Kenmore-Town of Tonawanda UFSD

We educate, prepare, and inspire all students to achieve their highest potential

Grade 4 Module 4
Parent Handbook

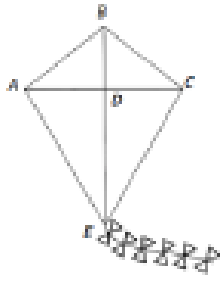
The materials contained within this packet have been taken from the Great Minds curriculum Eureka Math.

Eureka Math Tips for Parents

Grade 4
Module 4

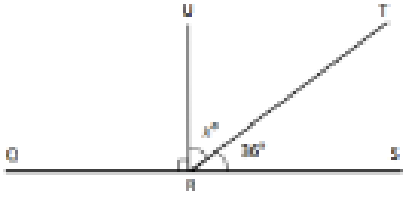
Angle Measure and Plane Figures

This 20-day module introduces points, lines, line segments, rays, and angles, as well as the relationships between them. Students will construct, recognize, and define these geometric objects before using their new knowledge and understanding to classify figures and solve problems. Students will construct and measure angles, as well as create equations to find an unknown angle.



Students will be asked to identify points, line segments, lines, rays, and angles.

Given a geometrical drawing like the one below, students will learn to use what they know to solve for an unknown angle measure.



Solve for ∠TRU.
∠QRS is a straight angle.

What Came Before this Module:

We applied multiplication and division to contexts such as area and perimeter, and worked up to multiplication and division of multi-digit whole numbers.

What Comes After this Module:

Students will explore fraction equivalence, working for the first time with mixed numbers. They will solve to find equivalent fractions, compare and order fractions, and add and subtract fractions using familiar models to support their conceptual understanding.

Key Words to Know

Angle - union of two different rays sharing a common vertex

Acute Angle - angle with a measure of less than 90 degrees

Line of symmetry - line through a figure such that when the figure is folded along the line two halves are created that match up exactly

Obtuse angle - angle with a measure greater than 90 degrees but less than 180 degrees

Parallel - two lines in a plane that do not intersect

Perpendicular - Two lines are perpendicular if they intersect, and any of the angles formed between the lines is a 90° angle

Right angle - angle formed by perpendicular lines, measuring 90 degrees

Straight angle - angle that measures 180 degrees

Triangle - A triangle consists of three non-collinear points and the three line segments between them.

Vertex - a point, often used to refer to the point where two lines meet, such as in an angle or the corner of a triangle

+ How you can help at home:

- Review vocabulary! This module introduces many new terms and ideas. Use your student's homework to find key terms to review.
- Practice adding to make 90, 180, 270 and 360, as well as subtracting from those numbers. This will be useful when students are solving problems like the missing angle one above.

Key Common Core Standards:

- *Geometric measurement: understand concepts of angle and measure angles.*
  - Recognize angles as geometric shapes that are formed whenever two rays share a common endpoint, and understand concepts of angle measurement.
  - Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
  - Recognize angle measure as additive.
- *Draw and identify lines and angles, and classify shapes by properties of their lines and angles.*
  - Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
  - Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size.
  - Recognize a line of symmetry for a two-dimensional figure.

Prepared by Erin Schweng, Math Coach

Some sample Total Physical Response questions from this module:

What teacher says:	*What students do:*
Model a point	Clench one hand in a fist.
Model a ray	Extend arms straight so that they are parallel with the floor. Clench one hand in a fist and point the fingers of the other hand towards the wall.
Model a right angle	Stretch one arm up, directly at the ceiling. Stretch another arm directly towards a wall, parallel to the floor.
Make an angle that measures approximately 60°	Open arms apart to approximately 60°.

Spotlight on Math Strategies:

Total Physical Response

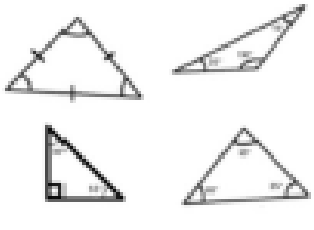
Borrowed from language instruction, this is a powerful tool for learning new math vocabulary.

A Story of Units has several key mathematical strategies that will be used throughout a student's elementary years.

In the world of language learning, "total physical response" refers to the coordination of language and physical movement. In this module, there are many new geometry terms and ideas that students must remember. Using their bodies in connection with new vocabulary helps students to cement these new words and their meanings in lasting ways. Throughout the module, students engage in fluency activities called "Physiometry" (a single-word combination of "physical" and "geometry") in which they use body movements and positioning to indicate terms such as point, line segment, ray, acute, obtuse, and right angles, as well as many others.

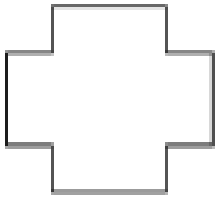
Other Key Skills in Module 4 Include:

Classifying 2-D figures:



Students will be able to classify these triangles by their sides and their angles.

Understanding line relationships:



Students will be able to identify the parallel and perpendicular lines in the figure.

Grade 4 • Module 4

Angle Measure and Plane Figures

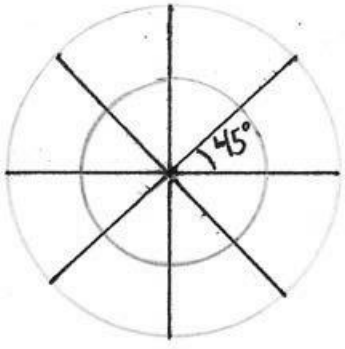
OVERVIEW

This 20-day module introduces points, lines, line segments, rays, and angles, as well as the relationships between them. Students construct, recognize, and define these geometric objects before using their new knowledge and understanding to classify figures and solve problems. With angle measure playing a key role in the work throughout the module, students learn how to create and measure angles, as well as how to create and solve equations to find unknown angle measures. In these problems, where the unknown angle is represented by a letter, students explore both measuring the unknown angle with a protractor and reasoning through the solving of an equation. This connection between the measurement tool and the numerical work lays an important foundation for success with middle school geometry and algebra. Through decomposition and composition activities, as well as an exploration of symmetry, students recognize specific attributes present in two-dimensional figures. They further develop their understanding of these attributes as they classify two-dimensional figures.

Topic A begins with students drawing points, lines, line segments, and rays, as well as identifying these in various contexts and within familiar figures. Students recognize that two rays sharing a common endpoint form an angle (**4.MD.5**). They create right angles through a paper-folding activity, identify right angles in their environment, and see that one angle can be greater (obtuse) or less (acute) than a right angle. Next, students use their understanding of angles to explore relationships between pairs of lines as they define, draw, and recognize intersecting, perpendicular, and parallel lines (**4.G.1**).

In Topic B, students explore the definition of degree measure, beginning with a circular protractor. By dividing the circumference of a circle into 360 equal parts, they recognize one part as representing 1 degree (**4.MD.5**). Through exploration, students realize that, although the size of a circle may change, an angle spans an arc, representing a constant fraction of the circumference. By carefully distinguishing the attribute of degree measure from that of length measure, the common misconception that degrees are a measure of length is avoided. Armed with their understanding of the degree as a unit of measure, students use various types of protractors to measure angles to the nearest degree and sketch angles of a given measure (**4.MD.6**). The idea that an angle measures the

amount of *turning* in a particular direction is explored as students recognize familiar angles in varied contexts (**4.G.1**, **4.MD.5**).



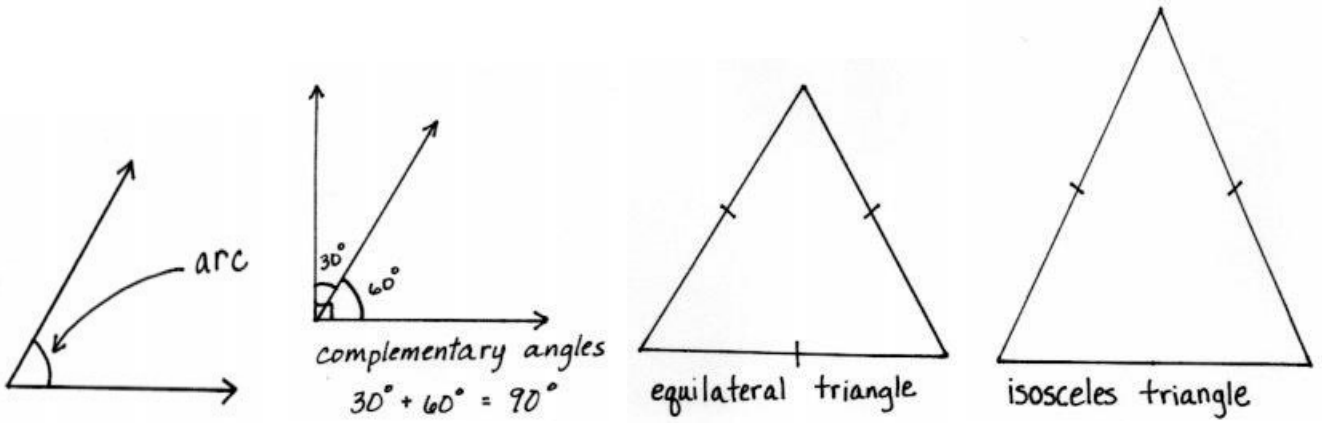
Topic C begins by decomposing 360° using pattern blocks, allowing students to see that a group of angles meeting at a point with no spaces or overlaps add up to 360°. With this new understanding, students now discover that the combined measure of two adjacent angles on a line is 180° (supplementary angles), that the combined measure of two adjacent angles meeting to form a right angle is 90° (complementary angles), and that vertically opposite angles have the same measure. These properties are then used to solve unknown angle problems (**4.MD.7**).

An introduction to symmetry opens Topic D as students recognize lines of symmetry for two-dimensional figures, identify line-symmetric figures, and draw lines of symmetry (**4.G.3**). Given one-half of a line-symmetric figure and the line of symmetry, students draw the other half of the figure. This leads to their work with triangles. Students are introduced to the precise definition of a triangle, and then classify triangles based on angle measure and side length (**4.G.2**). For isosceles triangles, a line of symmetry is identified, and a folding activity demonstrates that base angles are equal. Folding an equilateral triangle highlights multiple lines of symmetry and establishes that all interior angles are equal. Students construct triangles given a set of classifying criteria (e.g., create a triangle that is both right and isosceles). Finally, students explore the definitions of familiar quadrilaterals and classify them based on their attributes, including angle measure and parallel and perpendicular lines (**4.G.2**). This work builds on Grade 3 reasoning about the attributes of shapes and lays a foundation for hierarchical classification of two-dimensional figures in Grade 5. The topic concludes as students compare and analyze two-dimensional figures according to their properties and use grid paper to construct two-dimensional figures given a set of criteria.

Terminology

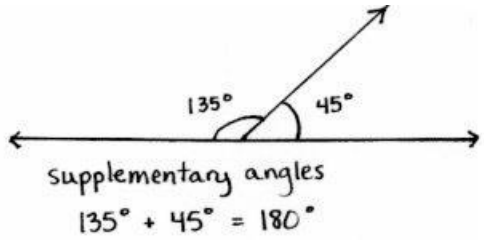
New or Recently Introduced Terms

- Acute angle (angle with a measure of less than 90°)
- Acute triangle (triangle with all interior angles measuring less than 90°)
- Adjacent angle (Two angles $\angle AOC$ and $\angle COB$, with a common side OC, are *adjacent angles* if C is in the interior of $\angle AOB$.)
- Angle (union of two different rays sharing a common vertex, e.g., $\angle ABC$)
- Arc (connected portion of a circle)



- Collinear (Three or more points are *collinear* if there is a line containing all of the points; otherwise, the points are *non-collinear*.)
- Complementary angles (two angles with a sum of 90°)
- Degree, degree measure of an angle (Subdivide the length around a circle into 360 arcs of equal length. A central angle for any of these arcs is called a *one-degree angle* and is said to have an angle measure of 1°.)
- Diagonal (straight lines joining two opposite corners of a straight-sided shape)
- Equilateral triangle (triangle with three equal sides)
- Figure (set of points in the plane)
- Interior of an angle (the convex[1] region defined by the angle)
- Intersecting lines (lines that contain at least one point in common)
- Isosceles triangle (triangle with at least two equal sides)
- Length of an arc (circular distance around the arc)
- Line (straight path with no thickness that extends in both directions without end)
- Line of symmetry (line through a figure such that when the figure is folded along the line, two halves are created that match up exactly)
- Line segment (two points, A and B, together with the set of points on the line AB between A and B, e.g., AB)
- Obtuse angle (angle with a measure greater than 90°, but less than 180°)
- Obtuse triangle (triangle with an interior obtuse angle)
- Parallel (two lines in a plane that do not intersect, e.g., $AB \parallel CD$)
- Perpendicular (Two lines are *perpendicular* if they intersect, and any of the angles formed between the lines is a 90° angle, e.g., $EF \perp GH$.)
- Point (precise location in the plane)
- Protractor (instrument used in measuring or sketching angles)

- Ray (The *ray* OA is the point O and the set of all points on the line OA that are on the same side of O as the point A.)
- Right angle (angle formed by perpendicular lines, measuring 90°)
- Right triangle (triangle that contains one 90° angle)
- Scalene triangle (triangle with no sides or angles equal)
- Straight angle (angle that measures 180°)



- Supplementary angles (two angles with a sum of 180°)
- Triangle (A *triangle* consists of three non-collinear points and the three line segments between them. The three segments are called the *sides* of the triangle, and the three points are called the *vertices.*)
- Vertex (a point, often used to refer to the point where two lines meet, such as in an angle or the corner of a triangle)
- Vertical angles (When two lines intersect, any two non-adjacent angles formed by those lines are called *vertical angles* or *vertically opposite angles*.)

Familiar Terms and Symbols

- Decompose (process of separating something into smaller components)
- Parallelogram (quadrilateral with two pairs of parallel sides)
- Polygon (closed two-dimensional figure with straight sides)
- Quadrilateral (polygon with four sides)
- Rectangle (quadrilateral with four right angles)
- Rhombus (quadrilateral with all sides of equal length)
- Square (rectangle with all sides of equal length)
- Sum (result of adding two or more numbers)
- Trapezoid (quadrilateral with at least one pair of parallel sides)

Suggested Tools and Representations

- Folded paper models
- Pattern blocks
- Protractors of various diameters, including a 360° and 180° protractor
- Rectangular and triangular grid paper
- Right angle template (created in Lesson 2), set square
- Ruler (used to measure length), straightedge (used to draw straight lines)

Grade 4 Module 3 Topic A

Lines and Angles

Focus Standard:

4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

Instructional Days Recommended: 4

Topic A begins with students drawing points, lines, line segments, and rays and identifying these in various contexts and familiar figures. As they continue, students recognize that two rays sharing a common endpoint form an angle. In Lesson 2, students create right angles through a paper folding activity and identify right angles in their environment by comparison with the right angles they have made. They also draw acute, right, and obtuse angles. This represents the students' first experience with angle comparison and the idea that one angle's measure can be greater (obtuse) or less (acute) than that of a right angle.

Next, students use their understanding of angles to explore relationships between pairs of lines, defining and recognizing intersecting, perpendicular, and parallel lines. In Lesson 3, the students' knowledge of right angles leads them to identify, define, and construct perpendicular lines. In Lesson 4, students learn lines that never intersect are also called parallel and have a special relationship. Students use, in conjunction with a straightedge, the right-angle templates that they created in Lesson 2 to construct parallel lines (**4.G.1).** Activities using different grids provide students with the opportunity to explore the concepts of perpendicularity and parallelism.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 1

Objective: Identify and draw points, lines, line segments, rays, and angles. Recognize them in various contexts and familiar figures.

Homework Key

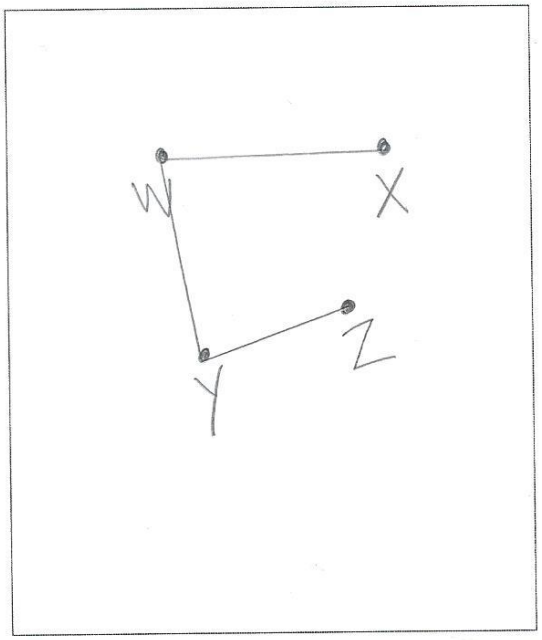
1. a. – f. Figure drawn accurately.
   g. Answers will vary.
2. a. – g. Figure drawn accurately.
   h. Answers will vary.
3. a. Points labeled; labels will vary.
   b. Answers will vary.

Homework Samples

1. Use the following directions to draw a figure in the box to the right.

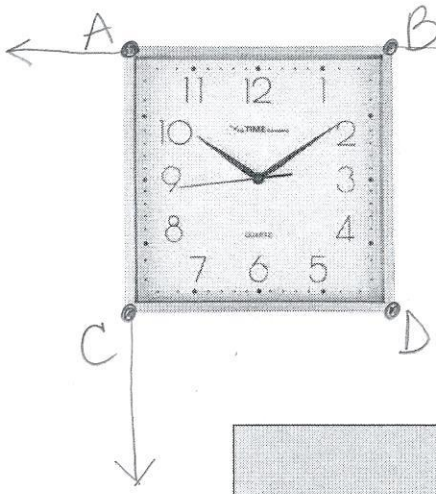
   a. Draw two points: W and X.
   b. Use a straightedge to draw $\overrightarrow{WX}$.
   c. Draw a new point that is not on $\overrightarrow{WX}$. Label it Y.
   d. Draw $\overline{WY}$.
   e. Draw a point not on $\overrightarrow{WX}$ or $\overline{WY}$. Call it Z.
   f. Construct $\overrightarrow{YZ}$.
   g. Use the points you've already labeled to name one angle. $\angle XWY$

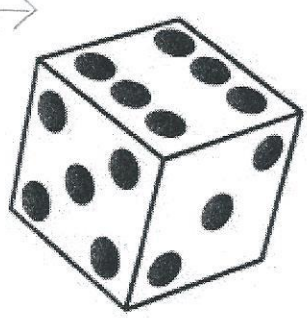
   answers vary



Lesson 1 (continued)

3. a. Observe the familiar figures below. Label some points on each figure.
   b. Use those points to label and name representations of each of the following in the table below: ray, line, line segment, and angle. Extend segments to show lines and rays.





	Clock	Die	Number line
Ray	$\overrightarrow{AC}$		
Line	$\overleftrightarrow{AB}$		
Line segment	$\overline{BD}$		
Angle	$\angle BAC$		

Lesson 2

Objective: Use right angles to determine whether angles are equal to, greater than, or less than right angles. Draw right, obtuse, and acute angles.

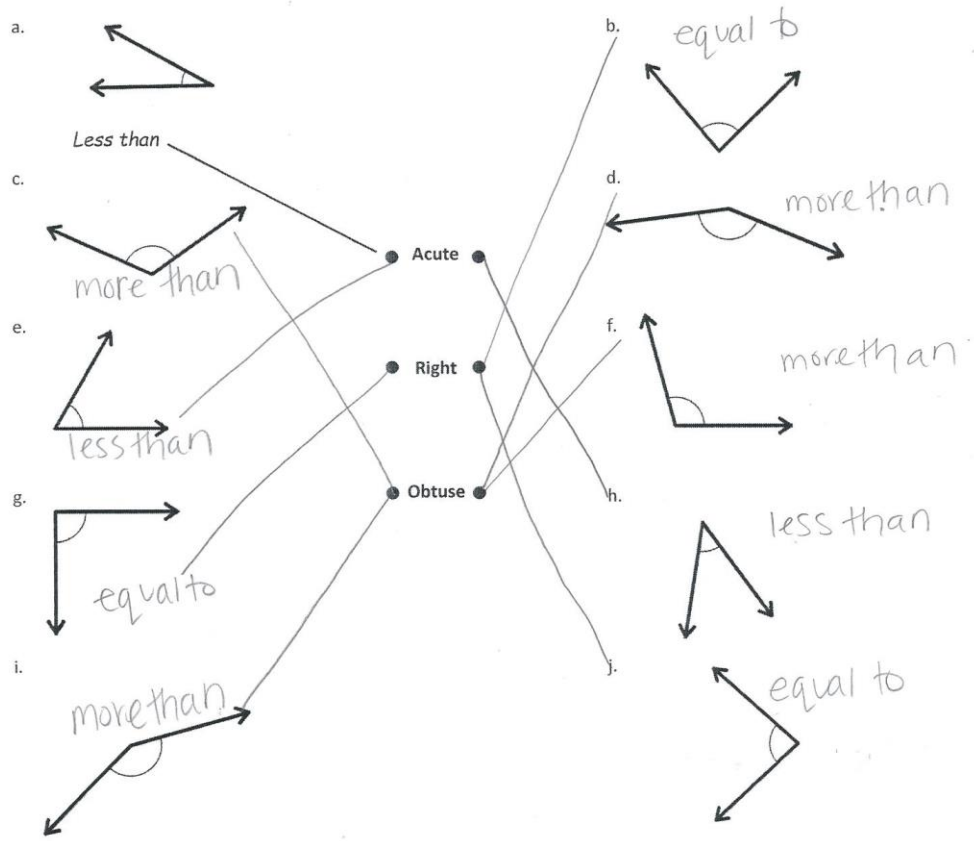
Homework Key

1. a. Answer provided
   b. Equal to; right
   c. Greater than; obtuse
   d. Greater than; obtuse
   e. Less than; acute
   f. Greater than; obtuse
   g. Equal to; right
   h. Less than; acute
   i. Greater than; obtuse
   j. Equal to; right

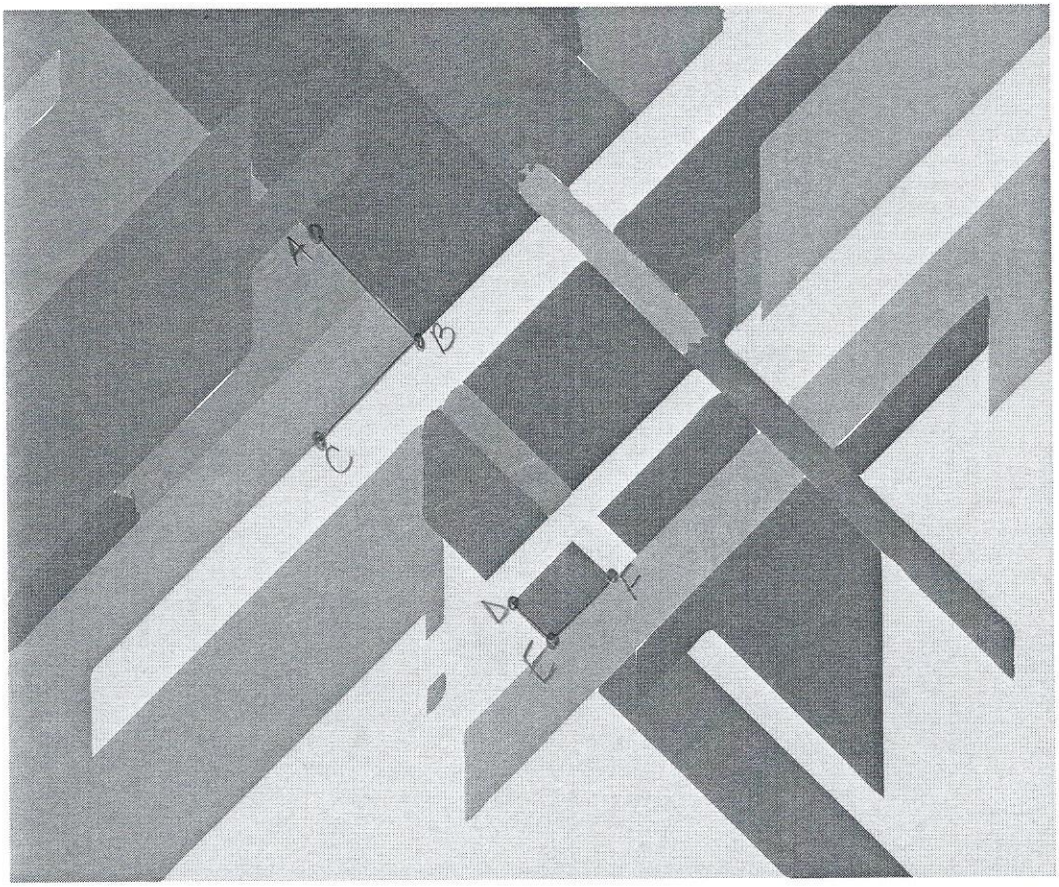
2. Angles accurately identified and traced; points labeled; angles named; answers will vary.
3. a. Acute angle constructed; less than a right angle
   b. Right angle constructed; equal to a right angle
   c. Obtuse angle constructed; greater than a right angle

Homework Samples

1. Use the right angle template that you made in class to determine if each of the following angles is greater than, less than, or equal to a right angle. Label each as *greater than*, *less than*, or *equal to*, and then connect each angle to the correct label of acute, right, or obtuse. The first one has been completed for you.



2. Use your right angle template to identify acute, obtuse, and right angles within this painting. Trace at least two of each, label with points, and then name them in the table below the painting.



Acute angle		
Obtuse angle		
Right angle	∠ABC	right angle ∠DEF

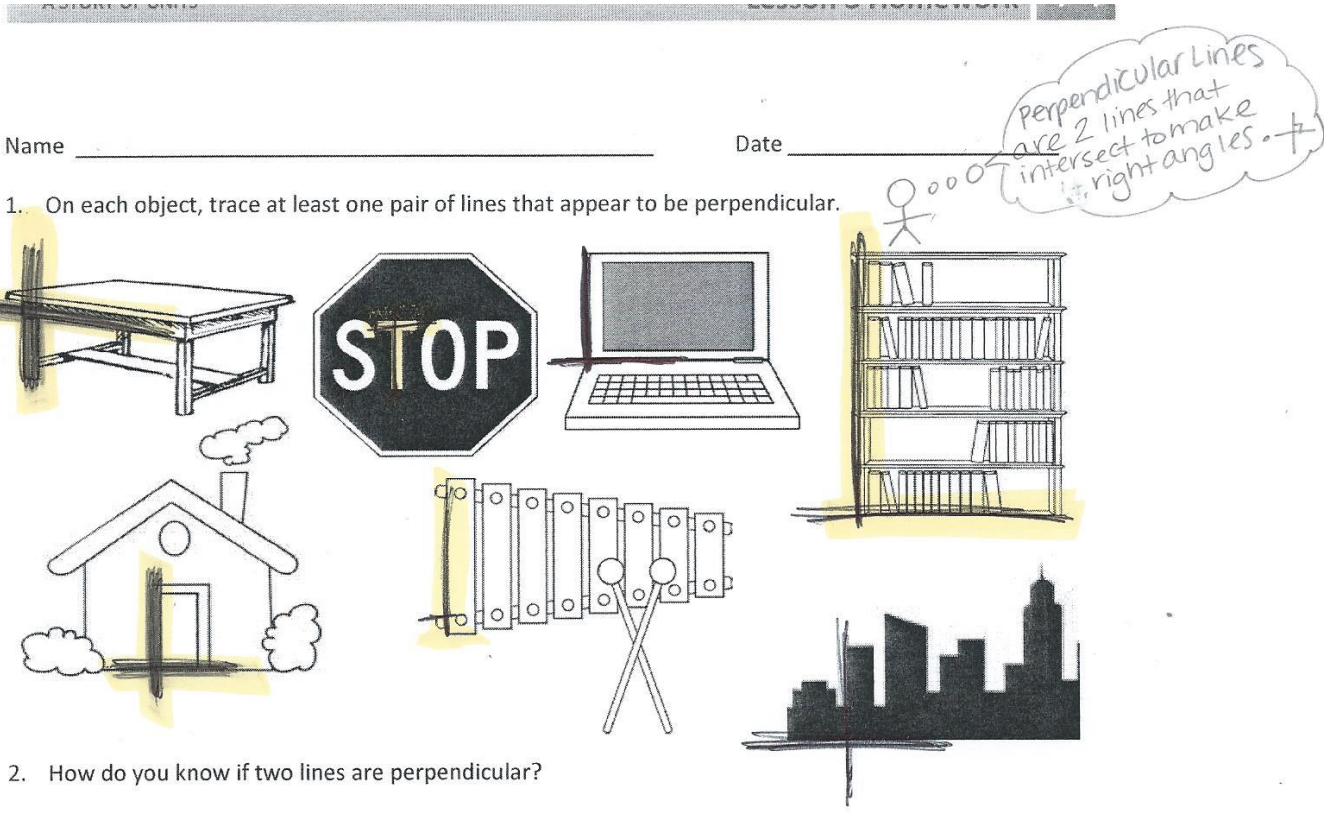
Lesson 3

Objective: Identify, define, and draw perpendicular lines.

Homework Key

1. Perpendicular lines accurately traced
2. Answers will vary.
3. Perpendicular lines accurately drawn
4. a. Right angles accurately identified and marked; $\overline{AB} \perp \overline{BD}$; $\overline{BD} \perp \overline{DC}$; $\overline{AC} \perp \overline{CD}$
   b. No right angles
   c. Right angle accurately identified and marked; $\overline{DO} \perp \overline{OG}$
   d. No right angles
   e. No right angles
   f. Right angles accurately identified and marked; $\overline{PO} \perp \overline{ON}$; $\overline{ON} \perp \overline{NM}$; $\overline{NM} \perp \overline{MP}$; $\overline{MP} \perp \overline{PO}$
   g. No right angles
   h. Right angles accurately identified and marked; $\overline{UT} \perp \overline{TZ}$; $\overline{TZ} \perp \overline{ZY}$; $\overline{ZY} \perp \overline{YX}$; $\overline{YX} \perp \overline{XW}$
5. Right angles accurately identified and marked; 8 perpendicular pairs
6. True; explanations will vary.

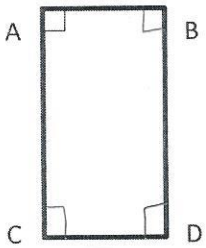
Homework Samples



Lesson 3 (continued)

4. Use the right angle template that you created in class to determine which of the following figures have a right angle. Mark each right angle with a small square. For each right angle you find, name the corresponding pair of perpendicular lines. (Problem 4(a) has been started for you.)

a.

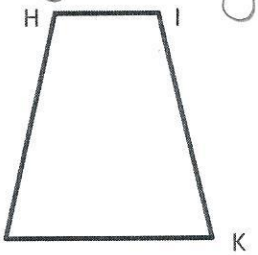


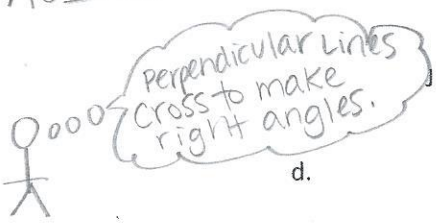
$\overline{AB} \perp \overline{BD}$

$\overline{BD} \perp \overline{DC}$

$\overline{AC} \perp \overline{CD}$

b. no right angles





c.

d.

Lesson 4

Objective: Identify, define, and draw parallel lines.

Homework Key

1. Parallel lines accurately traced
2. Answers will vary.
3. Parallel segments accurately drawn
4. a. Sides accurately identified and marked with arrows;

   b. Circled; sides accurately identified and marked with arrows; $\overline{AB} \parallel \overline{CD}$

   c. No parallel sides

   d. No parallel sides

   e. No parallel sides

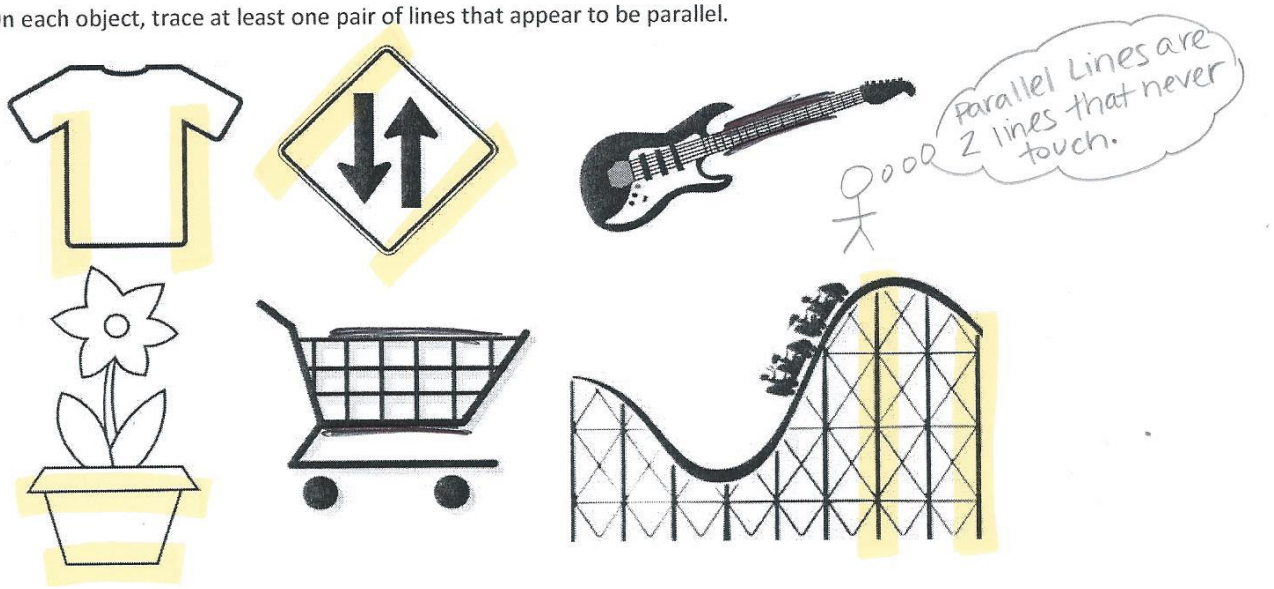
   f. Circled; sides accurately identified and marked with arrows; $\overline{OP} \parallel \overline{MN}; \overline{ON} \parallel \overline{PM}$

   g. Circled; sides accurately identified and marked with arrows; $\overline{TU} \parallel \overline{RQ}; \overline{ST} \parallel \overline{QP}; \overline{SR} \parallel \overline{UP}$

   h. Circled; sides accurately identified and marked with arrows; $\overline{TZ} \parallel \overline{XY}; \overline{TU} \parallel \overline{ZY}; \overline{WX} \parallel \overline{ZY}$
5. False; explanations will vary.
6. Explanations will vary.
7. Parallel lines constructed

Homework Samples

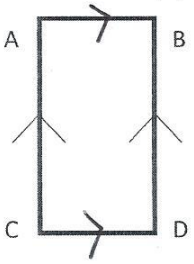
1. On each object, trace at least one pair of lines that appear to be parallel.



Lesson 4 (continued)

4. Determine which of the following figures have lines that are parallel by using a straightedge and the right angle template that you created. Circle the letter of the shapes that have at least one pair of parallel lines. Mark each pair of parallel lines with arrows, and then identify the parallel lines with a statement modeled after the one in 4(a).

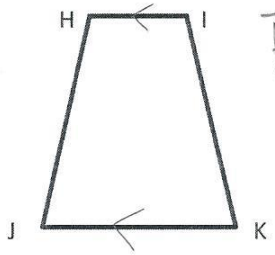
a.



$\overline{AB} \parallel \overline{BD}$

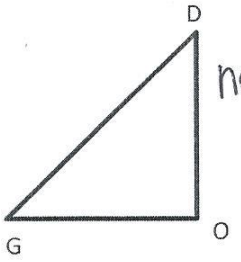
$\overline{AB} \parallel \overline{CD}$

b.



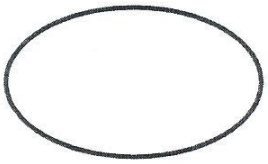
$\overline{HI} \parallel \overline{JK}$

c.



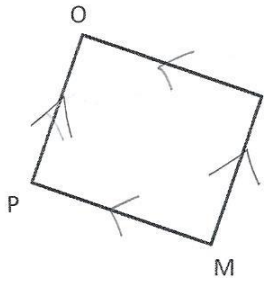
no parallel sides

d.



e.

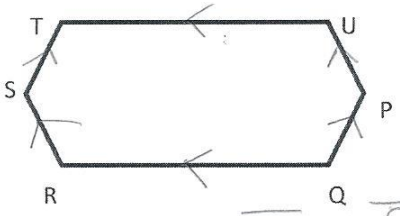
f.



$\overline{OP} \parallel \overline{MN}$

$\overline{ON} \parallel \overline{PM}$

g.

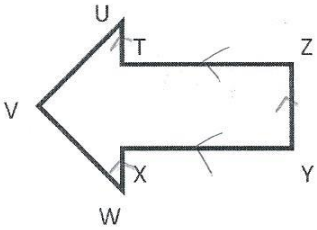


$\overline{TU} \parallel \overline{RQ}$

$\overline{ST} \parallel \overline{PQ}$

$\overline{SR} \parallel \overline{PU}$

h.



$\overline{TZ} \parallel \overline{XY}$

$\overline{TU} \parallel \overline{ZY}$

$\overline{WX} \parallel \overline{ZY}$

Grade 4 Module 4 Topic B

Angle Measurement

Focus Standards:

4.MD.5 Recognize angles as geometric shapes that are formed whenever two rays share a common endpoint, and understand concepts of angle measurement:

a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.

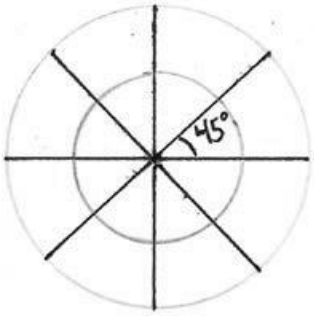
b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure

4.MD.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

Instructional Days Recommended: 4

In Topic B, students explore the definition of degree measure. Beginning in Lesson 5 with a circular protractor, students divide the circumference of a circle into 360 equal parts, with each part representing 1 degree (**4.MD.5**). Students apply this understanding as they discover that a right angle measures 90° and, in turn, that the angles they know as acute measure less than 90°, and obtuse angles measure more than 90°. The idea that an angle measures the amount of *turning* in a particular direction is explored, providing students with the opportunity to recognize familiar angles in varied positions (**4.G.1**, **4.MD.5**).

Through experimentation with circles of various sizes and angles constructed to varying specifications in Lesson 6, students discover that, although the size of a circle may change, an angle spans an arc, which represents a constant fraction of the circumference. This reasoning forms the basis for the understanding that degree measure is not a measure of length. For example, as shown at the right, the 45° angle spans 18 of the circumference of the circle, whether choosing the small or large circle.



Armed with this understanding of the degree as a unit of measure, students use various protractors in Lesson 7, including standard 180° protractors, to measure angles to the nearest degree and construct angles of a given measure (**4.MD.6**).

The topic concludes in Lesson 8 with students further exploring angle measure as an amount of turning. This provides a link to Grade 3 work with fractions as students reason that a $\frac{1}{4}$ turn is a right angle and measures 90°, a $\frac{1}{2}$ turn measures 180°, and a $\frac{3}{4}$ turn measures 270°. Students move forward to identify these angles in their environment.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 5

Objective: Use a circular protractor to understand a 1-degree angle as $\frac{1}{360}$ of a turn. Explore benchmark angles using the protractor.

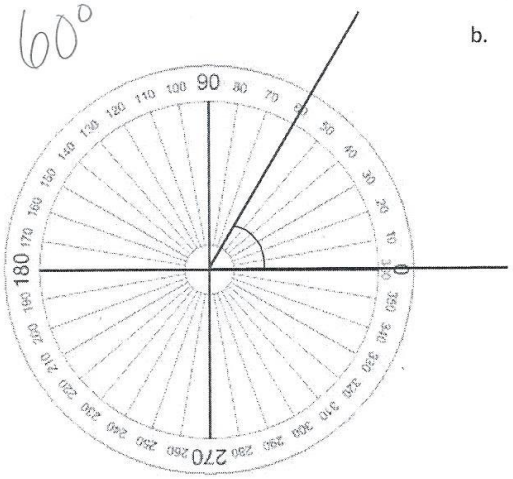
Homework Key

1. a. 60°
   b. 130°
   c. 315°
   d. 120°
2. Explanations will vary.

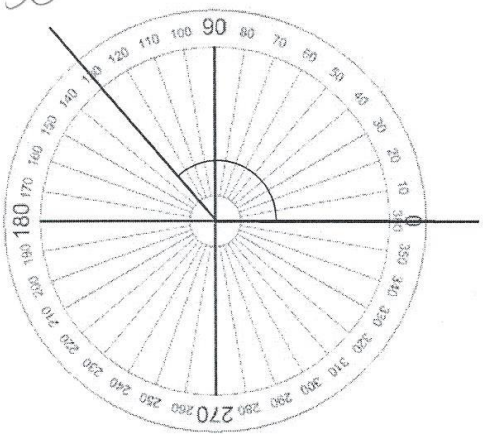
Homework Sample

1. Identify the measures of the following angles.

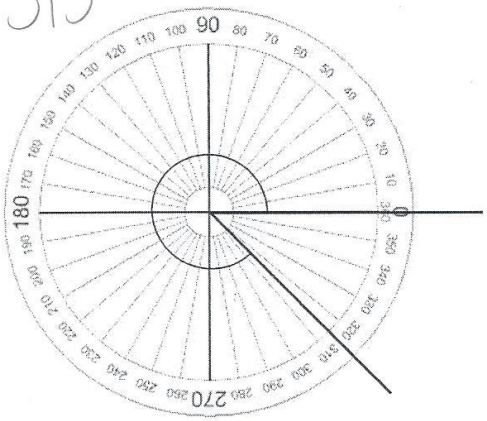
a. 60°



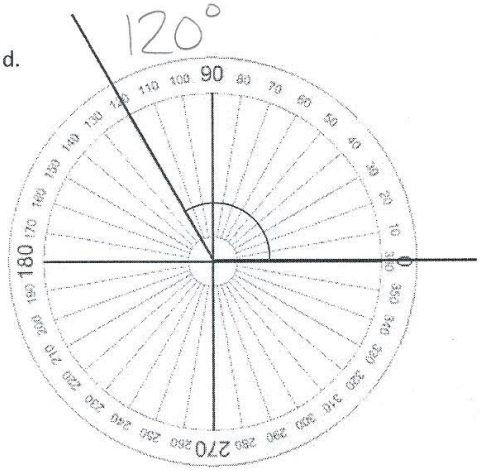
b. 130°



c. 315°



d. 120°



Lesson 6

Objective: Use varied protractors to distinguish angle measure from length measurement.

Homework Key

1. a. 67°
   b. 78°
   c. 32°
   d. 60°
   e. 105°
   f. 153°
   g. 135°
   h. 65°
   i. 45°
   j. 118°

2. Explanations will vary.

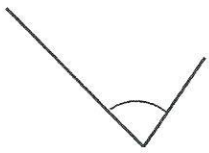
3. a. 172°
   b. 180°; explanations will vary.

Homework Samples

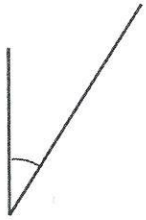
1. Use a protractor to measure the angles, and then record the measurements in degrees.

a. 67°

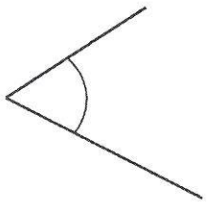
b. 78°



c. 32°

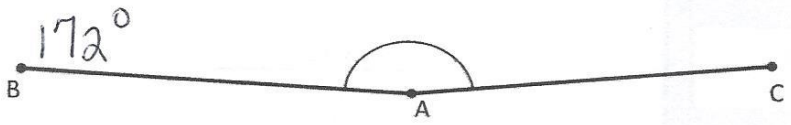


d. 60°

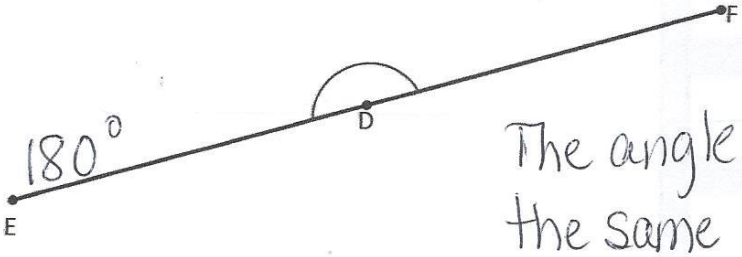


3. Use a protractor to measure each angle. Extend the length of the segments as needed. When you extend the segments, does the angle measure stay the same? Explain how you know.

a.



b.



The angle measure stays the same when the line segments are extended.

Lesson 7

Objective: Measure and draw angles. Sketch given angle measures, and verify with a protractor.

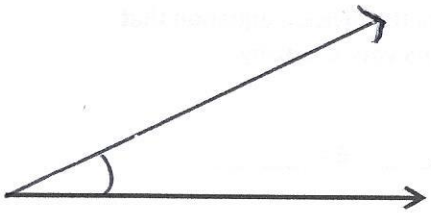
Homework Key

1. 25° angle constructed
2. 85° angle constructed
3. 140° angle constructed
4. 83° angle constructed
5. 108° angle constructed
6. 72° angle constructed
7. 25° angle constructed
8. 155° angle constructed
9. 45° angle constructed
10. 135° angle constructed

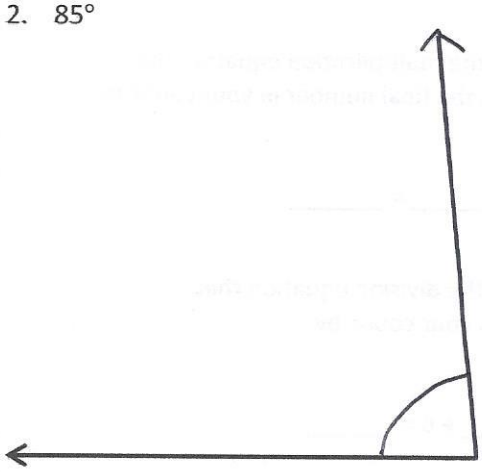
Homework Sample

Construct angles that measure the given number of degrees. For Problems 1–4, use the ray shown as one of the rays of the angle with its endpoint as the vertex of the angle. Draw an arc to indicate the angle that was measured.

1. 25°



2. 85°



Lesson 8

Objective: Identify and measure angles as turns and recognize them in various contexts.

Homework Key

1. House, fence, house
2. 360°
3. Opposite direction; explanations will vary.
4. Full turn
5. Picture shows a 180° turn.
6. 4 quarter turns
7. 2 quarter turns
8. West

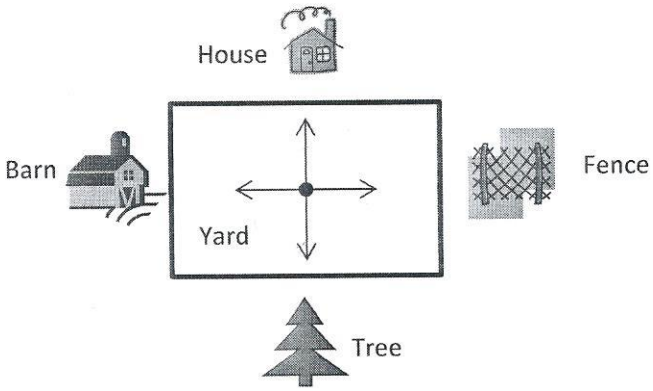
Homework Samples

1. Jill, Shyan, and Barb stood in the middle of the yard and faced the barn. Jill turned 90° to the right. Shyan turned 180° to the left. Barb turned 270° to the left. Name the object that each girl is now facing.

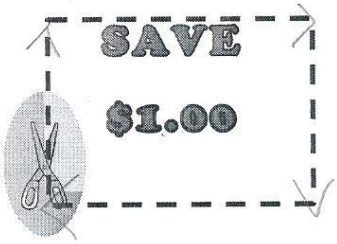
Jill House

Shyan Fence

Barb House



6. Betsy used her scissors to cut out a coupon from the newspaper. How many total quarter-turns will she need to rotate the paper in order to cut out the entire coupon?



4 quarter turns

Grade 4 Module 4 Topic C

Problem Solving with the Addition of Angle Measures

Focus Standard:

4.MD.7 Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

Instructional Days Recommended: 3

In Topic C, students use concrete examples to discover the additive nature of angle measurement. As they work with pattern blocks in Lesson 9, students see that the measures of all of the angles at a point, with no overlaps or gaps, add up to 360°, and they use this fact to find the measure of the pattern blocks' angles.

In Lesson 10, students use what they know about the additive nature of angle measure to reason about the relationships between pairs of adjacent angles. Students discover that the measures of two angles on a straight line add up to 180° (supplementary angles) and that the measures of two angles meeting to form a right angle add up to 90° (complementary angles).

In Lesson 11, students extend their learning by determining the measures of unknown angles for adjacent angles that add up to 360°. Additionally, through their work with angles on a line, students go on to discover that vertical angles have the same measure.

In both Lessons 10 and 11, students write addition and subtraction equations to solve unknown angle problems. Students solve these problems using a variety of pictorial and numerical strategies, combined with the use of a protractor to verify answers (**4.MD.7**).

Lesson 9

Objective: Decompose angles using pattern blocks.

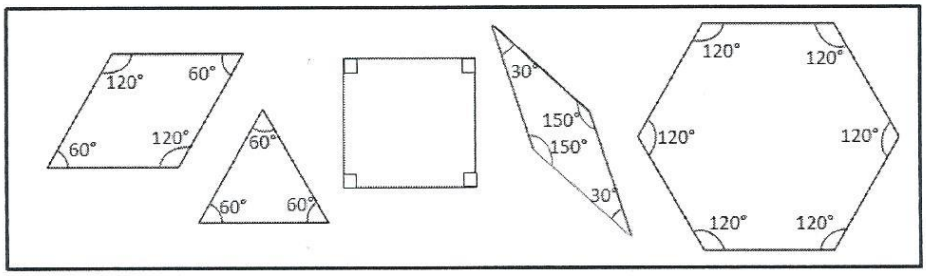
Homework Key

1. Answers will vary.
2. Answers will vary.
3. Answers will vary.
4. Answers will vary.
5. a. Answer provided
   b. 30° + 60°; 90°
   c. 120° + 60° + 30°; 210°

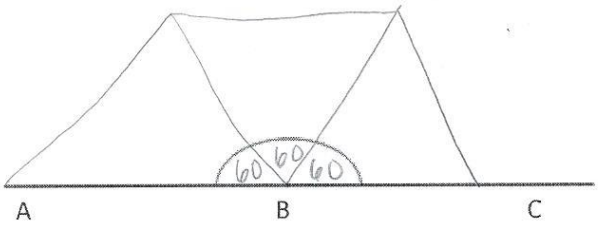
Homework Samples

Sketch two different ways to compose the given angles using two or more pattern blocks.

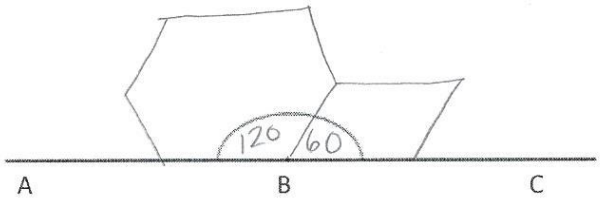
Write an addition sentence to show how you composed the given angle.



1. Points A, B, and C form a straight line.

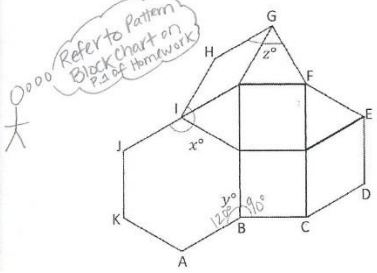


180° = 60°+60°+60°



180° = 120°+60°

5. Micah built the following shape with his pattern blocks. Write an addition sentence for each angle indicated by an arc and solve. The first one is done for you.



a. $y° = 120° + 90°$

$y° = 210°$

b. $z° =$ 60°+30°

$z° =$ 90°

c. $x° =$ _____

$x° =$ _____

Lesson 10 - 11

Objective: Use the addition of adjacent angle measures to solve problems using a symbol for the unknown angle measure.

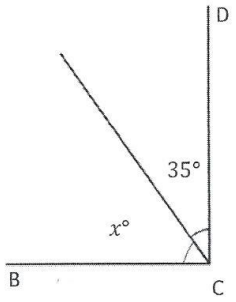
Homework Key (10)

1. 55°; 55°
2. 62° + 28° = 90°; 28°
3. 35°; 35°
4. 16°, 164°, 180°; 164°
5. Equations will vary; 75°
6. Equations will vary; 35°
7. Equations will vary; 16°
8. a. – d. Figure accurately constructed.
   e. Answers will vary.
   f. Equations will vary

Homework Samples (10)

Write an equation and solve for the measurement of $\angle x$. Verify the measurement using a protractor.

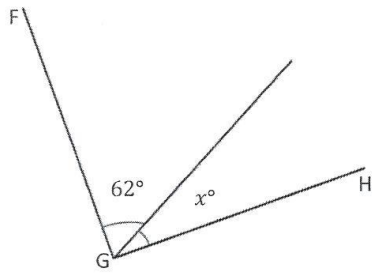
1. $\angle DCB$ is a right angle.



55° + 35° = 90°

$x°$ = 55°

2. $\angle HGF$ is a right angle.

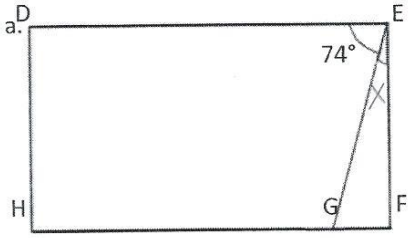


62° + 28° = 90°

$x°$ = 28°

7. In the following figure, $DEFH$ is a rectangle. Without using a protractor, determine the measurement of $\angle GEF$. Write an equation that could be used to solve the problem.

a.



<GEF is a right angle.

90° = 74° + X

16° = X

Lesson 11

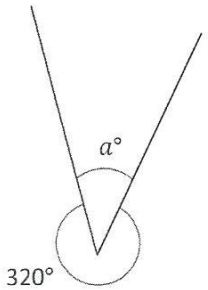
Homework Key

1. 40; 40
2. 45, 315; 315
3. 115, 100, 145, 360; 145
4. 135, 145, 80, 360; 80
5. Equations will vary; 145°; 35°
6. Equations will vary; 125°; °125°; 55°
7. Equations will vary; 44°; 46°; 134°

Homework Samples

Write an equation, and solve for the unknown angle measurements numerically.

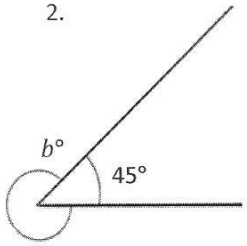
1.



40° + 320° = 360°

$a°$ = 40°

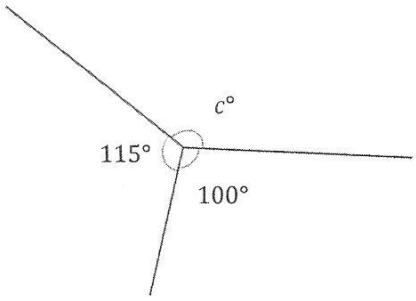
2.



315° + 45° = 360°

$b°$ = 315°

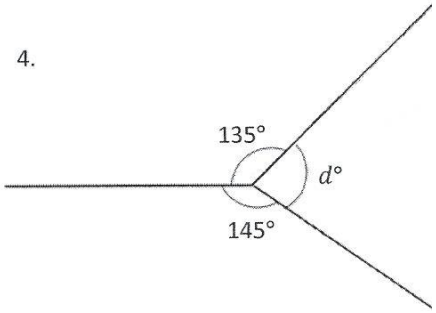
3.



115° + 100° + 145° = 360°

$c°$ = 145°

4.



____° + ____° + ____° = ____

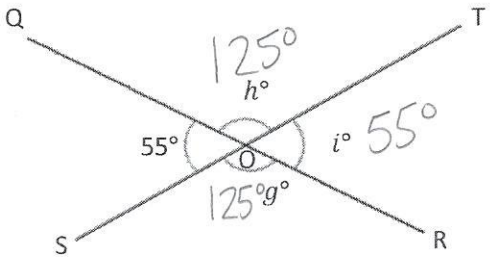
$d°$ = ____°

6. O is the intersection of $\overline{QR}$ and $\overline{ST}$. $\angle QOS$ is 55°.

$g°$ = 125° $h°$ = 125° $i°$ = 55°

$55 + g = 180$

$g = 125°$



Grade 4 Module 4 Topic D

Two-Dimensional Figures and Symmetry

Focus Standards:

4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

4.G.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry

Instructional Days Recommended: 5

An introduction to symmetry opens Topic D. In Lesson 12, students recognize lines of symmetry for two-dimensional figures, identify line-symmetric figures, and draw lines of symmetry. Given half of a figure and a line of symmetry, they draw the missing half. The topic then builds on students' prior knowledge of two-dimensional figures and allows students time to explore each figure's properties. Throughout this culminating topic, students use all of their prior knowledge of line and angle measure to classify and construct two-dimensional figures (**4.G.2**, **4.G.3**).

In Lesson 13, students are introduced to the precise definition of a triangle and further their understanding of right, acute, and obtuse angles by identifying them in triangles. They then classify triangles as right, acute, or obtuse based on angle measurements. Through a paper-folding activity with a right triangle, students see that the non-right angles of a right triangle are complementary. They also learn

that triangles can be classified as equilateral, isosceles, or scalene based on side lengths. For isosceles triangles, lines of symmetry are identified, and a folding activity demonstrates that base angles are equal. Folding an equilateral triangle highlights multiple lines of symmetry and proves that not only are all sides equal in length, but also that all interior angles have the same measure. Students apply their understanding of triangle classification in Lesson 14 as they construct triangles given a set of classifying criteria (e.g., create a triangle that is both right and isosceles).

As the topic progresses into Lesson 15, students explore the definitions of familiar quadrilaterals and reason about their attributes, including angle measure and parallel and perpendicular lines. This work builds on Grade 3 reasoning about the attributes of shapes and lays a foundation for hierarchical classification of two-dimensional figures in Grade 5. In Lesson 16, students compare and analyze two-dimensional figures according to their properties and use grid paper to construct two-dimensional figures given a set of criteria.

Lesson 12

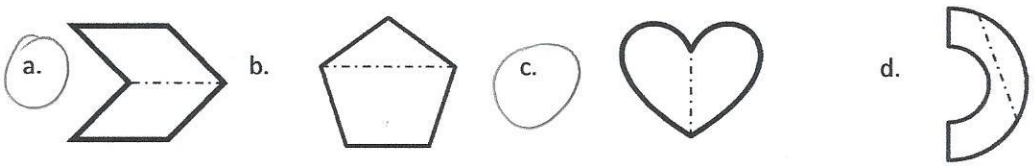
Objective: Recognize lines of symmetry for given two-dimensional figures. Identify line-symmetric figures, and draw lines of symmetry.

Homework Key

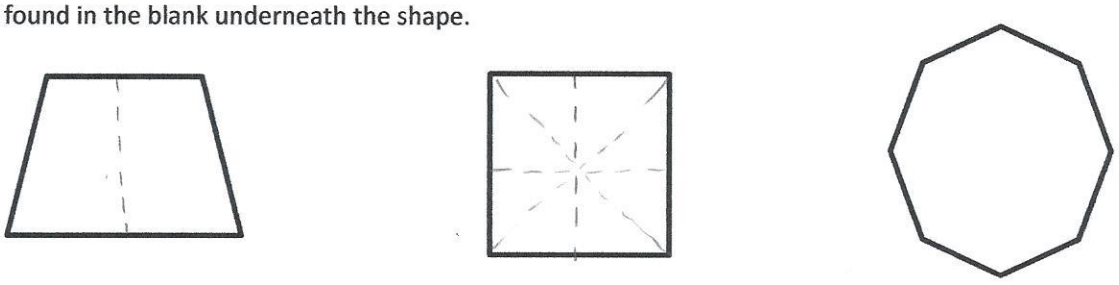
1. (a) and (c) circled
2. a. Line of symmetry accurately drawn; 1
   b. Lines of symmetry accurately drawn; 4
   c. Lines of symmetry accurately drawn; 8
   d. Line of symmetry accurately drawn; 5
   e. 0
   f. 0
   g. Lines of symmetry accurately drawn; 2
   h. Line of symmetry accurately drawn; 1
   i. Line of symmetry accurately drawn; 1
3. Symmetric figures accurately drawn
4. No; explanations will vary.

Homework Samples

1. Circle the figures that have a correct line of symmetry drawn.



2. Find and draw all lines of symmetry for the following figures. Write the number of lines of symmetry that you found in the blank underneath the shape.



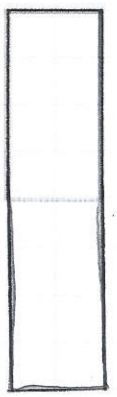
a. 1

b. 4

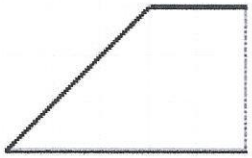
c. _____

3. Half of each figure below has been drawn. Use the line of symmetry, represented by the dashed line, to complete each figure.

a)



b)



Lesson 13

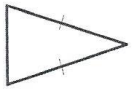
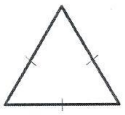
Objective: Analyze and classify triangles based on side length, angle measure, or both.

Homework Key

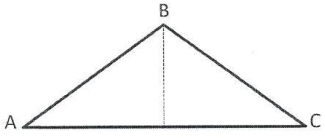
1. a. Scalene; right
   b. Scalene; obtuse
   c. Isosceles; acute
   d. Equilateral; acute
2. a. $\angle AA = \angle CC$
   b. Answers will vary.
3. Answers will vary.
4. 5 cm
5. No; explanations will vary.
6. No; explanations will vary.

Homework Samples

1. Classify each triangle by its side lengths and angle measurements. Circle the correct names.

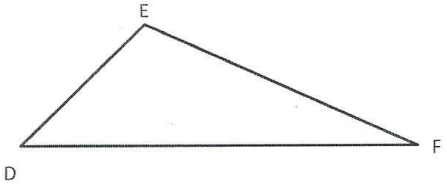
	Classify Using Side Lengths	Classify Using Angle Measurements
a. 	Equilateral Isosceles **Scalene**	Acute **Right** Obtuse
b. 	Equilateral Isosceles **Scalene**	Acute Right **Obtuse**
c. 	Equilateral **Isosceles** Scalene	**Acute** Right Obtuse
d. 	**Equilateral** Isosceles Scalene	**Acute** Right Obtuse

2. a. ΔABC has one line of symmetry as shown. Is the measure of $\angle A$ greater than, less than, or equal to $\angle C$?



$\angle A = \angle C$

b. ΔDEF is scalene. What do you observe about its angles? Explain.



Lesson 13 (continued)

5. Can a triangle have more than one obtuse angle? Explain.

No, it is not possible to draw a triangle with more than one obtuse angle.

Lesson 14

Objective: Define and construct triangles from given criteria. Explore symmetry in triangles.

Homework Key

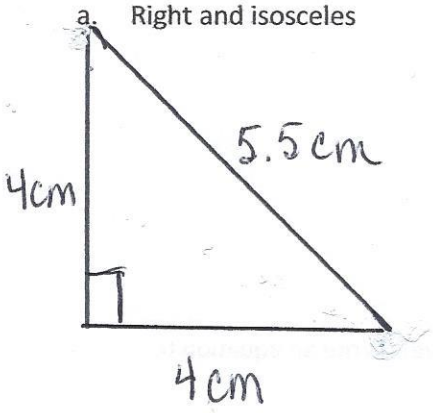
1. Triangles drawn accurately; side lengths and angles labeled
2. Lines of symmetry accurately drawn in 1(a) and 1(c); explanations will vary.
3. True; explanations will vary.
4. False; explanations will vary.
5. True; explanations will vary.
6. False; explanations will vary.

Extension: False; explanations will vary.

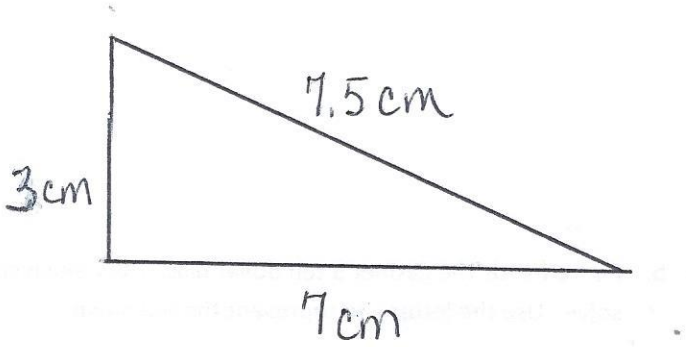
Homework Samples

1. Draw triangles that fit the following classifications. Use a ruler and protractor. Label the side lengths and angles.

a. Right and isosceles



b. Right and scalene



6. A right triangle is always scalene. True or False?

False, a right triangle can also be isosceles.

Lesson 15

Objective: Classify quadrilaterals based on parallel and perpendicular lines and the presence or absence of angles of a specified size.

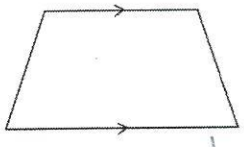
Homework Key

1. a. Trapezoid
   b. Parallelogram
   c. Square
   d. Rectangle
2. Sides of equal length; explanations will vary.
3. Four right angles; explanations will vary.
4. Two parallel pairs; explanations will vary.
5. a. Figure accurately constructed; square
   b. Figure accurately constructed; parallelogram (or rectangle or square)
   c. Figure accurately constructed; trapezoid
   d. Figure accurately constructed; rectangle (or square)

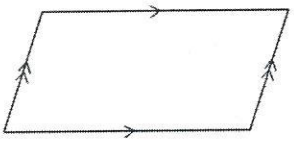
Homework Samples

1. Use the word bank to name each shape, being as specific as possible.

Parallelogram	Trapezoid	Rectangle	Square

a. 

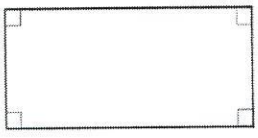
Trapezoid

b. 

Parallelogram

c. 

Square

d. 

Rectangle

2. Explain the attribute that makes a square a special rectangle.

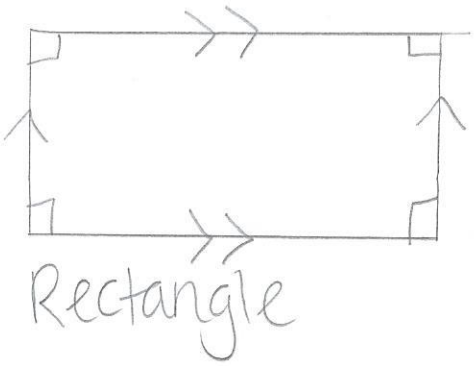
All four sides are equal length.

Lesson 15 (continued)

5. Construct the following figures based on the given attributes. Give a name to each figure you construct. Be as specific as possible.

   a. A quadrilateral with four sides the same length and four right angles.

   b. A quadrilateral with two sets of parallel sides.



Lesson 16

Objective: Reason about attributes to construct quadrilaterals on square or triangular grid paper.

Homework Key

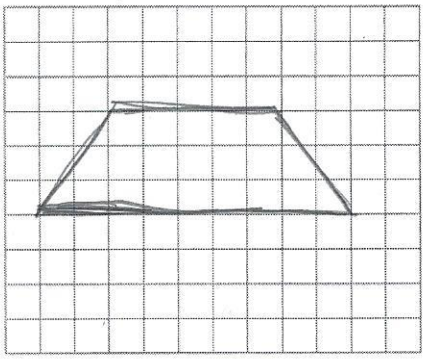
1. Figure accurately constructed; figures will vary; trapezoid
2. Figure accurately constructed; figures will vary; trapezoid
3. Figure accurately constructed; figures will vary; parallelogram, rectangle, square, or rhombus
4. Figure accurately constructed; figures will vary; rhombus or square
5. Figure accurately constructed; figures will vary; square

Homework Sample

Use the grid to construct the following. Name the figure you drew using one of the terms in the word box.

1. Construct a quadrilateral with only one set of parallel sides.

   Which shape did you create? Trapezoid



WORD BOX
Parallelogram
Trapezoid
Rectangle
Square
Rhombus