Grade 4 - Module 4: Angle Measure and Plane Figures

- Acute angle (angle with a measure of less than 90 degrees)

- Angle (union of two different rays sharing a common vertex)

- Complementary angles (two angles with a sum of 90 degrees)

- Equilateral triangle (triangle with three equal sides)

- Intersecting lines (lines that contain at least one point in common)

- 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, B, together with the set of points on the line Between)

- 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.)

- Point (precise location in the plane)

- Ray (The ray $\overrightarrow{OA}$ is the point O and the set of all points on the line $\overleftrightarrow{OA}$ that are on the same side of O as the point A.)

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

- Supplementary angles (two angles with a sum of 180 degrees)

- 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)

Topic A: Lines and Angles

A Teaching Sequence Towards Mastery of Lines and Angles

Objective 1: Identify and draw points, lines, line segments, rays, and angles and recognize them in various contexts and familiar figures.
(Lesson 1)

Objective 2: Use right angles to determine whether angles are equal to, greater than, or less than right angles. Draw right, obtuse, and acute angles.
(Lesson 2)

Objective 3: Identify, define, and draw perpendicular lines.
(Lesson 3)

Objective 4: Identify, define, and draw parallel lines.
(Lesson 4)

- draw points, lines, line segments, and rays and identifying these in various contexts and within familiar figures

- recognize that two rays sharing a common endpoint form an angle

- 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.

- use their understanding of angles to explore relationships between pairs of lines as they define, draw, and recognize intersecting, perpendicular, and parallel lines

- knowledge of right angles leads them to identify and define as well as construct perpendicular lines.

- Learn lines that never intersect also have a special relationship and are called parallel.

- Activities using different grids give students the opportunity to explore the concepts of perpendicularity and parallelism while answering such questions as, "Can you find a non-rectangular parallelogram on a rectangular grid?" and "Can you find a rectangle on a triangular grid?"

Topic B: Angle Measurement

- 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

- Students apply this understanding as they discover that a right angle measures 90 degrees and, in turn, that the angles they know as acute measure less than 90 degrees, and obtuse angles measure more than 90 degrees.

- Students realize that although the size of a circle may change, an angle spans an arc representing a constant fraction of the circumference.

- Armed with their understanding of the degree as a unit of measure, students use various protractors to measure angles to the nearest degree and sketch angles of a given measure

- The idea that an angle measures the amount of "turning" in a particular direction is explored as students recognize familiar angles in varied contexts 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 (This provides a link to Grade 3 work with fractions, as students reason that a ¼ turn is a right angle and measures 90, a ½ turn measures 180, and a ¾ turn measures 270)

Topic C: Problem Solving with the Addition of Angle Measures

A Teaching Sequence Towards Mastery of Problem Solving with the Addition of Angle Measures

Objective 1: Decompose angles using pattern blocks.
(Lesson 9)

Objective 2: Use the addition of adjacent angle measures to solve problems using a symbol for the unknown angle measure.
(Lessons 10–11)

- Students use concrete examples to discover the additive nature of angle measure. Working with pattern blocks in Lesson 9, they see that the measures of all of the angles at a point, with no overlaps or gaps, add up to 360 degrees, 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 degrees (supplementary angles) and that the measures of two angles meeting to form a right angle add up to 90 degrees (complementary angles).

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

- In both Lesson 10 and Lesson 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 begins by decomposing 360 degrees 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 degrees. With this new understanding, students now discover that the combined measure of two adjacent angles on a line is 180 degrees (supplementary angles), that the combined measure of two angles meeting to form a right angle is 90 degrees (complementary angles), and that vertically opposite angles have the same measure. These properties are then used to solve unknown angle problems

Topic D: Two-Dimensional Figures and Symmetry

A Teaching Sequence Towards Mastery of Two-Dimensional Figures and Symmetry

Objective 1: Recognize lines of symmetry for given two-dimensional figures; identify line-symmetric figures and draw lines of symmetry.
(Lesson 12)

Objective 2: Analyze and classify triangles based on side length, angle measure, or both.
(Lesson 13)

Objective 3: Define and construct triangles from given criteria. Explore symmetry in triangles.
(Lesson 14)

Objective 4: Classify quadrilaterals based on parallel and perpendicular lines and the presence or absence of angles of a specified size.
(Lesson 15)

Objective 5: Reason about attributes to construct quadrilaterals on square or triangular grid paper.
(Lesson 16)

- Lesson 12 is an introduction to symmetry, where 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

- 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 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.