

Green Township School District Gr. 8 Math Curriculum - July 2018

Unit 3: Similarity & Introduction to Pythagorean Theorem (Approximate Instructional Time: 3 weeks)

NJ Student Learning Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills <i>(Learning goals are for the Unit but may not necessarily be in sequential order.)</i>
8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> • <i>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.</i> <p>Students are able to:</p> <ul style="list-style-type: none"> • Describe, using coordinates, the resulting two-dimensional figure after applying dilations with scale factor greater than, less than, and equal to 1. • Describe, using coordinates, the resulting two-dimensional figure after applying translation, rotation, and reflection. <p>Learning Goal 1: Use the coordinate plane to locate images or pre-images of two dimensional figures and determine the coordinates of a resultant image after applying dilations, rotations, reflections, and translations.</p>
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	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> • <i>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.</i> • <i>Congruent figures are also similar.</i> <p>Students are able to:</p> <ul style="list-style-type: none"> • Describe a transformation or sequence of transformations that show the similarity between them given two similar two-dimensional figures. <p>Learning Goal 2: Apply an effective sequence of transformations to determine that figures are similar when corresponding angles are congruent and corresponding sides are proportional.</p> <p>Learning Goal 3: Write similarity statements based on such transformations.</p>

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<p>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. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i></p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments and critique the reasoning. of others.</p>	<p>Concept(s): <i>Foundations of theorems for similarity of triangles.</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> Give informal arguments to establish the angle-angle criterion for similarity of triangles. <p>Learning Goal 4: Give informal arguments to justify facts about the angle-angle relationship used to determine similar triangles.</p>
<p>8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.</p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concept(s)</p> <ul style="list-style-type: none"> <i>Pythagorean Theorem</i> <i>If the square of one side of a triangle is equal to the sum of the squares of the other two sides, then the triangle is a right triangle (Pythagorean theorem converse).</i> <p>Students are able to:</p> <ul style="list-style-type: none"> Given a proof of the Pythagorean theorem, explain the proof. Given a proof of the converse of the Pythagorean theorem, explain the proof. <p>Learning Goal 5: Use what is known about similarity of triangles to explain a proof of the Pythagorean Theorem.</p> <p>Learning Goal 6: Understand and be able to solve problems involving the converse of the Pythagorean Theorem.</p>
<p>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.</p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.7 Look for and make use of structure</p>	<p>Concept: <i>Pythagorean Theorem</i></p> <p>Students are able to:</p> <ul style="list-style-type: none"> Determine side lengths of right triangles by applying the Pythagorean Theorem to solve real world and mathematical problems involving two dimensional spaces. Determine side lengths of right triangles by applying the Pythagorean Theorem to solve real world and mathematical problems involving three dimensional spaces. <p>Learning Goal 6: Apply the Pythagorean Theorem to determine unknown side lengths of right triangles in two dimensional objects when solving real world and mathematical problems.</p>
<p>8.G.B.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system</p>	<p>MP.2 Reason abstractly and quantitatively.</p>	<p>Concept(s) <i>Pythagorean Theorem</i></p> <p>Students are able to:</p>

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	<p>MP.7 Look for and make use of structure</p>	<ul style="list-style-type: none"> • Determine the distance between two points in a coordinate plane by drawing a right triangle and applying the Pythagorean Theorem. <p>Learning Goal 7: Use the Pythagorean Theorem to determine the distance between two points in the coordinate plane.</p>
<p><u>Interdisciplinary Connections:</u></p> <p><u>NGSS Appendix for Alignment</u></p>	<p><u>Science:</u> MS Science standards do not overlap with concepts in this unit.</p> <p><u>English-Language Arts:</u></p> <p>RI.8.4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.</p> <p>RI.8.5. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept.</p> <p>RI.8.6. Determine an author’s point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.</p> <p>RI.8.7. Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.</p> <p>W.8.2. Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.</p> <p>A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).</p> <p>B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.</p> <p>C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.</p> <p>D. Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p>E. Establish and maintain a formal style/academic style, approach, and form.</p> <p>F. Provide a concluding statement or section that follows from and supports the information or explanation presented.</p> <p>W.8.4. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)</p> <p>W.8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.</p> <p>W.8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.</p> <p>W.8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</p> <p>SL.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</p> <p>A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <p>B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</p> <p>C. Pose questions that connect the ideas of several speakers and respond to others’ questions and comments with relevant evidence, observations, and ideas.</p>	

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	<p>D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</p> <p>SL.8.2. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.</p> <p>SL.8.3. Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.</p> <p>SL.8.5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>
<p><u>21st Century Skills/ Career Ready Practices:</u></p>	<p>CRP1. Act as a responsible and contributing citizen and employee.</p> <ul style="list-style-type: none"> ● Students will learn to work respectfully in groups within the classroom. <p>CRP2. Apply appropriate academic and technical skills.</p> <ul style="list-style-type: none"> ● Students will use technology to enhance conceptual understanding that distance is preserved when an object or line is translated on a plane or coordinate plane. <p>CRP4. Communicate clearly and effectively and with reason.</p> <ul style="list-style-type: none"> ● In line with the mathematical practices, students will explain and defend their reasoning when working on tasks in class and support this reasoning with evidence either verbally or in writing. <p>CRP6. Demonstrate creativity and innovation.</p> <ul style="list-style-type: none"> ● Through the course of real world applications and use of the Pythagorean Theorem, students will determine how the theorem can be used to informally measure distances that are too large for standard measurement tools. ● Students are encouraged to look at more than one way to solve a problem. This is evident through tasks that require the mathematical practice: modeling with mathematics. <p>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</p> <ul style="list-style-type: none"> ● Students will be prompted to explore and determine informal proofs of the Pythagorean Theorem using similarity of triangles, and when looking at the converse of the Pythagorean Theorem. <p>CRP9. Model integrity, ethical leadership and effective management.</p> <ul style="list-style-type: none"> ● Students will learn time management skills when given both short-term and long-term tasks to complete. ● Students will learn leadership skills when working with groups. ● Students model integrity when completing assignments independently. <p>CRP11. Use technology to enhance productivity.</p> <ul style="list-style-type: none"> ● Students will use technology (calculator, online geometry software and other resources) to transform objects and determine an informal proof of the Pythagorean Theorem. ● Students will use technology (calculator, online geometry software and other resources) to dilate objects. <p>CRP12. Work productively in teams while using cultural global competence.</p> <ul style="list-style-type: none"> ● When working in groups, students will be encouraged to include all members and to encourage the contribution of all members.
<p><u>2014 NJ Technology Standards:</u></p>	<p>8.1 Educational Technology (Word PDF)</p> <p>All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.</p> <ul style="list-style-type: none"> ● 8.1.8.A.1: Students will use technology (calculators, online geometry software and other resources) to dilate objects. ● 8.1.8.A.1: Students will use technology (calculators, online geometry software and other resources) to transform objects and

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determine an informal proof of the Pythagorean Theorem.

- **8.1.8.A.3:** Students may use a simulation that provides an environment to solve a real world problem or theory, namely the Pythagorean Theorem.

8.2 Technology Education, Engineering, Design and Computational Thinking - Programming

([Word](#) | [PDF](#))

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

- **8.2.8.E.3:** Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution. (Students should use a spreadsheet to explore the calculation functions and the Pythagorean Theorem to meet this standard.)

Please see relevant projects for technology standards [8.1](#) and [8.2](#):

District/School Primary and Supplementary Resources	
<p>Primary Resource:</p> <p><u>Eureka Math (Unbound Ed - Module 3)</u></p> <p><u>Eureka Math (Unbound Ed - Module 7)</u></p>	<p>Supplementary Resources:</p> <p><i>Algebra I</i> (Glencoe 2018)</p> <p><i>Larsen Pre-Algebra</i> (Houghton Mifflin Harcourt 2012) <i>Chapter 12</i></p> <p><i>NJ Progress for Grade 8</i> (William H. Sadlier 2014) Unit 4: Lessons 28 - 29; 33</p> <p><i>Understanding Algebra I</i> (The Critical Thinking Company)</p> <p><u>Open Up Resources Online Curriculum</u></p> <p>Video that demonstrates Pythagorean Theorem proof using similar triangles: <u>http://www.youtube.com/watch?v=QCyvXYLFSfU</u></p> <p>Khan Academy <u>Desmos: Exploring Lengths with (Online) Geoboards</u></p> <p>In this activity, students use Desmos-powered geoboards to explore length and to further develop their proficiency with the Pythagorean theorem. Students should already have some experience with the Pythagorean theorem.</p> <p>Project involving Spreadsheets and the Pythagorean Theorem (Can cover Units 2 & 3) Project involving Transformations.</p> <p>Performance Tasks are available for use from the following sites:</p>

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	Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month YouCubed Tasks PARCC Released test items- Grade 8
Materials:	Suggested Tasks for Use During Unit
<ul style="list-style-type: none"> <input type="checkbox"/> Transparency or patty paper <input type="checkbox"/> Wet or dry erase markers for use with transparency <input type="checkbox"/> Geometry software (optional) <input type="checkbox"/> Ruler <input type="checkbox"/> Protractor 	<p>8.G.A.3 Effects of dilations on length, area and angles More TBD as lesson planning commences</p>
District/School Formative Assessment Plan	District/School Summative Assessment Plan
<ul style="list-style-type: none"> ● Teacher observation of students engaged in group and independent activities. ● Individual and small group conferences/interviews to assess understanding with rubric ● Self-assessment by students with guidance from teacher. ● Eureka Math Sprints ● Exit tickets 	<ul style="list-style-type: none"> ● Teacher created assessments and projects ● Eureka Math Mid- and End- Module Assessments (Constructed response item with rubric) ● Teacher/District created Quarterly Assessments ● Project on the use of water bottles Students should investigate how many water bottles are purchased versus recycled and use scientific notation to demonstrate understanding of the magnitude of numbers; extend to explore the impact on the environment and solutions to lessen the impact on the environment in our community.
Instructional Best Practices and Exemplars	Mathematical Terms/Vocabulary
<ul style="list-style-type: none"> ● Facilitate partner and group collaborations ● Inquiry based tasks introduced before direct teaching ● Small and large group discussions ● Have students use a variety of representations or methods to show and explain their understanding. ● Build fluency over time. 	<ul style="list-style-type: none"> ● Scale factor: the number used to multiply the lengths of a figure to make it smaller or larger. ● Scale Drawing ● Dilation: Dilation, D, is a transformation of the plane with center C and scale factor k ($k > 0$). If $D(P) = P'$ and if $C \neq P$, then the point P', to be denoted by P', is the point on the ray \overrightarrow{CP}, so that $CP' = k CP$. If the scale factor $k \neq 1$, then a dilation in

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the coordinate plane is a transformation that shrinks or magnifies a figure by multiplying each coordinate of the figure by the scale factor.

- **Congruence:** A finite composition of basic rigid motions—reflections, rotations, translations—of the plane. Two figures in a plane are congruent if there is a congruence that maps one figure onto the other figure.
- **Similar:** Two figures in the plane are similar if there exists a similarity transformation taking one figure to the other.
- **Similarity Transformation:** A similarity transformation, or similarity, is a composition of a finite number of basic rigid motions or dilations. The scale factor of a similarity transformation is the product of the scale factors of the dilations in the composition; if there are no dilations in the composition, the scale factor is defined to be 1.
- **Similarity:** A similarity is an example of a transformation.

Focus Mathematical Concepts

Grade Level Fluency Requirement:

- ❖ *Concepts related to linear algebra and linear functions*

Mathematical Practices Applied to this Unit

MP 3: Construct viable arguments and critique the reasoning of others. Many times in this module, students are exposed to the reasoned logic of proofs. Students are called on to make conjectures about the effect of dilations on angles, rays, lines, and segments, and then they must evaluate the validity of their claims based on evidence. Students also make conjectures about the effect of dilation on circles, ellipses, and other figures. Students are encouraged to participate in discussions and evaluate the claims of others.

MP 4: Model with mathematics. This module provides an opportunity for students to apply their knowledge of dilation and similarity in real-world applications. Students will use shadow lengths and a known height to find the height of trees, the distance across a lake, and the height of a flagpole.

MP 6: Attend to precision. Attend to precision. To communicate precisely, students will use clear definitions in discussions with others and in their own reasoning with respect to similar figures. Students will use the basic properties of dilations to prove or disprove claims about a pair of figures. Students will incorporate their knowledge about basic rigid motions as it relates to similarity, specifically in the description of the sequence that is required to prove two figures are similar.

MP 7: Look for and make use of structure. Through the exploration and use of the Pythagorean Theorem, students begin to work with the concepts of taking the square root of both sides of an equation or squaring both sides of an equation as a strategy for solving a problem. This concept is foundational for work in Algebra 1.

MP 8: Look for and express regularity in repeated reasoning. Students will look at multiple examples of dilations with different scale factors. Then students explore dilations to determine what scale factor to apply to return a figure dilated by a scale factor \square to its original size.

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Prerequisite skills & Foundational Standards

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $3/4$ cup of flour for each cup of sugar.” “We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger.” (Unit rates in are not limited to non-complex fractions in Grade 8.)

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7.RP.A.2 Recognize and represent proportional relationships between quantities.

a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.

d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.

7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Draw, construct, and describe geometrical figures and describe the relationships between them.

7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

7.G.A.2 Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities

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- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).
- Activities defined as “Gold” require more advanced logic and reasoning skills and will be provided as additional or replacement work on a weekly basis.
- Coordination with the G&T teacher in order to supplement the math curriculum as needed.

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of class notes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(possible appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.

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- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of class notes
- Preferential seating to be mutually determined by the student and teacher
- Establish expectations for correct spelling on assignments.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests and check Google classroom for updates and assignments
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of class notes
- Preferential seating to be mutually determined by the student and teacher
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests

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- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
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