Unit 3: Geometry

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 9**
Length: **6 weeks**
Status: **Published**

Unit Overview

Students will begin this unit by reviewing the properties of complementary, supplementary, and vertical angles. They will also discover the properties of angles formed by parallel lines and a transversal. They will be able to identify corresponding, alternate interior, and alternate exterior angles. Students will learn to use algebra and the fact that the sum of the angles in a triangle equals 180 degrees to find missing angle measurements in triangles. Then, they will apply this to finding the sum of the interior and exterior angles of any polygon. Next, students will be introduced to the four types of transformations. Students will see these transformations in various contexts including on a coordinate grid. Next, students will review the types of solid figures and learn how to calculate the volume of them. Volume of circular solid figures will be focused upon, however volume of prisms and pyramids will be reviewed as well. Finally, students will learn about the Pythagorean Theorem and utilize it in order to find the missing sides of right triangles. Real-world problem solving will be integrated throughout this unit.

Standards

MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations:
MA.8.G.A.1a	Lines are transformed to lines, and line segments to line segments of the same length.
MA.8.G.A.1b	Angles are transformed to angles of the same measure.
MA.8.G.A.1c	Parallel lines are transformed to parallel lines.
MA.8.G.A.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
MA.8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
MA.8.G.A.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
MA.8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the

	angle-angle criterion for similarity of triangles.
MA.8.G.B	Understand and apply the Pythagorean Theorem.
MA.8.G.B.6	Explain a proof of the Pythagorean Theorem and its converse.
MA.8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
MA.8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
MA.8.G.C	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Essential Questions

- In what jobs will you use the concepts of geometry, and how will you use them?
- How are we able to build upon our previously-acquired knowledge of equations and apply it to geometry?
- How is it possible that by knowing that the angles in a triangle add up to 180 degrees, we can find out the sum of the angles of any polygon?
- In what practical ways is it important to know the volume of a solid?

Application of Knowledge: Students will know that...

- a dilation is when a figure is "shrunk" or "expanded", which then produces a similar figure.
- a reflection is a "flip" that produces a congruent figure.
- a rotation is a "turn" that produces a congruent figure.
- a translation is a "slide" that produces a congruent figure.
- alternate exterior angles are congruent when the angles are formed by parallel lines.
- alternate interior angles are congruent when the angles are formed by parallel lines.
- complementary angles add up to 90 degrees.
- corresponding angles are congruent when the angles are formed by parallel lines.
- supplementary angles add up to 180 degrees.
- the pre-image is the picture of the original figure and the image is the picture of the figure after a transformation.
- the Pythagorean Theorem is a^2 + b^2 = c^2 and can only be used for right triangles.
- the sum of the angles in a triangle equals 180 degrees.
- the sum of the exterior angles of a polygon is equal to 360 degrees.
- the sum of the interior angles in a polygon can be found by the formula 180(n - 2) where n is the number of sides that the polygon has.
- the volume of a cone is found by V = 1/3 x pi x r^2 x h, where r is the radius and h is the height.
- the volume of a cylinder is found by V = pi x r^2 x h, where r is the radius and h is the height.

- the volume of a prism is found by V = Bh, where B is the area of the base and h is the height.
- the volume of a pyramid is found by V = 1/3 Bh, where B is the area of the base and h is the height.
- the volume of a sphere is found by V = 4/3 x pi x r^3, where r is the radius.
- vertical angles are congruent.

Application of Skills: Students will be able to...

- apply their knowledge of complementary and supplementary angles to find missing angle measures by setting up an equation.
- calculate missing angle measures by identifying the relationship between different angles.
- calculate the measure of an exterior angle of any regular n-sided polygon.
- calculate the missing angles in triangles.
- calculate the missing sides of right triangles by utilizing the Pythagorean Theorem.
- calculate the sum of the interior angles of any n-sided polygon.
- calculate the volume of three-dimensional solid figures.
- complete a translation, reflection, rotation, dilation, or a series of transformations on a two-dimensional figure.
- discover the image points of a figure after a given transformation by following mathematical rules.

Assessments

- Do-Nows: These daily assessments will be used to check for prior knowledge and to determine mastery of particular topics. If needed, remediation will be completed on an as needed basis.
- Communicator practice: This will be used as a quick whole-class assessment tool to check for complete comprehension.
- Exit Tickets: These will be used to measure student understanding of the lesson and assist in determining whether remediation is needed for the topic.
- Volume Stations: An activity that can be used as a summative assessment (see description in activity section).
- Pythagorean Theorem Stations: An activity that can be used as a summative assessment (see description in activity section).
- Practice using IXL
- Mid-Unit Quiz
- Unit Test
- Information from this unit will be included on a locally developed, mid-year or end of year benchmark assessment that may take the form of a test, performance based project, or other summative assessment.

Suggested Activities

- Grade 8 Digits Topics 9 - 13 Launches

- Investigations: Students will use examples of the topic being studied as well as a protractor and ruler in order to discover properties of geometric figures. For example, students could be given a diagram of a pair of parallel lines with an intersecting transversal and be asked to measure the resulting eight angles. Then they would be asked to find the relationship for corresponding, alternate interior, and alternate exterior angles.
- Student-centered SMART Board lessons: including interactive protractor for measuring angles to prove angle relationships and the sum of the angles in triangles and using flipping and rotation tools and large coordinate graphs for transformations
- Review games using Communicators
- Crane Game (for introduction to translations): Place an object on the floor and let the tiles represent one unit. The class is then to pretend they are "crane game operators" and give instructions for a student to walk to retrieve the object as if they were a crane (i.e. "Move 3 up and 4 to the left").
- Volume Stations: Students will work cooperatively on completing math stations. At each station, students will need to solve a multi-step word problem involving volume.
- Pythagorean Theorem Stations: Students will work cooperatively on completing math stations. At each station, students will need to solve a multi-step word problem involving the Pythagorean Theorem.

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments

- Content specific modifications may include:
    - Provide personal handout for integer rules
    - Provide graphic organizer for angle relationships
    - Provide coordinate planes in which the x and y-axis go from -5 to 5 rather than -10 to 10 for transformations
    - Provide personal handout with names and examples of each solid figure to assist in identifying a solid
    - Provide students with a formula sheet with one type of problem for each formula worked out for them already.
    - Provide completed problems for practice work and homework

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher

- Content specific vocabulary important for ELL students to understand include: angle, right angle, straight angle, parallel, interior, exterior, triangle, sum, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon, slide, turn, flip, shrink, expand, figure, congruent, similar, prism, pyramid, cylinder, cone, sphere, volume, area, base, right triangle, hypotenuse

Differentiation to extend learning for gifted students may include:

- Write equations for word problems that require variables to be on both sides of the equal sign
- For angle relationship and triangle problems, provide expressions containing rational numbers
- For transformations, give coordinates of image and list of multiple transformations completed and ask students to find the coordinates of the pre-image.
- For volume, find the volume of complex figures (i.e. find the volume of a castle made completely of solid figures).
- For Pythagorean Theorem, integrate speed into the problems to find how long it would take something to move along the path of the hypotenuse or legs.

Technology Integration

- iPads or Chromebooks as appropriate to the activity.
- Online learning components including use of the Digits digital textbook and resources.
- Teacher integration of the SMART board to facilitate active student engagement throughout the course of the lesson.
- Software or online programs that teachers may use to create students materials or generate problems such as Kuta software.
- Additional practice provided through the use of IXL.

Integrated/Cross-Disciplinary Instruction

- **ELA:** Practice formulating complete and grammatically correct responses to open-ended questions.
- **Physical Education:** Students will engage in physical responses required to complete certain tasks. This will include the human crane game.
- **Art:** Students will utilize methods to create congruent and similar figures. They will also recognize how symmetry is utilized with reflections.
- **Architecture:** Students will utilize skills and concepts learned about volume and apply it to construction and architecture.

Resources

- Digits student access and support: www.MyMathUniverse.com
- Digits teacher materials and support: www.pearsonrealize.com
- IXL: www.ixl.com
- SMART Exchange: http://exchange.smarttech.com/index.html#tab=0
- SMART Board lessons
- Coordinate graph worksheets
- Interior angles exploratory activity
- Hands-on solids and net shapes
- Punchline/Pizzazz worksheets (self-correcting)
- Kuta software generated worksheets

21st Century Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.