Terms**

In this investigation you will write definitions for terms associated with circles.

In your book, look at the examples of chords and nonchords. What do the chords have in common? What characteristics do the chords have that the nonchords do not? For example, the chords are all segments, and each chord has two points on the circle. One of the nonchords, namely \( RS \), also has these properties. However, each chord has both endpoints on the circle, while \( RS \) has only one of its endpoints on the circle. Using these observations, you could write this definition.

A chord of a circle is a segment with both of its endpoints on the circle.

Now study the examples of diameters and nondiameters. Use your observations to write a definition for diameter. Because you have already defined chord, you can use this term in your definition. Your definition might be in one of the following forms.

A diameter of a circle is a segment that ____________.

A diameter of a circle is a chord that ____________.

Finally, study the examples of tangents and nontangents, and use your observations to define tangent. Be sure to check your definition by looking...
Lesson 1.7 • Circles (continued)

for a counterexample. Note that the point where the tangent touches the circle is called the point of tangency.

Look at the questions in Steps 2 and 3 in your book. Make sure you can answer these questions. Think about the definitions you wrote in Step 1 and how they are similar and different.

Congruent circles are circles with the same radius. Concentric circles are circles in the same plane with the same center.

An arc of a circle is two points on the circle and the continuous (unbroken) part of the circle between the two points. Arcs can be classified into three types. A semicircle is an arc of a circle whose endpoints are on a diameter. A minor arc is an arc that is smaller than a semicircle. A major arc is an arc that is larger than a semicircle. You name a minor arc with the letters of its endpoints. You name semicircles and major arcs with the letters of three points—the first and last letters are the endpoints, and the middle letter is any other point on the arc. See the diagram on page 71 of your book for examples of each type of arc.

Arcs are measured in degrees. A full circle has an arc measure of 360°, a semicircle has an arc measure of 180°, and so on. The measure of a minor arc is equal to the measure of the central angle associated with the arc. The central angle is the angle with its vertex at the center of the circle and its sides passing through the endpoints of the arc.

Add definitions for all the new terms in this lesson to your definition list. Be sure to include a labeled drawing with each definition.
In this lesson you will

- Learn the mathematical definition of space
- Learn the names of common three-dimensional objects and how to draw them
- Solve problems that require you to visualize objects in space

The work you have done so far has involved objects in a single plane. In this lesson you will need to visualize objects in three dimensions, or space. Read about space on page 75 of your book.

In geometry, it is important to be able to recognize three-dimensional objects from two-dimensional drawings, and to create drawings that represent three-dimensional objects. Pages 75-77 in your book show examples of common three-dimensional objects and give tips for drawing these objects. Read this text carefully and practice drawing the objects.

Investigation: Space Geometry

In this investigation you need to decide whether statements about geometric objects are true or false. You can make sketches or use physical objects to help you visualize each statement. For example, you might use a sheet of paper to represent a plane and a pencil to represent a line. In each case, try to find a counterexample to the statement. If you find one, the statement must be false. If a statement is false, draw a picture and explain why it is false.

Below are some suggestions for visualizing the situations described in the statements. Try to determine whether each statement is true or false on your own before you read the suggestion.

1. For any two points, there is exactly one line that can be drawn through them.
   Draw two points on a sheet of paper and draw a line through them. Is there a way to draw another straight line through the points? Remember that you are not limited to the surface of the paper.

2. For any line and a point not on the line, there is exactly one plane that contains them.
   Draw a dot on a sheet of paper to represent the point, and use a pencil to represent the line. Hold the pencil above the paper and imagine a plane passing through both the point and the line.
Lesson 1.8 • Space Geometry (continued)

Without moving the point or the line, try to imagine a different plane passing through them. Can you do it? Change the position of the pencil and the paper so that they represent a different point and line. Can you imagine more than one plane passing through them? Experiment until you think you know whether the statement is true or false.

3. For any two lines, there is exactly one plane that contains them.

There are three situations that you must consider: intersecting lines, parallel lines, and skew lines.

![Diagram of intersecting, parallel, and skew lines]

First, look at the intersecting lines. They are drawn on a sheet of paper, which can represent a plane containing the lines. Try to imagine a different plane that also contains both lines. Can you do it?

Next, study the parallel lines contained in the plane of the sheet of paper. Can a different plane contain both parallel lines? Finally, look at the third pair of lines, which are skew lines, or lines that are not parallel and do not intersect. Can you imagine a sheet of paper that will contain these lines?

4. If two coplanar lines are both perpendicular to a third line in the same plane, then the two lines are parallel.

Notice that all the lines mentioned in this statement are in the same plane. You can use a sheet of paper to represent the plane. On the paper, draw a line and then draw two lines that are each perpendicular to the line. Are the two lines parallel? Make more sketches if you need to.

5. If two planes do not intersect, then they are parallel.

Use two sheets of paper or cardboard to represent the planes. You’ll need to picture the sheets extending forever. Can you arrange the planes so that they will never intersect but so they are not parallel?

6. If two lines do not intersect, then they are parallel.

You know that if lines in the same plane do not intersect, then they must be parallel. But what if the lines are in different planes? You can use two pencils to represent two lines. See if you can position the lines so that they will not intersect and are not parallel.

7. If a line is perpendicular to two lines in a plane, but the line is not contained in the plane, then the line is perpendicular to the plane.

You can use a sheet of paper to represent the plane. Draw two lines on the paper to represent the two lines in the plane. The third line is not contained in the plane. Represent this line with a pencil. Hold the pencil so that it is perpendicular to both of the lines in the plane. (Note: In order for you to do this, the lines in the plane must intersect.) Is the pencil perpendicular to the plane? Experiment until you are convinced you know whether the statement is true or false.
In this lesson you will

- Solve problems that require visual thinking
- Draw diagrams to help you solve problems

When you are solving a problem that requires you to visualize something, it often helps to draw a diagram. In the examples in this lesson, you will apply your visualization skills to solve problems. Work through all the examples in your book, using diagrams to help you find the solutions. Below are some additional examples. Try to solve each problem yourself before looking at the solution.

**EXAMPLE A**

Five friends rode in a 50-mile bike race. Sue finished 25 minutes after Ana. Ana finished 40 minutes before Mel. Mel finished 25 minutes after Jing. Rosi finished 20 minutes before Jing. If Ana finished at 1:30 P.M., what time did each of the other girls finish?

**Solution**

You can plot the information, one fact at a time, on a “time line.”

Sue finished 25 minutes after Ana.

Anim

---

Ana finished 40 minutes before Mel.

Ana

---

Mel

Sue

---

Sue finished 25 minutes after Jing.

Ana

---

Jing

Sue

---

Mel

Rosi finished 20 minutes before Jing.

Rosi

---

Ana

---

Jing

Sue

---

Mel

Use the fact that Ana finished at 1:30 P.M., along with the information on the time line, to figure out when each girl finished.

Rosi: 1:25 P.M.  Jing: 1:45 P.M.  Sue: 1:55 P.M.  Mel: 2:10 P.M.

In the next example, you need to identify a **locus** of points.

**EXAMPLE B**

Oak Street and Maple Street are perpendicular to one another. Maya and Chris are looking for their lost dog. Maya is on Oak Street, 50 meters north of the corner of Oak and Maple. Chris is on Maple Street, 70 meters east of the corner. The dog is 60 meters from Maya and 50 meters from Chris. Make a diagram showing the places where the dog might be located.

(continued)
Lesson 1.9 • A Picture Is Worth a Thousand Words (continued)

Solution

Start by drawing a diagram showing the two streets and the locations of Maya and Chris. Because the dog is 60 meters from Maya, draw a circle with radius 60 meters centered at point $M$. Because the dog is 50 meters from Chris, draw a circle with radius 50 meters centered at point $C$. The intersection of the circles marks the two places the dog might be.

A Venn diagram is a large circle (or oval) that contains smaller circles (or ovals). The large circle represents a whole collection of things, and the smaller circles represent special parts (or subsets) of the whole collection.

EXAMPLE C

Create a Venn diagram showing the relationships among polygons, equilateral polygons, equiangular polygons, and regular polygons.

Solution

The large circle in your Venn diagram must represent what polygons, equilateral polygons, equiangular polygons, and regular polygons all have in common. All of these are polygons. So, the large outer circle represents polygons.

An equilateral polygon is a special polygon with all sides the same length. So, a small inner circle can represent equilateral polygons.

An equiangular polygon is a special polygon in which all angles have equal measures. Therefore, a second small inner circle can represent equiangular polygons.

The intersection of the two inner circles represents polygons that are both equilateral and equiangular. This is the definition of a regular polygon.

The Venn diagram at right can visually represent the relationships among these figures.