## Englewood Public School District <br> Geometry <br> Third Marking Period

## Unit 3: Similarity, Right Triangles and Trig, and Transformations

Overview: During this unit, students will understand similarity, the relationships between side lengths in a right triangle and their application to trigonometry, and transformations.

Time Frame: 43 to 47 Days

## Enduring Understandings:

- Proportions can be set up and solved using corresponding sides of similar polygons.
- Two triangles are similar if certain relationships exist between two or three pairs of corresponding parts.
- Triangles can be sketched and labeled separately in the same orientation to see how the sides and vertices correspond.
- The Pythagorean Theorem and trigonometric ratios can be used to find the length of a side or measure of an angle in a right triangle.
- The Law of Sines and Law of Cosines can be used to find the length of a side or measure of an angle in any triangle.
- A trigonometric ratio compares the lengths of two sides of a right triangle.
- The trigonometric ratios remain constant within a group of similar right triangles.
- A figure that is translated, reflected, or rotated maintains its size and shape. A dilated figure is enlarged or reduced.
- A transformation in the coordinate plane can be shown by graphing a figure and its image.
- If two figures are congruent, then you can visualize a congruence transformation that maps one figure onto the other.
- If two figures are similar, then you can visualize a composition of rigid motions and dilations that map one figure onto another.
- The area of a polygon or the circumference of a circle can be round by determining the formula and then substituting the measures into the formula.
- The perimeters of similar polygons are proportional to the ratio of corresponding measures.
- The areas of similar polygons are proportional to the square of the ratio of corresponding measures.


## Essential Questions:

- How do you use proportions to find side lengths in similar polygons?
- How do you show two triangles are similar?
- How do you identify corresponding parts of similar triangles?
- How do you find a side length or angle measure in a right triangle?
- How do trigonometric ratios relate to similar right triangles?
- How can you change a figure's position without changing its size and shape?
- How can you change a figure's size without changing its shape?
- How can you represent a transformation in a coordinate plane?
- How do you recognize congruence and similarity in figures?
- How do you find the area of a polygon or find the circumference and area of a circle?
- How do perimeters and areas of similar polygons compare?

| Standards | Topics and Objectives | Activities | Resources | Assessments |
| :---: | :---: | :---: | :---: | :---: |
| MP1, MIP2, MP3, MP4, MP5, MP6, MP7, MP8 <br> G-CO.A. 1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. <br> G-CO.A. 2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not G-CO.A. 4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments G-CO.A. 5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, | Topics <br> Similarity, Pythagorean Theorem and its Converse, Trigonometry, Laws of Sines and Cosines, <br> Transformations, Area <br> Twenty-First Century Themes and Skills includes: <br> - Creativity and Innovation <br> - Critical Thinking and Problem Solving <br> - Communication and Collaboration <br> Objectives <br> Students will <br> - Write ratios and solve proportions <br> - Identify and apply similar polygons <br> - Use the AA Postulate, SAS, and SSS theorems and use similarity to find indirect measurements <br> - Find and use relationships in similar right triangles <br> - Use the side splitter and triangle-angle-bisector theorem <br> - Use the Pythagorean theorem and its converse | Standards Solution Common Core Geometry Lessons: <br> - Applications of the Pythagorean Theorem and Foundational Trigonometry <br> - Dilations to Discover properties of Similar Triangles <br> - Discovering More Properties of Similar Triangles <br> - Transformations: Rotations, Reflections, and Translations <br> Fixed Points of Rigid Motions https://www.illustrativemath ematics.org/contentstandards/HSG/CO/A/2/tasks /1545 <br> Seven Circles II https://www.illustrativemath ematics.org/contentstandards/HSG/CO/A/3/tasks $\underline{1708}$ <br> Symmetries of a Quadrilateral I https://www.illustrativemath ematics.org/contentstandards/HSG/CO/A/3/tasks /1471 | Pearson Realize Chapters <br> $7,8,9$, and 10 <br> Standards Solution <br> Common Core Lessons <br> Illustrative Mathematics https://www.illustrativemat hematics.org/ <br> National Library of Virtual <br> Manipulatives <br> http://nlvm.usu.edu/ <br> Alabama Learning <br> Exchange <br> http://alex.state.al.us/search <br> .php?fa_submit=ALLPLA <br> NS <br> Arizona Math Flipbook <br> http://www.azed.gov/azco <br> mmoncore/files/2012/11/hi <br> gh-school-ccss-flip-book- <br> usd-259-2012.pdf <br> NYC Department of <br> Education <br> http://schools.nyc.gov/defa ult.htm <br> Mathematics Assessment <br> Project <br> http://map.mathshell.org/ | Formative Assessments: <br> Textbook Pages 459, 483, 484, 515, 537, <br> 538, 577, 607, 608, <br> 642, 681, 682 <br> Math journal <br> (NJSLSA.R1, <br> NJSLSA.W2, <br> NJSLSA.L1, SL.9- <br> 10.4, NJSLSA.L6) <br> Summative <br> Assessments: <br> Multiple choice / short answer assessments <br> (CRP2, CRP4, CRP8) <br> Chapter quizzes/tests <br> - Pearson <br> Realize <br> - MathXL <br> Grade 10 Geometry <br> Common Core <br> Assessment 3, <br> Standards Solution <br> Benchmark <br> Assessment: <br> Common Formative <br> Assessment <br> Alternative |



| circle. |
| :--- |
| G-SRT.A. 2 Given two |
| figures, use the definition of |
| similarity in terms of |
| similarity transformations |
| to decide if they are |
| similar; explain using |
| similarity transformations |
| the meaning of similarity |
| for triangles as the equality |
| of all corresponding pairs |
| of angles and the |
| proportionality of all |
| corresponding pairs of |
| sides. |
| G-SRT.A. 3 Use the |
| properties of similarity |
| transformations to establish |
| the AA criterion for two |
| triangles to be similar |
| G-SRT.B. 4 Prove theorems |
| about triangles |
| G-SRT.B. 5 Use congruence |
| and similarity criteria for |
| triangles to solve problems |
| and to prove relationships |
| in geometric figures |
| G-SRT.C. 7 Explain and use |
| the relationship between the |
| sine and cosine of |
| complementary angles |
| G-SRT.C. 8 Use |
| trigonometric ratios and the |
| Pythagorean Theorem to |
| solve right triangles in |
| applied problems |
| G-SRT.D. 9 Derive the |
| formula $A$ |
| for the area of a triangle by |
| drawing an auxiliary line |

- Use trigonometry to find the area of regular polygons and triangles standards/HSG/CO/A/5/tasks 131

Reflections and Equilateral Triangles
https://www.illustrativemath ematics.org/content-
standards/HSG/CO/B/tasks/9 82

Reflections and Equilateral Triangles II
https://www.illustrativemath ematics.org/contentstandards/HSG/CO/B/tasks/9 84

Reflections and Isosceles
Triangles
https://www.illustrativemath ematics.org/content-
standards/HSG/CO/B/tasks/9 83

Dilating a Line
https://www.illustrativemath
ematics.org/content-
standards/HSG/SRT/A/1/task s/602

Congruent and Similar
Triangles
https://www.illustrativemath ematics.org/contentstandards/HSG/SRT/A/2/task s/1901

Similar Quadrilaterals
https://www.illustrativemath

- Use segment and area models to find the probabilities of events


## 3

Worksheets / assessment items for all topics based on standards:
http://jmap.org/JMAP_RE SOURCES_BY_TOPIC.ht m\#AI
(CRP2, CRP4, CRP8, 9.3.ST.2, 9.3.ST-ET.5)

| from a vertex perpendicular to the opposite side | ematics.org/content- <br> standards/HSG/SRT/A/2/task <br> s/1858 |
| :---: | :---: |
| G-SRT.D. 10 Prove the Laws |  |
| of Sines and Cosines and use them to solve problems | Similar Triangles https://www.illustrativemath |
| G-SRT.D. 11 Understand | ematics.org/content- |
| and apply the Law of Sines and the Law of Cosines to | $\frac{\text { standards/HSG/SRT/A/2/task }}{\text { s/1890 }}$ |
| find unknown measurements in right and | Pythagorean Theorem |
| non--right triangles <br> Cur A Prove that all | https://www.illustrativemath ematics org/content- |
| circles are similar | standards/HSG/SRT/B/4/task |
| G-C.B. 5 Derive using | s/1568 |
| similarity the fact that the |  |
| length of the arc | Finding the Area of an |
| intercepted by an angle is | Equilateral Triangle |
| proportional to the radius, | https://www.illustrativemath |
| and define the radian | ematics.org/content- |
| measure of the angle as the | standards/HSG/SRT/C/tasks/ |
| constant of proportionality; | 1322 |
| derive the formula for the area of a sector. | Defining Trigonometric |
| G-GPE.B. 4 Use coordinates | Rations |
| to prove simple geometric | https://www.illustrativemath |
| theorems algebraically | ematics.org/content- |
| G-GPE.B. 7 Use coordinates | standards/HSG/SRT/C/6/task |
| to compute perimeters of polygons and areas of | s/1635 |
| triangles and rectangles | Tangent of Acute Angles |
| G-MG.A. 1 Give an informal | https://www.illustrativemath |
| argument for the formulas | ematics.org/content- |
| for the circumference of a | standards/HSG/SRT/C/6/task |
| circle, area of a circle, volume of a cylinder, | s/1904 |
| pyramid, and cone. | Sine and Cosine of Complementary Angles https://www.illustrativemath ematics.org/content- |

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standards/HSG/SRT/C/7/task s/1443
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Pythagorean Theorem http://nlvm.usu.edu/en/nav/fr ames_asid_164_g_4_t_3.htm 1?open=instructions\&from=c ategory_g_4_t 3.html

Transformations-
Composition
http://nlvm.usu.edu/en/nav/fr ames_asid_164_g_4_t_3.htm 1?open=instructions\&from=c ategory_g_4_t_3.html

Transformations-Dilation http://nlvm.usu.edu/en/nav/fr ames_asid_296_g_4_t_3.htm 1?open=activities\&from=cate gory_g_4_t_3.html

Transformations-Reflection http://nlvm.usu.edu/en/nav/fr ames_asid_298_g_4_t_3.htm l?open=activities \& from=cate gory_g_4_t 3.html

Transformations-Rotations http://nlvm.usu.edu/en/nav/fr ames_asid_300_g_4_t_3.htm 1?open=activities\&from=cate gory_g_4_t_3.html

Transformations-
Translations
http://nlvm.usu.edu/en/nav/fr ames_asid_302_g_4_t_3.htm 1?open=activities\&from=cate

```
Triangle Solver
http://nlvm.usu.edu/en/nav/fr
ames_asid_336_g_4_t 3.htm
1?from=category_g_4_t_3.ht
ml
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Proofs into Practice:
Pythagorean Theorem in the Real World
http://alex.state.al.us/lesson_ view.php?id=30577

Exploring Similar Figures using Proportions http://alex.state.al.us/lesson_ view.php?id=30067

Transformations on the Graphing Calculator http://alex.state.al.us/lesson_ view.php?id=26439

Area and Perimeter of Various Polygons http://alex.state.al.us/lesson_ view.php?id=10191

Proving the Pythagorean
Theorem
http://map.mathshell.org/less ons.php?unit=9325\&collecti on=8

## Area Formulas

https://education.ti.com/en/us /activity/detail?id=D3074DD 1E73C47CF8600C8FEDB1 AFF9B\&ref=/en/us/activity/s


## Key Vocabulary:

Extremes of a proportion, geometric mean, indirect measurement, means of a proportion, proportion, ratio, scale drawing, scale factor, similar, similar polygons, angle of depression, angle of elevation, cosine, Law of cosines, Law of Sines, Pythagorean Triple, sine, tangent, adjacent arcs, apothem, arc length, central angle, concentric circles, congruent arcs, diameter, major arc, minor arc, radius, sector of a circle, segment of a circle, congruence transformation, dilation, image, isometry, preimage, reflection, rigid motion, rotation, similarity transformation, translation

## Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered. Additional staff should be included so all students can fully participate in the standards associated with this curriculum.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA -
https://www.wida.us/standards/CAN DOs/
Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure. Student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges.

## English Language Learners:

- Teaching modeling
- Peer modeling
- Word walls
- Give directions in small steps and in as few words as possible
- Provide visual aids
- Group similar problems together
- Repeat directions when necessary
- Provide a vocabulary list with definitions
- Use of alge-tiles when


## Special Education:

- Utilize modifications \& accommodations delineated in the students' IEP
- Work with paraprofessional
- Work with a partner
- Shorten assignments to focus on mastery or key concepts
- Maintain adequate space between desks
- Keep workspaces clear of unrelated materials
- Provide fewer problems to attain passing grades


## At-Risk:

- Use visual demonstrations, illustrations and models
- Give directions / instructions verbally and in simple written format
- Peer support
- Increased one - on - one time
- Teachers may modify instructions by modeling what the student is expected to do
- Instructions may be printed out in large print and hung up for the students to see


## Gifted and Talented:

- Inquiry based instruction
- Independent study
- Higher order thinking skills
- Adjusting the pace of the lessons
- Real world scenarios
- Student driven instruction
- Allow students to complete an independent project as an alternative test
needed
- Use of number line when needed
- Tape a number line to the student's desk
- Create a math journal that they can use during class, on assignments and (if teacher allows) on assessments
- Provide extra time to complete a task when needed
- Provide definitions of different graphs / charts with illustrations
- Allow tests to be taken in a separate room
- Allow students to use a calculator when appropriate
- Divide test into small sections of similar questions or problems
- Use of alge-tiles when needed
- Use of number line when needed
during the time of the lesson
- Review behavior expectations and make adjustments
- Create a math journal that they can use during class, on assignments and (if teacher allows) on assessments
- Allow students to complete an independent project as an alternative test
- Use of alge-tiles when needed
- Use of number line when needed


## Interdisciplinary Connections: ELA

NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content
NJSLSA.L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking
SL.9-10.4: Present information, findings and supporting evidence clearly, concisely and logically. The content, organization, development and style are appropriate to task, purpose and audience.
NJSLSA.L6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
9.2.12.C.1: Review career goals and determine steps necessary for attainment.
9.2.12.C.2: Modify Personalized Student Learning Plans to support declared career goals.
9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.
9.3.ST-ET.5: Apply the knowledge learned in STEM to solve problems.

## Career Ready Practices:

CRP2: Apply appropriate academic and technical skills
CRP4: Communicate clearly and effectively and with reason
CRP6: Demonstrate creativity and innovation
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them
CRP11: Use technology to enhance productivity
Technology Standards:
8.1.12.A.3: Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.

