



Geometry: Congruence, Constructions, and Parallel Lines

In *Fourth* and *Fifth Grade Everyday Mathematics*, students used a compass and straightedge to construct basic shapes and create geometric designs. In Unit 5 of *Sixth Grade Everyday Mathematics*, students will review some basic construction techniques and then devise their own methods for copying triangles and quadrilaterals and for constructing parallelograms. The term *congruent* will be applied to their copies of line segments, angles, and 2-dimensional figures. Two figures are congruent if they have the *same size* and the *same shape*.

Another approach to congruent figures in Unit 5 is through isometry transformations. These are rigid motions that take a figure from one place to another while preserving its size and shape. Reflections (flips), translations (slides), and rotations (turns) are basic isometry transformations (also known as rigid motions). A figure produced by an isometry transformation (the image) is congruent to the original figure (the preimage).

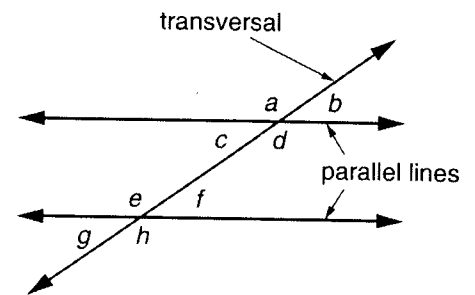
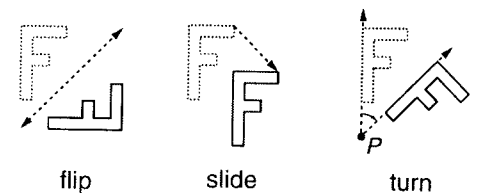
Students will continue to work with the Geometry Template, a tool that was introduced in *Fifth Grade Everyday Mathematics*. The Geometry Template contains protractors and rulers for measuring and cutouts for drawing geometric figures. Students will review how to measure and draw angles using the full-circle and half-circle protractors.

Students will also use a protractor to construct circle graphs that represent data collections. This involves converting the data to percents of a total, finding the corresponding degree measures around a circle, and drawing sectors of the appropriate size.

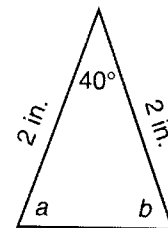
Measures often can be determined without use of a measuring tool. Students will apply properties of angles and sums of angles to find unknown measures in figures similar to those at the right.

One lesson in Unit 5 is a review and extension of work with the coordinate grid. Students will plot and name points on a 4-quadrant coordinate grid and use the grid for further study of geometric shapes.

Please keep this Family Letter for reference as your child works through Unit 5.



If the measure of any one angle is given, the measures of all the others can be found without measuring.



The sum of the angles in a triangle is 180° . Angles a and b have the same measure, 70° .

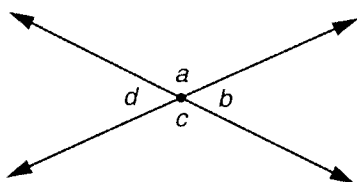
Math Tools

Your child will use a compass and a straightedge to construct geometric figures. A compass is used to draw a circle, or part of a circle, called an arc. A straightedge is used only to draw straight lines, not for measuring. The primary difference between a compass-and-straightedge construction and a drawing or sketch of a geometric figure is that measuring is not allowed in constructions.

Vocabulary

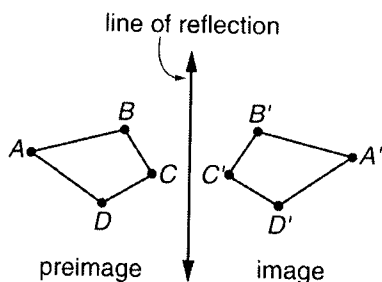
Important terms in Unit 5:

adjacent angles Two angles with a common side and vertex that do not otherwise overlap. In the diagram, angles a and b are adjacent angles. So are angles b and c , d and a , and c and d .



congruent Figures that have exactly the same size and shape are said to be congruent to each other. The symbol \cong means "is congruent to."

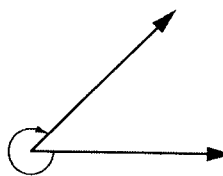
line of reflection (mirror line) A line halfway between a figure (preimage) and its reflected image. In a reflection, a figure is flipped over the line of reflection.



ordered pair Two numbers, or coordinates, used to locate a point on a rectangular coordinate grid. The first coordinate x gives the position along the horizontal axis of the grid, and the second coordinate y gives the position along the vertical axis. The pair is written (x,y) .

reflection (flip) The flipping of a figure over a line (line of reflection) so its image is the mirror image of the original (preimage).

reflex angle An angle measuring between 180° and 360° .

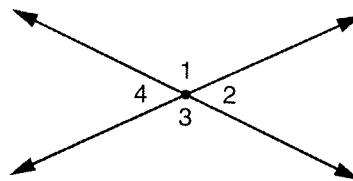


rotation (turn) A movement of a figure around a fixed point or an axis; a turn.

supplementary angles Two angles whose measures add to 180° . Supplementary angles do not need to be adjacent.

translation (slide) A transformation in which every point in the image of a figure is at the same distance in the same direction from its corresponding point in the figure. Informally called a slide.

vertical (opposite) angles The angles made by intersecting lines that do not share a common side. Same as opposite angles. Vertical angles have equal measures. In the diagram, angles 1 and 3 are vertical angles. They have no sides in common. Similarly, angles 4 and 2 are vertical angles.



Do-Anytime Activities

To work with your child on the concepts taught in this unit, try these interesting and engaging activities:

1. While you are driving in the car together, ask your child to look for congruent figures, for example, windows in office buildings, circles on stoplights, or wheels on cars and trucks.
2. Look for apparent right angles or any other type of angles: acute (less than 90°) or obtuse (between 90° and 180°). Guide your child to look particularly at bridge supports to find a variety of angles.
3. Triangulation lends strength to furniture. Encourage your child to find corner triangular braces in furniture throughout your home. Look under tables, under chairs, inside cabinets, or under bed frames. Have your child count how many examples of triangulation he or she can find in your home.

Building Skills through Games

In Unit 5, students will work on their understanding of geometry concepts by playing games such as those described below.

Angle Tangle See *Student Reference Book*, page 306

Two players need a protractor, straightedge, and blank paper to play *Angle Tangle*. Skills practiced include estimating angle measures as well as measuring angles.

Polygon Capture See *Student Reference Book*, page 330

Players capture polygons that match both the angle property and the side property drawn. Properties include measures of angles, lengths of sides, and number of pairs of parallel sides.

Students will review concepts from previous units by playing games such as:

2-4-8 and 3-6-9 Frac-Tac-Toe (Decimal Versions) See *Student Reference Book*, pages 314–316

Two players need a deck of number cards with four each of the numbers 0–10; a gameboard; a 5×5 grid that resembles a bingo card; a *Frac-Tac-Toe* Number-Card board; markers or counters in two different colors; and a calculator. The two versions, *2-4-8 Frac-Tac-Toe* and *3-6-9 Frac-Tac-Toe*, help students practice conversions between fractions and decimals.

As You Help Your Child with Homework

As your child brings assignments home, you may want to go over the instructions together, clarifying them as necessary. The answers listed below will guide you through some of the Unit 5 Study Links.

Study Link 5•1

2. a. $\angle H$ b. $\angle J$
 c. $\angle D$ d. $\angle ABC, \angle GFE, \angle L$
 3b. 180 3c. 360

Study Link 5•2

1. $m\angle y = 120^\circ$ 2. $m\angle x = 115^\circ$
 3. $m\angle c = 135^\circ$ $m\angle a = 45^\circ$ $m\angle t = 135^\circ$
 4. $m\angle q = 120^\circ$ $m\angle r = 80^\circ$ $m\angle s = 70^\circ$
 5. $m\angle a = 120^\circ$ $m\angle b = 60^\circ$ $m\angle c = 120^\circ$
 $m\angle d = 40^\circ$ $m\angle e = 140^\circ$ $m\angle f = 140^\circ$
 $m\angle g = 80^\circ$ $m\angle h = 100^\circ$ $m\angle i = 100^\circ$
 6. $m\angle w = 90^\circ$ $m\angle a = 75^\circ$ $m\angle t = 105^\circ$
 $m\angle c = 75^\circ$ $m\angle h = 105^\circ$
 7. 12 8. 30 9. 110

Study Link 5•3

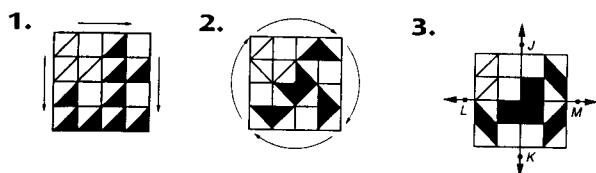
2. a. 1,920,000 adults b. 3,760,000 adults
 3. -7, 0, 0.07, 0.7, 7
 4. $0.06, \frac{1}{10}, 0.18, 0.2, 0.25, 0.75, \frac{4}{5}, \frac{4}{4}$

Study Link 5•4

Sample answers for 1–3:

1. Vertex C: (1,2)
 2. Vertex F: (5,10) Vertex G: (3,7)
 3. Vertex J: (2,1) 4. Vertex M: (-2,-3)
 5. Vertex Q: (8,-3)

Study Link 5•5



4. 64 5. 243 6. 1 7. 64

Study Link 5•7

1. $m\angle r = 47^\circ$ $m\angle s = 133^\circ$ $m\angle t = 47^\circ$
 2. $m\angle NKO = 10^\circ$
 3. $m\angle a = 120^\circ$ $m\angle b = 120^\circ$ $m\angle c = 60^\circ$
 4. $m\angle a = 57^\circ$ $m\angle c = 114^\circ$ $m\angle t = 57^\circ$
 5. $m\angle x = 45^\circ$ $m\angle y = 45^\circ$ $m\angle z = 135^\circ$
 6. $m\angle p = 54^\circ$
 7. 0.0027 8. 0.12 9. 0.0049 10. 0.225

Study Link 5•8

2. $A': (-2, -7)$ $B': (-6, -6)$
 $C': (-8, -4)$ $D': (-5, -1)$
 3. $A'': (2, 1)$ $B'': (6, 2)$
 $C'': (8, 4)$ $D'': (5, 7)$
 4. $A''': (1, -2)$ $B''': (2, -6)$
 $C''': (4, -8)$ $D''': (7, -5)$
 5. 0.3 6. 0.143 7. 0.0359

Study Link 5•9

3. Sample answers: All of the vertical angles have the same measure; all of the angles along the transversal and on the same side are supplementary; opposite angles along the transversal are equal in measure.

Study Link 5•10

1. a. 50° ; $\angle YZW$ plus the 130° angle equals 180° , so $\angle YZW = 50^\circ$. Because opposite angles in a parallelogram are equal, $\angle X$ also equals 50° .
 b. 130° ; $m\angle YZW = 50^\circ$ and $\angle Y$ and $\angle Z$ are consecutive angles. Because consecutive angles of parallelograms are supplementary, $\angle Y = 130^\circ$.
 2. Opposite sides of a parallelogram are congruent.
 3. 110° ; Adjacent angles that form a straight angle are supplementary.
 4. square 5. rhombus