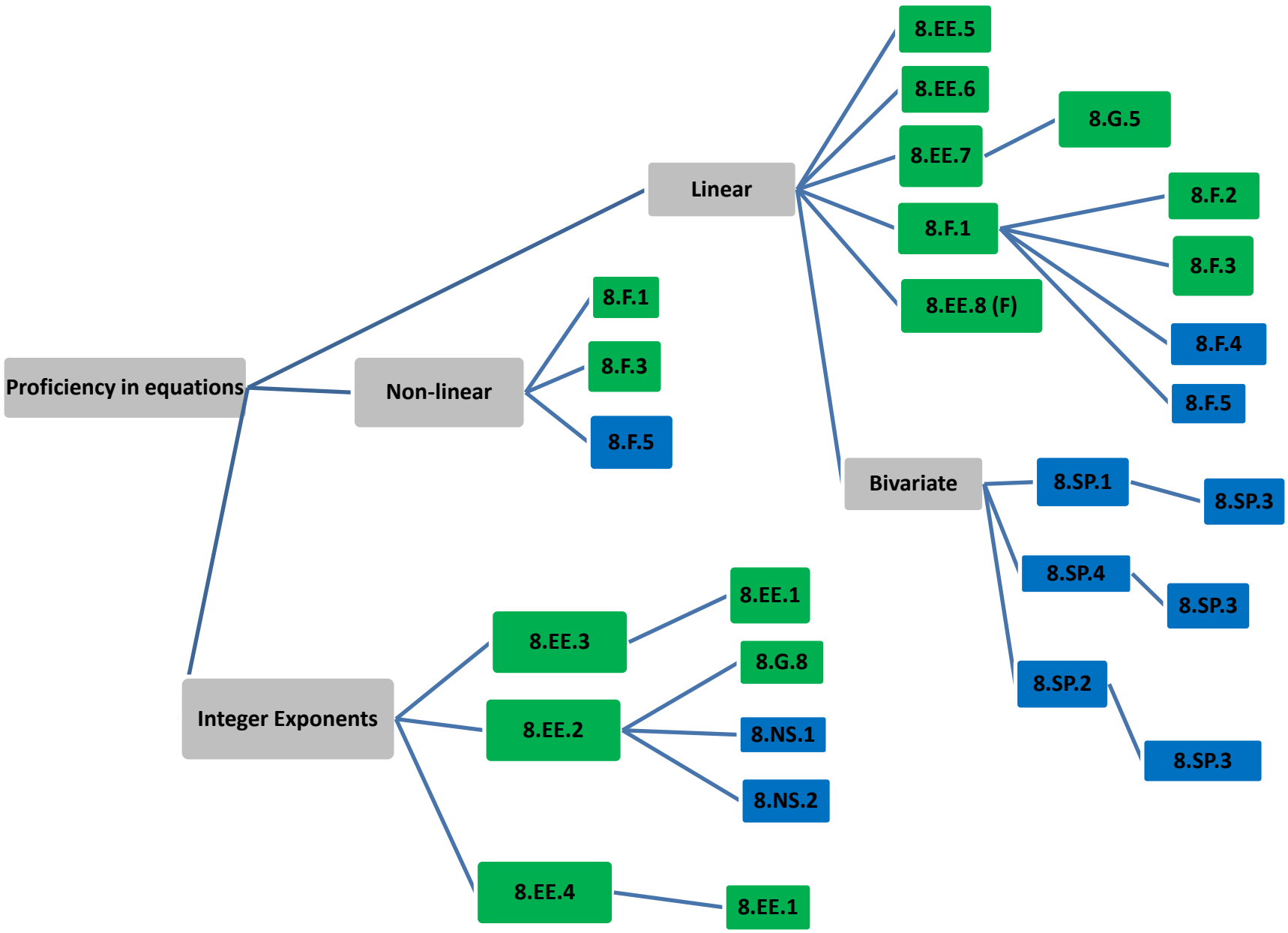
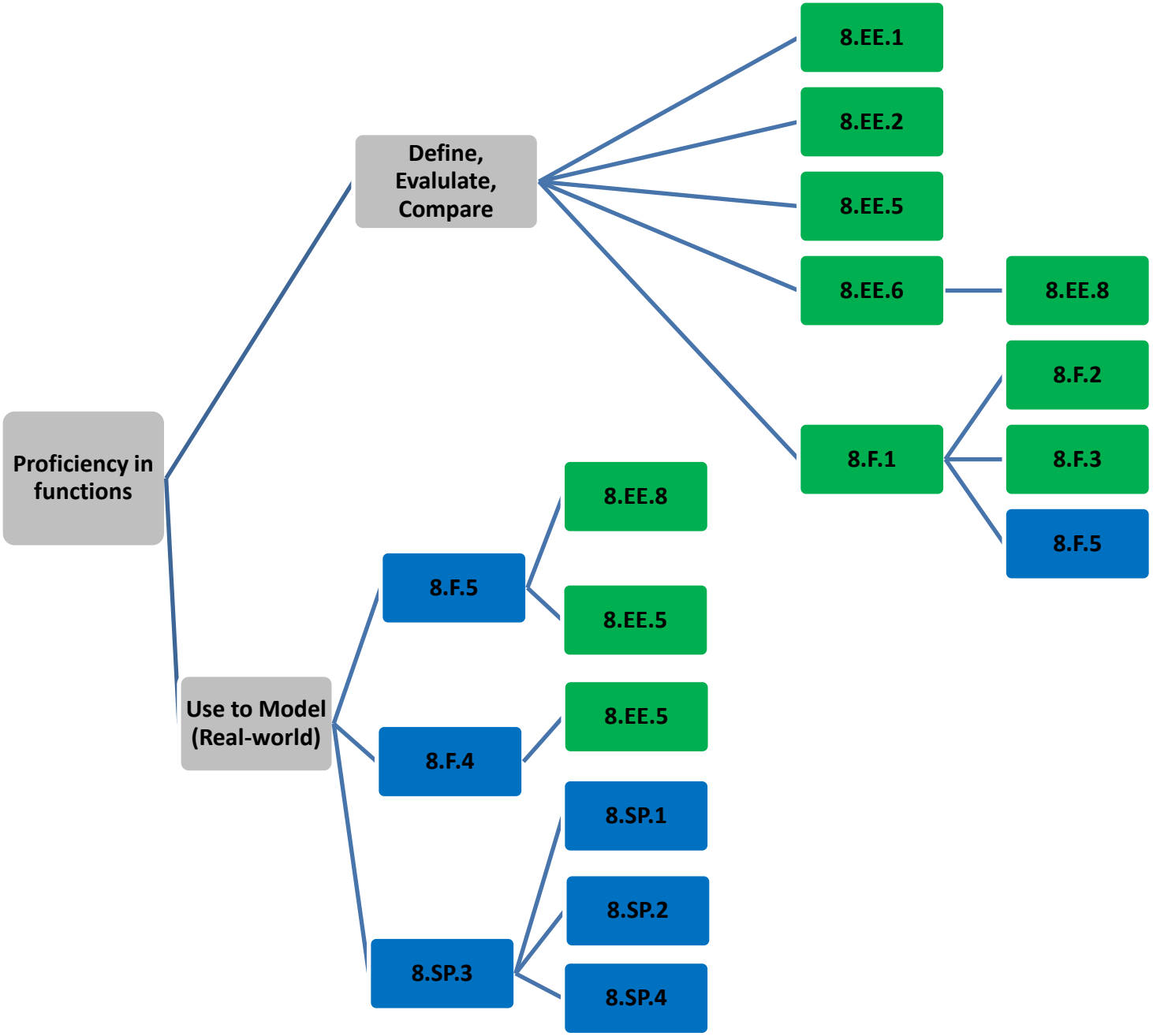
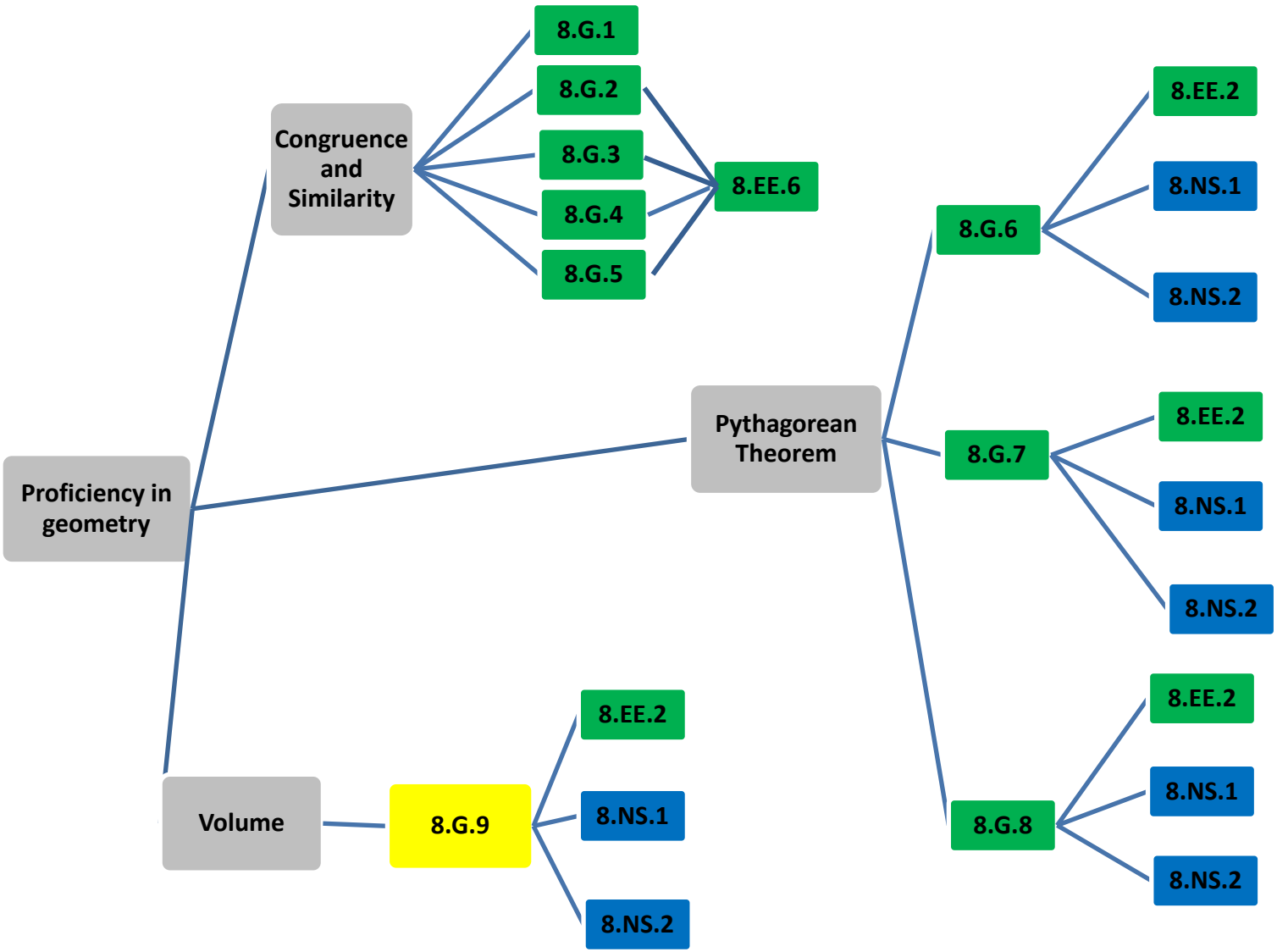
Math 8 Map


Proficiency in equations
Linear
8.EE.5
8.EE.6
8.EE.7
8.G.5
8.F.1
8.F.2
8.F.3
8.F.4
8.F.5
8.EE.8 (F)
Bivariate
8.SP.1
8.SP.3
8.SP.4
8.SP.3
8.SP.2
8.SP.3
Non-linear
8.F.1
8.F.3
8.F.5
Integer Exponents
8.EE.3
8.EE.1
8.EE.2
8.G.8
8.NS.1
8.NS.2
8.EE.4
8.EE.1

Math 8 Map


Proficiency in functions
Define, Evalulate, Compare
8.EE.1
8.EE.2
8.EE.5
8.EE.6
8.EE.8
8.F.1
8.F.2
8.F.3
8.F.5
Use to Model (Real-world)
8.F.5
8.EE.8
8.EE.5
8.F.4
8.EE.5
8.SP.3
8.SP.1
8.SP.2
8.SP.4

Math 8 Map


Proficiency in geometry
Congruence and Similarity
8.G.1
8.G.2
8.G.3
8.G.4
8.G.5
8.EE.6
Pythagorean Theorem
8.G.6
8.EE.2
8.NS.1
8.NS.2
8.G.7
8.EE.2
8.NS.1
8.NS.2
8.G.8
8.EE.2
8.NS.1
8.NS.2
Volume
8.G.9
8.EE.2
8.NS.1
8.NS.2

Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:32PM

Standard/Module: Mathematical Practices (Week 1, 39 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%)
- Supporting (20%)
- Additional (10%)

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

Enduring Understandings	Essential Questions

Critical Content

Skills	Vocabulary

Stage 2: Assessment Evidence

Assessments

Stage 3: Learning Plan

Learning Activities	Resources

Differentiation Opportunities

<< Previous Year

Last Updated: Wednesday, June 27, 2012, 11:29AM

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:36PM

Standard/Module: Proficiency with Geometry: 8.G.1 (Week 1, 4 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.G.2
  8.G.3
  8.G.4
  8.G.5
  8.EE.6

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 1. Verify experimentally the properties of rotations, reflections, and translations:
- 1a. Lines are taken to lines, and line segments to line segments of the same length.
- 1b. Angles are taken to angles of the same measure.
- 1c. Parallel lines are taken to parallel lines.

Enduring Understandings	Essential Questions
Understand the transformation properties of lines and angles (only rotations, reflections, and translations).	What are the properties of rotations, reflections, and translations?

Critical Content

1. Congruency of line segments and angles

- Reflection
- Rotation
- Translation

2. Lines remain lines

- Reflection
- Rotation
- Translation

3. Parallel lines remain parallel lines

- Reflection
- Rotation
- Translation

Skills	Vocabulary
1. Verify that congruence of line segments and angles is maintained through rotation, reflection, and translation. 2. Verify that lines remain lines through rotation, reflection, and translation 3. Verify that when parallel lines are rotated, reflected, or translated, each in the same way, they remain parallel lines.	Tier 2: line, angle, parallel line, congruent Tier 3: line segment, center of rotation, line of reflection, line of symmetry, rotation, reflection, translation, transformation

Stage 2: Assessment Evidence

Assessments

Congurence & Similarity
Formative: Performance: Skill Demonstration

Students are given a polygon drawn on a coordinate plane and asked to perform rotations, reflections and translations given specific criteria (eg. reflect over the x-axis, rotate 45 degrees).

Students are asked to prove that two shapes are congruent when given two polygons on a coordinate plane, justifying congruency or non-congruency by explaining what rotations, reflections or translations would need to occur.

Stage 3: Learning Plan

Learning Activities	Resources
It is important that students have an opportunity to work with transformations in a "hands-on" setting. They should perform rotations, reflections and translations both on paper and using technology such as Math Warehouse Interactives and/or Geometry software. Students can use that technology to define rotations, reflections, and translations. Math Warehouse Interactives	www.illuminations.nctm.org www.mathwarehouse.com www.illustrativemathematics.org Math Warehouse Interactives Geogebra Software Geometer's Sketchpad v. 5.04 free download NCTM Illuminations Illustrative Mathematics Project

Differentiation Opportunities

The difficulty of tasks for this standard can be tiered. For example, struggling students could be doing reflections, rotations and translations with one step, students who are on grade-level could be doing two or three step problems. Students who need enrichment could be determining the steps that were taken to move a polygon from one position to another on a coordinate grid, or creating problems for other students to solve.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:37PM

Standard/Module: Proficiency with Geometry: 8.G.2 (Week 1, 4 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.G.1
  8.G.3
  8.G.4
  8.G.5
  8.EE.6

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 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.

Enduring Understandings	Essential Questions
Understand that two dimensional figures remain congruent after a transformation.	How is congruency preserved under a transformation (not dilation)?

Critical Content

Congruency of two-dimensional figures

- Rotation
- Reflection
- Translation
- Combination of transformations

Skills	Vocabulary
preserved, rotation, reflection, translation, transformation	Tier 2: congruent, two-dimensional, sequence Tier 3: preserved, rotation, reflection, translation, transformation

Stage 2: Assessment Evidence

Assessments

Transformations
Formative: Performance: Skill Demonstration

Students are given a polygon drawn on a coordinate plane and asked to perform a combination of rotations, reflections and translations given specific criteria (eg. reflect over the x-axis and rotate 45 degrees).

Students are asked to prove that two shapes are congruent when given two polygons on a coordinate plane, justifying congruency or non-congruency by explaining what combinations of rotations, reflections or translations would need to occur.

Stage 3: Learning Plan

Learning Activities	Resources
It is important that students have an opportunity to work with transformations in a "hands-on" setting. They should perform **combinations of** rotations, reflections and translations both on paper and using technology (Geometry software, for example).	www.mathwarehouse.com www.illuminations.nctm.org www.illustrativemathematics.org Math Warehouse Interactives Free Downlaod of Geometer's Sketchpad NCTM Illuminations Illustrative Mathematics Project

Differentiation Opportunities

The difficulty of tasks for this standard can be tiered. For example, struggling students could be doing reflections, rotations and translations with one and two steps, students who are on grade-level could be doing two or three step problems. Students who need enrichment could be determining the combinations of transformations that were used to move a polygon from one position to another on a coordinate grid, or creating problems for other students to solve.

<< Previous Year

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:37PM

Standard/Module: Proficiency with Geometry: 8.G.3 (Week 1, 4 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.G.1
  8.G.2
  8.G.4
  8.G.5
  8.EE.6

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

Enduring Understandings	Essential Questions
Effects of transformation on two-dimensional figures	Given a two-dimensional figure can you describe the effect of dilation? Reflection? Rotation? Translation?

Critical Content

1. Graph two-dimensional figures on the coordinate plane

- Rotation
- Dilation
- Reflection
- Translation

2. Use coordinates to describe a transformation.

- Rotation
- Dilation
- Reflection
- Translation

Skills	Vocabulary
1. Understand how to dilate, translate, rotate, and reflect two-dimensional figures on the coordinate plane. 2. Describe the effects of dilations, translations, rotations, and reflections using coordinates.	Tier 2: transformation, coordinates Tier 3: dilation, rotation, reflection, translation,

3. Given an image and its transformed image, use coordinates to describe the transformation. Given an original image and transformed image, use prime notation (A').	image, prime notation, center of rotation, angle of rotation, line of reflection

Stage 2: Assessment Evidence

Assessments

Transformations
Performance: Authentic Task

Students are given a polygon drawn on a coordinate plane and asked to perform a combination of rotations, reflections and translations given specific criteria (eg. reflect over the x-axis and rotate 45 degrees).

Students are asked to prove that two shapes are congruent when given two polygons on a coordinate plane, justifying congruency or non-congruency by explaining what combinations of rotations, reflections or translations would need to occur. Students use coordinates and prime notation to justify their ideas.

Stage 3: Learning Plan

Learning Activities	Resources
It is important that students have an opportunity to work with transformations in a "hands-on" setting. They should perform **combinations of** rotations, reflections and translations both on paper and using technology (Geometry software, for example).	www.mathwarehouse.com www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

The difficulty of tasks for this standard can be tiered. For example, struggling students could be doing reflections, rotations and translations with one and two steps, students who are on grade-level could be doing two or three step problems. Students who need enrichment could be determining the combinations of transformations that were used to move a polygon from one position to another on a coordinate grid, or creating problems for other students to solve.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:38PM

Standard/Module: Proficiency with Geometry: 8.G.4 (Week 1, 4 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.G.1
  8.G.2
  8.G.3
  8.G.5
  8.EE.6

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 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.

Enduring Understandings	Essential Questions
Understand similarity and congruency of figures	Can you describe the sequence of transformations that will exhibit similarity between two-dimensional figures?

Critical Content

Similar figures formed by transformations
- Translation
- Reflection
- Rotation
- Dilation

Skills	Vocabulary
1. Understand similar figures (7.G.1). 2. Understand that any combination of transformations will result in similar figures. 3. Describe the sequence of transformations needed to show how one figure is similar to another. 4. Use scale factor to dilate two-dimensional figures.	Tier 2: corresponding, congruent, proportional Tier 3: dilation, reflection, rotation, scale factor, similar figures, transformation, translation, similarity symbol (~)

Stage 2: Assessment Evidence

Assessments

Proving Similarity or Congruence Through Transformations
Formative: Performance: Authentic Task

Students are given a polygon drawn on a coordinate plane and asked to perform a combination of rotations, reflections and translations given specific criteria to prove whether two figures are similar, congruent, or neither.

Students are asked to prove that two shapes are congruent when given two polygons on a coordinate plane, justifying congruency or non-congruency by explaining what combinations of rotations, reflections or translations would need to occur. Students use coordinates and prime notation to justify their ideas.

Stage 3: Learning Plan

Learning Activities	Resources
It is important that students have an opportunity to work with transformations in a "hands-on" setting. They should perform **combinations of** rotations, reflections and translations both on paper and using technology (Geometry software, for example) to prove whether or not two figures are similar or congruent, or not similar or not congruent.	www.mathwarehouse.com www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

The difficulty of tasks for this standard can be tiered. For example, struggling students could be doing reflections, rotations and translations with one and two steps to prove whether there is similarity or congruence (or neither), students who are on grade-level could be doing two or three step problems. Students who need enrichment could creating problems for other students to solve.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:39PM

Standard/Module: Proficiency with Geometry: 8.G.5 (Week 1, 4 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.G.1
  8.G.2
  8.G.3
  8.G.4
  8.EE.6

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 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.

Enduring Understandings	Essential Questions
Understanding angle relationships in geometric problems/representations.	1. How are the measures of angles related when parallel lines are cut by a transversal? 2. How do you find the interior and exterior angles measures of a triangle, given an angle? 3. How do you find the angle measure of all the angles, given the measure of one angle when parallel lines are cut by a transversal?

Critical Content

1. Sum of interior angles

- Equal to sum of measures of the non-adjacent angles

2. Relationships of angles created by parallel lines cut by a transversal

3. Angle-angle (informal) proof of similar triangles

Skills	Vocabulary
1. Understand that the measure of an exterior angle of a triangle is equal to the sum of the measures of the non-adjacent angles.	Tier 2: complementary pairs, supplementary pairs

2. Know that the sum of the angles of a triangle equals 180°. 3. Determine the relationship between adjacent angles, corresponding angles, alternate interior angles, alternate exterior angles, vertical pairs, and supplementary pairs when parallel lines are cut by a transversal. 4. Recognize that if two triangles have two congruent angles, then they are similar triangles (angle-angle).	Tier 3: adjacent angles, alternate exterior angles, alternate interior angles, corresponding angles, exterior angle of a triangle, non-adjacent angles of a triangle, parallel lines, perpendicular lines, transversal, transformations, vertical pairs

Stage 2: Assessment Evidence

Assessments

Triangles and Transversals
Formative: Performance: Authentic Task

Use the learning activities as informal assessment and use an exit slip for each of the three parts of the standard to determine whether students independently understand the concepts.

Stage 3: Learning Plan

Learning Activities	Resources
Students should draw a set of parallel lines and cut the set with a transversal line, using a straight edge to draw. By having students construct the drawing, it will help them to draw their attention to the parts of the diagram. Challenge students to find examples of parallel line cut by a transversal in the real world and bring in examples of pictures. Use a protractor to determine one angle, and work to find the measures of the rest mathematically. Work on determining the exterior angles of a triangle, using geometry software if possible. Prove two triangles are similar or congruent if I know two angles of each triangle.	www.mathwarehouse.com www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

Advanced students can work, once they understand proving two triangles congruent, on formulating a general rule about other shapes besides triangles, and experiment with their ideas. Challenge students to bring in real-world examples of a set of parallel lines cut by a transversal.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:39PM

Standard/Module: Proficiency with Functions: 8.EE.1 (Week 5, 5 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.2
  8.EE.5
  8.EE.6
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Work with radicals and integer exponents.

- 1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.

Enduring Understandings	Essential Questions
Know and apply properties of integer exponents	How do the properties of integer exponents assist you in simplifying an expression?

Critical Content

1. Properties of integer exponents

- $x^a \bullet x^b = x^{a+b}$
- $x^a \div x^b = x^{a-b}$
- $x^{-a} = 1/x^a$
- $(x^a)^b = x^{ab}$

Equivalent numerical expressions

Skills	Vocabulary
1. Write and evaluate numerical expressions involving whole number exponents (6.EE.1). 2. Evaluate expressions with zero exponent. 3. Understand exponents as repeated multiplication (6.EE.1). 4. Compute fluently with integers. 5. Know properties of integer exponents. 6. Apply properties of integer exponents. 7. Generate equivalent numerical expressions using integer exponents.	Tier 2: evaluate, simplify Tier 3: base, exponent, integer, numerical expression, power

Stage 2: Assessment Evidence

Assessments

Properties of Exponents
Formative: Test: Written

Written test of the different properties of exponents (each property tested individually) and then include items with combinations of the properties.

Stage 3: Learning Plan

Learning Activities	Resources
Use expanded notation to help students derive the rules/properties of exponents. For example, (x • x • x) • (x • x • x • x • x) is the same as 8 x's being multiplied together, so $x^3 \bullet x^5 = x^8$, or I can add the exponents to get x^{3+5} or x^8. Use multiple examples of each property to help students see that these rules will apply every time.	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

If numbers are getting in the way, use variables or symbols. If the symbols are a struggle, try using numbers instead. Sometimes, numbers seem less abstract, but often times students want to simplify the expressions when numbers are present with variables, so they may not see the properties as readily.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:40PM

Standard/Module: Proficiency with Equations: 8.EE.3 (Week 5, 5 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.2
  8.EE.4
  8.EE.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations
8.EE Work with radicals and integer exponents.

- 3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

Enduring Understandings	Essential Questions
1. Compare very large or very small quantities using expression in powers of 10.	1. How would you use expressions in powers of 10 in real-life situations (population, national debt, science)? 2. When do you use positive exponents? Negative exponents?

Critical Content

Integer power of 10

Skills	Vocabulary
1. Multiply and divide by powers of 10. 2. Use large and small real-life numbers (e.g. national debt). 3. Estimate very large or very small quantities. 4. Express small and large quantities in the form of a product of a single digit and a power of 10. 5. Compare numbers expressed as a product of a single digit and a power of ten by a scale factor (2 times, 3 times).	Tier 2: compare, estimate, quantities Tier 3: integer, power of 10

Stage 2: Assessment Evidence

Assessments

Scientific Notation
Formative: Test: Written

Students go between scientific notation and expanded notation and justify their answers. Students justify whether the result is very large or very small and why they claim that statement.

Stage 3: Learning Plan

Learning Activities	Resources
Have students find real-world examples of where scientific notation is used (science periodicals, journals, magazines, etc.). Experiment with moving the decimal point in an expanded notation given a scientific notation representation and talking about whether the resulting value is very large or very small and justifying whether the answer is reasonable.	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

Provide graphic organizers to help students rationalize whether a decimal value is very large or very small.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:42PM

Standard/Module: Proficiency with Equations: 8.EE.4 (Week 5, 5 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.3
  8.EE.2
  8.EE.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations
8.EE Work with radicals and integer exponents.

- 4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Enduring Understandings	Essential Questions
Use and understand scientific notation. Understand the relationship between scientific notation and expanded notation.	1. Why is it helpful to write numbers in different forms? 2. How do you perform operations with numbers in scientific notation?

Critical Content

1. Operations with scientific notation
   - Add, subtract, multiply, divide
2. Numbers expressed in scientific notation
3. Decimal and scientific notation

Skills	Vocabulary
1. Apply properties of exponents. 2. Perform operations with numbers expressed in scientific notation. 3. Use scientific notation.	Tier 2: interpret, quantities, unit of measure

4. Represent very large and small quantities in scientific notation. 5. Choose units of appropriate size for measurements of very large or very small quantities. 6. Interpret scientific notation using technology (calculator will display scientific notation differently).	Tier 3: coefficient, decimal notation, power of 10, scientific notation

Stage 2: Assessment Evidence

Assessments

Operations with Scientific Notation
Formative: Test: Written

Students perform operations with scientific notation both in context situations, and with only numbers, and justify their answers. Students justify whether the result is larger or smaller and why they claim that statement.

Stage 3: Learning Plan

Learning Activities	Resources
Have students find real-world examples of where scientific notation is used (science periodicals, journals, magazines, etc.). Have students experiment with their properties of exponents knowledge to add, subtract, multiply and divide numbers in scientific notation. For example, the distance from the sun to the Earth is _____. The distance from the sun to Mars is _____. Given this information, how far is the Earth from Mars? Why would this information be useful to NASA and other organizations who are trying to conduct a manned-space flight to Mars?	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

Provide graphic organizers to help students add, subtract, multiply and divide with exponents..

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:43PM

Standard/Module: Proficiency with Functions: 8.EE.5 (Week 10, 22 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.1
  8.EE.2
  8.EE.6
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Understand the connections between proportional relationships, lines, and linear equations.

- 5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Enduring Understandings	Essential Questions
Graph, interpret, and compare proportional relationships representing in different ways.	1. Why are graphs helpful? 2. What is the difference between the graph of a proportional relationship and a non-proportional relationship?

Critical Content

1. Proportional relationship

- In tables
- In equations
- In contextual situations

2. Unit rate

3. Slope of the graph

Skills	Vocabulary
1. Determine the slope between two points. -change in y compared to change in x (using	Tier 2: graph, proportion, relationships, table

graph or slope formula) 2. Graph a proportional relationship given a table, equation or contextual situation. 3. Recognize unit rate as slope and interpret the meaning of the slope in context (positive, negative, zero, and undefined slopes). 4. Recognize that proportional relationships include the point (0, 0). 5. Compare different representations of two proportional relationships represented as contextual situations, graphs, or equations.	Tier 3: proportional relationships, rate of change, slope, *m* (slope), unit rate

Stage 2: Assessment Evidence

Assessments

D = RT, graphically and algebraically
Formative: Performance: Authentic Task

Use the learning activities as a form of assessment.

Stage 3: Learning Plan

Learning Activities	Resources
Have students take a look at or write at least 2 related d = rt problems where one element is changed in the second problem, which prompts a change in at least one of the other variables, and graph the results. Students could construct a t-chart and plot the points on a graph, analyzing which variable (d, r, or t) represents x and which represents y. Students should write an equation to represent the d = rt and compare which problem/equation/graph shows greater speed and justify the results.	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

Give students d = rt problems if they struggle to write their own.

Have students write stories where d = rt is used at least twice in the story. This will help them to think about how d = rt is used in the real world, the broad use of it. Brainstorm as a class where you could go, modes of transportation, and how fast you might get there using the mode. Play around by putting

in values for each variable and talk about how it affects the 3rd variable. For example:

"We are going to New York City which is about 360 miles away. If we drive in a car, it will take about 6 hours to get there. How fast will we be traveling?"

"We are going to New York City and traveling in a car at 70 miles per hour. If New York City is 360 miles away, how long will it take us to get there?

"We are going to New York City and we will be in the car for about 5.5 hours, traveling at a rate of 70 miles per hour. How many miles away is New York City?"

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:44PM

Standard/Module: Proficiency with Functions: 8.EE.6 (Week 10, 22 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.1
  8.EE.2
  8.EE.5
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Understand the connections between proportional relationships, lines, and linear equations.

- 6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

Enduring Understandings	Essential Questions
1. Linear equations can be used to solve mathematical and real-life problems.	1. How can use slope to solve real-world problems?
	2. What does slope tell you about a situation?
2. You can represent a relationship between two variables using a linear equation	

Critical Content

1. Similar triangle
   - proportionality
2. Slope m between two distinct points
3. Equations of lines
   - y = mx
   - y = mx + b

Skills	Vocabulary
1. Set up a coordinate plane and plot/label points in all four quadrants (6.NS.8). 2. Use similar triangles to determine the slope of a non-vertical line. 3. Derive the equation of y = mx for a line through the origin. 4. Derive the equation y = mx + b for a line intercepting the vertical axis at b.	Tier 2: coordinate plane, derive, intersecting, origin, rise, run Tier 3: linear, rate of change, right triangle, similar triangles, slope (m), y-intercept (b)

Stage 2: Assessment Evidence

Assessments

Find three smilar triangles on the graph of the linear function
Formative: Performance: Authentic Task

Students are presented with a linear function to graph. They are to find at least three similar triangles and color in each one on the graph. They should label the ratio of the "rise" over "run" for each triangle and show how how each ratio is equivalent to the others.

Stage 3: Learning Plan

Learning Activities	Resources
Magic Money Machine (see link) addressed 8th grade functions standards, but can be tied into this standard as well While graphing the equations, show students the similar triangles and write each slope in equivalent fractions form. For example, "notice that when I go up 2, right 4, I land on a point and I can write the slope as 2/4. I can also go up 1, right 2 and land on a point, and I can write the slope as 1/2. How is 1/2 related to 2/4? Find three more similar triangles that are valid for this line." Repeat this process for different equations with different slopes including negative slopes, fractional slopes, and whole number slopes. Magic Money Machine	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

When drawing in the similar triangles, color each in a different color. This helps students to see the right triangles that are similar.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:46PM

Standard/Module: Proficiency with Equations: 8.EE.7 (Week 13, 9 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.5
  8.EE.6
  8.F.1
  8.EE.8 (F)
  8.G.5

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Analyze and solve linear equations and pairs of simultaneous linear equations.

- 7. Solve linear equations in one variable.
- 7a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
- 7b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Enduring Understandings	Essential Questions
Linear equations can have one solution, infinitely many solutions, or no solutions.	1. What part of the original equation reveals the number of solutions? 2. How can you write an equation with one solution, infinitely many solutions, or no solutions?

Critical Content

1. Linear equations
2. Equations with one solution
3. Equations with infinitely many solutions
4. Equations with no solutions

Skills	Vocabulary
1. Analyze and solve linear equations in one variable - With rational number coefficients	Tier 2: equivalent, finite, linear equation, infinite, solution, solve, variable

▪ With parentheses (Distributive Property) ▪ Like terms ▪ Variables on both sides 2. Generate examples of linear equations with one solution, infinitely many solutions, or no solutions.	Tier 3: coefficient, Distributive Property, like terms, no solution

Stage 2: Assessment Evidence

Assessments

Solving linear equations
Formative: Test: Written

Students solve linear (2-step) equations when one variable is unknown, including situations where like terms must be combined, or equations that must be expanded using the distributive property.

Students analyze linear equations to determine whether there is one solution, infinitely many solutions, or no solution.

Stage 3: Learning Plan

Learning Activities	Resources
Student learn to solve linear equations. Students are shown a set of equations to graph that each have only solution, and draw conclusions about their commonalities. Students are shown a set of equations to graph that each have infinite solutions, and draw conclusions about their commonalities. Students are shown a set of equations to graph that each have no solution, and draw conclusions about their commonalities.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Use graphic organizers to help students solve equations.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 1:46PM

Standard/Module: Proficiency with Equations: 8.EE.8 (F) (Week 13, 9 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.5
  8.EE.6
  8.EE.7
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Analyze and solve linear equations and pairs of simultaneous linear equations.

- 8. Analyze and solve pairs of simultaneous linear equations.
- 8a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- 8b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
- 8c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Enduring Understandings	Essential Questions
1. Solve systems of linear equations.	1. How do you name the solution of a system of linear equations?
2. Apply systems of equations to solve real-world problems	2. How do you determine which method to use to solve a system of linear equations?

Critical Content

Systems of linear equations with

- One solution
- Infinitely many solutions
- No solutions

Skills	Vocabulary

1. Graph a linear equation 2. Solve one-variable equations 3. Analyze and solve pairs of simultaneous linear equations ▪ graphically ▪ Numerically (table) ▪ Algebraically (substitution and elimination) 4. Identify and label the point of intersection of a system of linear equations 5. Estimate solutions by graphing the equations 6. Solve simple cases by inspection	Tier 2: estimate, intersection, linear equation, simultaneous(ly), solution, solve, unique Tier 3: algebraically, elimination, substitution, system of linear equations

Stage 2: Assessment Evidence

Assessments

Pairs of linear equations
Formative: Test: Written

Students analyze pairs of linear equations to determine whether there is one solution, infinitely many solutions, or no solution and justify their conclusions. Students set up equations for a real-world problem and solve them graphically.

Stage 3: Learning Plan

Learning Activities	Resources
Students are shown a set of equations to graph that each have only solution, and draw conclusions about their commonalities. Students are shown a set of equations to graph that each have infinite solutions, and draw conclusions about their commonalities. Students are shown a set of equations to graph that each have no solution, and draw conclusions about their commonalities.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Graph by hand and using technology.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:03PM

Standard/Module: Proficiency with Functions: 8.F.1 (Week 22, 3 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) Connects to Standards:
  8.EE.1
  8.EE.2
  8.EE.5
  8.EE.6
  8.F.2
  8.F.3
  8.F.5

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Functions
8.F Define, evaluate, and compare functions.

- 1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

Enduring Understandings	Essential Questions
Understand what a function is and what it looks like (ordered pairs, table, graph, mapping).	1. What is a function? 2. What is input and output? 3. What is a real-life example of a function? Non-example?

Critical Content

1. Function
   - Ordered pairs
   - Table
   - Graph
   - Mapping
2. Input and output
3. Graph of a function

Skills	Vocabulary
1. Understand that functions describe	Tier 2: corresponding, graph, ordered pairs,

relationships where one variable determines a unique value of the other. 2. Recognize a graph of a function as the set of ordered pairs consisting of an input and corresponding output. 3. Utilize the vertical line test to determine if a graph represents a function. 4. Give real-life examples of functions and non-functions.	relationship, table, unique Tier 3: dependent, function, independent, input, mapping, output, relation, vertical line test

Stage 2: Assessment Evidence

Assessments

Function or not a function?
Formative: Test: Written

Student determine whether the t-chart, graph and/or equation represents a function or not and justifies each response.

Stage 3: Learning Plan

Learning Activities	Resources
Use "Function Man" on www.harveyshomepage.com Use the Magic Money Machine Show examples of different functions versus non-functions. Students record their findings about what functions have in common to define a function. The Magic Money Machine	www.harveyshomepage.com www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Connect the table, the equation and the graph as being three representations of a function.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:03PM

Standard/Module: Proficiency with Functions: 8.F.2 (Week 22, 10 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.F.3
  8.F.4
  8.F.5
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Functions

8.F Define, evaluate, and compare functions.

- 2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Enduring Understandings	Essential Questions
Compare properties of two functions represented in different forms.	1. What are the similarities and differences of two functions that are represented in two different ways? 2. How can you determine if two linear functions are similar or different?

Critical Content

Properties of a function

- Slope
- Y-intercept
- Rate of change from table of values

Skills	Vocabulary
1. Substitute pairs of numbers into a two-variable linear equation and determine if the coordinates satisfy the equation. 2. Compare two linear functions each represented a different way and describe similarities and differences in slopes, y-intercepts, and values. (For example, given a	Tier 2: rate of change, slope Tier 3: algebraically, function, graphically, linear function, non-linear function, numerically in tables, y-intercept

linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has a greater rate of change.)	

Stage 2: Assessment Evidence

Assessments

Representing Linear Functions
Formative: Test: Written

Students are given either an equation, table or graph of a linear function, and they are to represent the same function in the other two ways. For example, if the student is given y = -3x +4, they would have to graph it and show a table of possible values (at least three points) that would be points on the line that results. If they are given a graph, the should derive the equation and table from it with at least three points in the table. In each representation, students identify the slope and y-intercept.

Stage 3: Learning Plan

Learning Activities	Resources
Use "Function Man" on www.harveyshomepage.com	www.harveyshomepage.com
Use the Magic Money Machine	www.illustrativemathematics.org
	www.illuminations.nctm.org
Magic Money Machine	

Differentiation Opportunities

See "Magic Money Machine."

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:04PM

Standard/Module: Proficiency with Functions: 8.F.3 (Week 22, 3 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.F.1
  8.F.5

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Functions

8.F Define, evaluate, and compare functions.

- 3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

Enduring Understandings	Essential Questions
Interpret the equation y = mx+b as a linear function	What determines if a function is linear or non-linear?

Critical Content

1. Define a linear function in the form y = mx + b
2. Give examples of non-linear function

- Quadratic: $y = x^2$, $y = x^2+5x+10$, $y = x(2+x)$
- Cubic: $y = x^3$

Skills	Vocabulary
1. Generate and plot ordered pairs from an equation. 2. Understand linear slope as a constant rate of change. 3. Distinguish between linear and non-linear functions given their algebraic expression, a table, or a graph. 4. Recognize functions written in the form y = mx + b are linear and that every linear function can be written in the form y = mx + b. 5. State examples of functions that are not linear. (For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains (1, 1), (2, 4) and (3, 9), which are	Tier 2: function, rate of change, slope Tier 3: co-linear, linear, non-linear function, slope intercept form of a line (y = mx + b)

not on a straight line.)	

Stage 2: Assessment Evidence

Assessments

Name that Functions
Formative: Test: Written

Students are shown different representations of functions and they are to identify if it is linear, quadratic, or cubic and justify how they know.

Stage 3: Learning Plan

Learning Activities	Resources
Use "Function Man" on www.harveyshomepage.com	www.harveyshomepage.com
Use the Magic Money Machine	www.illustrativemathematics.org
	www.illuminations.nctm.org
Show examples of different functions and compare their properties to linear functions. Use technology to experiment with what happens when different coefficients are introduced the basic equation.	
Magic Money Machine	

Differentiation Opportunities

Start with the graphs of the functions as they are the most obvious in showing the differences between the functions.

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Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:05PM

Standard/Module: Proficiency of Functions: 8.F.4 (Week 22, 3 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.F.5
  8.SP.3
  8.EE.5

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Functions

8.F Use functions to model relationships between quantities.

- 4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Enduring Understandings	Essential Questions
Finding slope and y-intercept given a linear function in multiple representations.	Can you determine the slope and y-intercept of a linear function?

Critical Content

1. Model a linear relationship between two quantities
2. Find the rate of change (m) and initial value (b) of a function.

- From a table
- From a graph
- From two points
- Real-world application

Skills	Vocabulary
1. Construct a function between two quantities. 2. Determine the rate of change (m) and the initial value (b) of the function. ▪ From a table ▪ From a graph ▪ From two points 3. Interpret the rate of change (m) and initial value	Tier 2: y-intercept (b), slope (m), rate of change (slope) Tier 3: linear relationship, initial value (y-intercept, starting point)

(b) given a situation (verbal description) ▪ From a table ▪ From a graph ▪ From two points	

Stage 2: Assessment Evidence

Assessments

Determing the Rate of Change
Formative: Performance: Authentic Task

Use the learning activities as your form of assessment.

Stage 3: Learning Plan

Learning Activities	Resources
Use the Magic Money Machine Relate the rate of change to the equation, graph, and table. Magic Money Machine	www.illuminations.nctm.org www.illustrativemathematics.org www.harveyshomepage.com

Differentiation Opportunities

see Magic Money Machine

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:05PM

Standard/Module: Proficiency in Functions: 8.F.5 (Week 22, 18 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.F.4
  8.SP.3
  8.EE.8
  8.EE.5

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Functions

8.F Use functions to model relationships between quantities.

- 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Enduring Understandings	Essential Questions
Sketch and describe qualitative graphs.	1. How is a function illustrated given a real – life situation? 2. What are some advantages of displaying the relationship between two quantities using a qualitative graph?

Critical Content

1. Tell a story based on a graph

- Increase slope (positive)
- Decrease slope (negative)
- No slope
- Zero slope
- Linear or nonlinear

2. Given a story, draw a graph.

Skills	Vocabulary
1. Describe attributes of a function by analyzing	Tier 2: quantities

a graph. 2. Create a graphical representation given the description of the relationship between two quantities.	Tier 3: positive slope (increasing), negative slope (decreasing), no slope, zero slope, initial value (b), qualitative

Stage 2: Assessment Evidence

Assessments

Analyzing a graph of a linear function
Formative: Test: Written

Given a situation, students sketch a graph and determine the relationship between the quantities described. Students describe the graph as linear or non-linear, and increasing or decreasing

Stage 3: Learning Plan

Learning Activities	Resources
See Magic Money Machine Students analyze different graphs with different types of lines with regard to the situation presented. Students match graphs to verbal situations, and/or write situations to match a graph. Magic Money Machine	www.harveyshomepage.com www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Matching is easier than creating. Build students up to writing situations by spending lots of time with matching graphs to verbal situations.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:06PM

Standard/Module: Proficiency with Statistics & Probability: 8.SP.1 (Week 25, 6 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.SP.4
  8.SP.2
  8.SP.3

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Statistics & Probability
8.SP Investigate patterns of association in bivariate data.

- 1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Enduring Understandings	Essential Questions
Construct and interpret scatter plots for bivariate data.	1. How are patterns used when comparing two quantities? 2. Where in real-life would you graph bivariate data? 3. What are the inferences that can be drawn from sets of data points having a positive association and negative associations?

Critical Content

1. Bivariate data using a scatter plot

- Collect
- Record
- Construct

2. Scatter plot of bivariate data

- Linear, nonlinear (association)
- Positive, negative, no correlation (association)
- Outliers

Skills	Vocabulary

1. Collect, record, and construct a set of bivariate data using a scatter plot. 2. Interpret patterns on scatter plot such as clustering, outliers, and positive, negative, or no correlation (association). 3. Investigate whether the relation between bivariate data is linear or nonlinear by inspection of a scatter plot.	Tier 2: construct, data, interpret, investigate, linear, nonlinear, pattern, quantity Tier 3: association, bivariate data, clustering, correlation, negative association, no association, outlier, positive association, scatter plot

Stage 2: Assessment Evidence

Assessments

Bivariate data
Formative: Performance: Authentic Task

Use the learning activities as the assessment

Stage 3: Learning Plan

Learning Activities	Resources
Collect, record, and construct a set of bivariate data using a scatter plot. Interpret patterns on scatter plot such as clustering, outliers, and positive, negative, or no correlation (association). Investigate whether the relation between bivariate data is linear or nonlinear by inspection of a scatter plot	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:07PM

Standard/Module: Proficiency with Statistics & Probability: 8.SP.2 (Week 25, 6 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.SP.1
  8.SP.4
  8.SP.3

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Statistics & Probability
8.SP Investigate patterns of association in bivariate data.

- 2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Enduring Understandings	Essential Questions
Line of best fit	1. What is a line of best fit? 2. Does the data fall along a line?

Critical Content

Line of best fit for scatter plots

- Does not go through all of the points

Skills	Vocabulary
1. Graph linear relationships. 2. Know that straight lines are widely used to model the relationship between two quantitative variables. 3. Draw a straight line (line of best fit) on a scatter plot that closely fits the data points. 4. Interpret and describe how well the line of best fit (trend line) represents the data by looking at the closeness of the data points.	Tier 2: closeness, data, model, variable Tier 3: line of best fit, linear association, quantitative, scatter plot

Stage 2: Assessment Evidence

Assessments

Line of Best Fit
Formative: Performance: Skill Demonstration

Given a scatter plot, students construct a line of best fit and determine the linear equation for the line they drew.

Stage 3: Learning Plan

Learning Activities	Resources
Draw a straight line (line of best fit) on a scatter plot that closely fits the data points. Interpret and describe how well the line of best fit (trend line) represents the data by looking at the closeness of the data points.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Use the interactive on NCTM Illuminations website:
http://illuminations.nctm.org/ActivityDetail.aspx?ID=146

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:07PM

Standard/Module: Proficiency with Statistics & Probability: 8.SP.3 (Week 25, 6 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.F.5
  8.F.4
  8.SP.1
  8.SP.2
  8.SP.4

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Statistics & Probability
8.SP Investigate patterns of association in bivariate data.

- 3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Enduring Understandings	Essential Questions
Interpret the slope and y-intercept of the line of best fit in the context of real-world situations represented by bivariate data.	1. Why do we estimate the line of best fit for a scatter plot? 2. What does the slope and y-intercept tell you about the data?

Critical Content

1. Slope as rate of change of bivariate data

2. Y-intercept of bivariate data

Skills	Vocabulary
1. Use the equation of a linear model to solve problems. 2. Interpret the meaning of the slope as a rate of change in context given bivariate data. 3. Interpret the meaning of the y-intercept in context given bivariate data.	Tier 2: interpret Tier 3: bivariate data, line of best fit, rate of change, slope, y-intercept

Stage 2: Assessment Evidence

Assessments

Interpreting a line of best fit
Formative: Test: Written

Given a scatter plot, students construct a line of best fit and determine the linear equation for the line they drew. Justify the slope and y-intercept with regard to the data.

Stage 3: Learning Plan

Learning Activities	Resources
Draw a straight line (line of best fit) on a scatter plot that closely fits the data points. Interpret and describe how well the line of best fit (trend line) represents the data by looking at the closeness of the data points. Write a linear equation for the line. Interpret the slop and y-intercept with regard to the data.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Use the interactive on NCTM Illuminations website:
http://illuminations.nctm.org/ActivityDetail.aspx?ID=146

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:08PM

Standard/Module: Proficiency with Statistics & Probaibility: 8.SP.4 (Week 25, 6 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.SP.1
  8.SP.2
  8.SP.3

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Statistics & Probability
8.SP Investigate patterns of association in bivariate data.

- 4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Enduring Understandings	Essential Questions
Construct and interpret a two-way frequency table of bivariate data.	How is a two-way table used when determining associations between two different categories?

Critical Content

Frequency table of bivariate data

Skills	Vocabulary
1. Construct a two-way frequency table of bivariate data. 2. Interpret and describe relative frequencies for possible associations from a two-way table.	Tier 2: associations, bivariate data, categorical, correlation, pattern Tier 3: frequency, relative frequency, two-way frequency table

Stage 2: Assessment Evidence

Assessments

Two-Way Frequency Table
Formative: Test: Written

Given a two-way frequency table, determine patterns of association.

Stage 3: Learning Plan	
Learning Activities	**Resources**
Construct a two-way frequency table of bivariate data. Interpret and describe relative frequencies for possible associations from a two-way table	www.illustrativemathematics.org www.illuminations.nctm.org
Differentiation Opportunities	
Video: http://learni.st/users/S33572/boards/3233-two-way-frequency-tables	

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:08PM

Standard/Module: Proficiency with Geometry: 8.NS.1 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.NS.2
  8.EE.2
  8.G.6
  8.G.7
  8.G.8

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , The Number System

8.NS Know that there are numbers that are not rational, and approximate them by rational numbers.

- 1. Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.

Enduring Understandings	Essential Questions
1. Within the real number system, there are rational and irrational numbers. 2. Rational numbers can be expressed in equivalent forms (fraction and decimal).	1. What does an irrational number look like? 2. Why is a repeating decimal not irrational? 3. How do you know if a real number is rational or irrational? 4. How do you convert a repeating decimal to a fraction?

Critical Content

1. Rational number

- Subsets of rational numbers: natural, whole, integers
- Can be expressed as a/b where b≠0, and a and b are integers
- Repeating decimal
- Terminating decimal

2. Irrational number

- Subsets of real numbers: rational, irrational
- Not rational

3. Decimal expansion

- Repeating decimal
- Terminating decimal

- Long division

Skills	Vocabulary
1. Understand the subsets of the real number system 2. Know that real numbers that are not rational are irrational. 3. Understand that decimal expansions of irrational numbers are approximations. 4. Show that rational numbers have decimal expansions that repeat eventually. 5. Convert a decimal expansion (terminating and repeating) into a rational number. 6. Convert a rational number to a decimal using long division (7.NS.2d).	Tier 2: approximate, convert, decimal, finite, fraction, infinite, repeating, terminating Tier 3: Decimal expansion, irrational number, rational number, repeating decimal, square root, terminating decimal, √, π

Stage 2: Assessment Evidence

Assessments

Label numbers as rational or irrational
Formative: Test: Written

Students identify numbers as rational or irrational and justify their answers.

Stage 3: Learning Plan

Learning Activities	Resources
1. Examine the subsets of the real number system and determine that real numbers that are not rational are irrational. Understand that decimal expansions of irrational numbers are approximations. Show that rational numbers have decimal expansions that repeat eventually. Convert a decimal expansion (terminating and repeating) into a rational number.Convert a rational number to a decimal using long division (7.NS.2d). 2. Examine square numbers and determine that the inverse of "squaring" is the "square root." Write out square numbers to 10 x 10 and draw the squares on graph paper. Determine that the square root is the same as the length of one side of the square. 3. Make a number line of square numbers and	www.illustrativemathematics.org www.illuminations.nctm.org

square roots in consecutive order. Show where irrational numbers fit on the number line in between perfect squares in order to approximate any irrational number.	

Differentiation Opportunities

Put the squares from the graph paper on a large number line to provide a visual of perfect square numbers and the irrational numbers that are in between.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:09PM

Standard/Module: Proficiency with Geometry: 8.NS.2 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Supporting (20%) 8.NS.1
  8.EE.2
  8.G.6
  8.G.7
  8.G.8
  8.G.9

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , The Number System

8.NS Know that there are numbers that are not rational, and approximate them by rational numbers.

- 2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions

Enduring Understandings	Essential Questions
Compare, locate, and estimate rational approximations of irrational numbers.	1. Why would you change an irrational number to a rational approximation? 2. How can you get a better approximation of the square root of a non-perfect square number? 3. Why is it important to estimate the value of irrational expressions? For example, 6п.

Critical Content

1. Rational approximation
2. Irrational numbers
3. Number line
4. Value of expressions
5. Decimal expansion

Skills	Vocabulary
1. Know perfect squares up to 225. 2. Know how to use the square root button on the calculator. 3. Compare and place rational numbers on a	Tier 2: approximate, compare, estimate, expression, locate, number line, repeating decimal, terminating decimal

number line (6.NS.6). 4. Use rational approximations of irrational numbers to compare the size of irrational numbers. 5. Locate irrational numbers on a number line diagram. 6. Estimate the value of expressions involving irrational numbers. 7. Truncating the decimal expansion of a non-perfect square number. 8. Show that the square root of a non-perfect square number is between the square roots of two perfect square numbers. 9. Explain how to continue on to get better approximations.	Tier 3: decimal expansion, irrational number, rational number, rounding, square root, truncating, √, π

Stage 2: Assessment Evidence

Assessments

Estimate Square Roots
Formative: Test: Written

Students are given irrational numbers written in square root notation and are asked to approximate the values in decimal notation to the nearest tenth. For example, √46 is between 6 and 7 (√36 and √49). Because 46 is closer to 49, the decimal approximation must be around 6.8. (actual is 6.78232 . . .).

Stage 3: Learning Plan

Learning Activities	Resources
1. Examine square numbers and determine that the inverse of "squaring" is the "square root." Write out square numbers to 15 x 15 and draw the squares on graph paper. Determine that the square root is the same as the length of one side of the square. 2. Make a number line of square numbers and square roots in consecutive order. Show where irrational numbers fit on the number line in between perfect squares in order to approximate any irrational number. 3. Students use calculators to verify their estimates of square roots that result in irrational numbers.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Put the squares from the graph paper on a large number line to provide a visual of perfect square numbers and the irrational numbers that are in between.

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Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:10PM

Standard/Module: Proficiency with Equations: 8.EE.2 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.1
  8.EE.5
  8.EE.6
  8.F.1

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Expressions & Equations

8.EE Work with radicals and integer exponents.

- 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.

Enduring Understandings

1. Understand that all non-perfect square roots and cube roots are irrational.
2. Evaluate and use square roots and cube roots to solve equations.

Essential Questions

1. Is the square/cube root of a number always smaller than the number itself?
2. What is the difference between square root and cube root of a number?
3. What is the relationship between squaring and square root? Cubing and cube root?

Critical Content

1. Square root symbol
2. Cube root symbol
3. Solutions to equations of the form $x^2 = p$ and $x^3 = p$, where *p* is a positive **rational number**.
4. Perfect squares
5. Small perfect cubes

Skills

1. Use square root and cube root symbols.
2. Use the cube root button on the calculator.
3. Evaluate square roots and cube roots.
4. Represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where *p* is a positive

Vocabulary

Tier 2: equations, evaluate

Tier 3: cube, cube root, inverse operation, radical, perfect cube, perfect square, square, square root, √

rational number (including fractions and decimals such as 9/16, 0.64) 5. Use inverse operations to solve equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive **rational number**. 6. Understand that all non-perfect square roots and cube roots are irrational.	

Stage 2: Assessment Evidence

Assessments

Evaluate square and cube roots
Formative: Test: Written

Students evaluate square and cube roots including those resulting in perfect cubes or perfect squares.

Stage 3: Learning Plan

Learning Activities	Resources
Evaluate square roots and cube roots. Represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive **rational number** (including fractions and decimals such as 9/16, 0.64). Use inverse operations to solve equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive **rational number**. Understand that all non-perfect square roots and cube roots are irrational.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Stick with whole numbers as long as possible to help "solidify" the concept for struggling students and gradually introduce fractions and decimals.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:11PM

Standard/Module: Proficiency with Geometry: 8.G.6 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.2
  8.NS.1
  8.NS.2

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand and apply the Pythagorean Theorem.

- 6. Explain a proof of the Pythagorean Theorem and its converse.

Enduring Understandings	Essential Questions
Prove the Pythagorean Theorem and its converse	1. Can you explain the reasoning behind the Pythagorean Theorem proof? 2. How do you determine if a triangle is a right triangle?

Critical Content

1. Proof of Pythagorean Theorem
2. Proof of the converse of the Pythagorean Theorem

Skills	Vocabulary
1. Identify the parts of a right triangle (legs, hypotenuse). 2. Know that the Pythagorean Theorem of a right triangle is $a^2 + b^2 = c^2$. 3. Understand and explain a proof of the Pythagorean Theorem. 4. Understand and explain the proof of the converse of the Pythagorean Theorem (If $a^2 + b^2 = c^2$, then it is a right triangle).	Tier 2: right triangle, squaring a number Tier 3: converse, hypotenuse, leg, proof, Pythagorean Theorem

Stage 2: Assessment Evidence

Assessments

Explain Pythagorean Theorem
Formative: Performance: Authentic Task

Students work in groups to prove/explain Pythagorean Theorem and it's converse

Stage 3: Learning Plan

Learning Activities	Resources
See links below Use Pythagorean Triples to help students derive $a^2 + b^2 = c^2$ Multiple Proofs of the Pythagorean Theorem Proving Pythagorean Theorem	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

See power point above.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:13PM

Standard/Module: Proficiency with Geometry: 8.G.7 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.2
  8.NS.1
  8.NS.2

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand and apply the Pythagorean Theorem.

- 7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Enduring Understandings	Essential Questions
Using the Pythagorean Theorem	1. What can the Pythagorean Theorem be used for? 2. Do you need to find the length of one of the legs or the hypotenuse?

Critical Content

1. Missing sides of a right triangle
2. Real-world context
   - two-dimensional
   - three-dimensional

Skills	Vocabulary
1. Solve equations using squares and square roots. 2. Apply the Pythagorean Theorem to find an unknown length of a side of a right triangle. 3. Use the Pythagorean Theorem to solve real-world problems including three-dimensional	Tier 2: right triangle, square of a number, square root, square root symbol, three-dimensional, two-dimensional

figures.	Tier 3: hypotenuse, leg, Pythagorean Theorem

Stage 2: Assessment Evidence

Assessments

Using Pythagorean Theorem in the Real World
Formative: Performance: Skill Demonstration

Students are presented with a problem in which they have to accurately set up and solve for Pythagorean Theorem, including correctly identifying the legs and hypotenuse. Students justify their answer and determine whether it is reasonable, while demonstrating an understanding that the hypotenuse is always the longest side in a right triangle.

Stage 3: Learning Plan

Learning Activities	Resources
Students find examples of right triangles in the real world and bring in examples or photos. Students should also take at least two measurements if possible, and find the third measurement using Pythagorean Theorem. Examples should include 2D and 3D representations.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Help students to find the right angle when the triangle is rotated or displayed as part of a 3D drawing.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:14PM

Standard/Module: Proficiency with Geometry: 8.G.8 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Major (70%) 8.EE.2
  8.NS.1
  8.NS.2

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Understand and apply the Pythagorean Theorem.

- 8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Enduring Understandings	Essential Questions
Distance between two points	1. How do you use the Pythagorean Theorem to find the distance between two points? 2. How do you use the distance formula to find the distance between two points?

Critical Content

Distance between two points

- Using Pythagorean Theorem
- Using distance formula

Skills	Vocabulary
1. Calculate the distance between two points in a coordinate system using Pythagorean Theorem. 2. Connect findings to the distance formula to find the distance between two points on the coordinate plane.	Tier 2: calculate, coordinate plane, leg, hypotenuse, Pythagorean Theorem, right triangle Tier 3: distance formula, perpendicular

Stage 2: Assessment Evidence

Assessments

Determine the distance using Pythagorean Theorem
Formative: Test: Written

Students are given two points and asked to plot them on a coordinate plan and determine the distance using the Pythagorean Theorem. Students are expected to justify their answers.

Stage 3: Learning Plan

Learning Activities	Resources
Students graph three equations on a coordinate plane in which one is vertical, one is horizontal, and one is a linear equation and find the distance between two specified points. For example, graph x = 4, y = 2, and y =2x+2 on the same coordinate plane Shade in the resulting right triangle. Find the distance between (0,2) and (4, 10). Students write three equations for another group to graph and solve for a specified point on the graph. Students are given two points on the graph and they draw in the right triangle, and find the distance between the vertices that are on opposite ends of the hypotenuse. Students write the equations for the legs and hypotenuse.	www.illustrativemathematics.org www.illuminations.nctm.org

Differentiation Opportunities

Eliminate writing the equations if this is too overwhelming for students.

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Unit Map 2012-2013

Monroe #2 - Orleans BOCES (Regional Collaboration)

Collaboration / Math 8* / Grade 8 (Math Regional Curriculum)

Wednesday, October 31, 2012, 2:14PM

Standard/Module: Proficiency with Geomerty: 8.G.9 (Week 32, 8 Weeks)

Stage 1: Desired Results

Standards Focus

- Additional (10%) 8.EE.2
  8.NS.1
  8.NS.2

Grade 8 Map

Standards

NYS: CCLS:Mathematics, NYS: 8th Grade , Geometry

8.G Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

- 9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Enduring Understandings	Essential Questions
Volume formulas of three-dimensional shapes	1. Why are mathematical formulas important? 2. Where/When would you use formulas for volume of cone, cylinder, or sphere?

Critical Content

Volume formulas

- Cones
- Cylinders
- Spheres

Skills	Vocabulary
1. Derive the formulas for cones and cylinders based on prior knowledge of prisms and pyramids. 2. Know when to use the formulas for the volumes of cones, cylinders, and spheres. 3. Know how to use the formulas for the volumes of cones, cylinders, and spheres. 4. Use the volume formulas for real-world problems.	Tier 2: height Tier 3: cone, cubic units, cylinder, diagonal, diameter, hemisphere, perpendicular height, radius, pi (π), slant height, sphere, volume

5. Know when to leave expressions in terms of π and when to use approximations. 6. Given the volume of a cone, cylinder, or sphere, find the radius, or height.	

Stage 2: Assessment Evidence

Assessments

Apply formulas for volumes of cones, cylinders, and spheres
Formative: Test: Written

Apply the formulas for volumes of cones, cylinders, and spheres when presented with real-world problems such as the volume of an ice cream cone with ice cream in which (measurements are given of the cone and the ice cream scooper, assuming it produces ice cream in the shape of a perfect sphere).

Stage 3: Learning Plan

Learning Activities	Resources
Derive the formulas for cones and cylinders based on prior knowledge of prisms and pyramids. Experiment with situations that require the student to know when to use the formulas for the volumes of cones, cylinders, and spheres. Calculate with the formulas for the volumes of cones, cylinders, and spheres in real-world problems. Determine when to leave expressions in terms of π and when to use approximations. Given the volume of a cone, cylinder, or sphere, find the radius, or height.	www.illuminations.nctm.org www.illustrativemathematics.org

Differentiation Opportunities

Use hands-on models as much as possible. 3D geometry is not conceptualized when it is always presented in 2D formats.

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“The Magic Money Machine”

Objectives: Understand the relationship between the slope and y-intercept in all three representations of linear functions: the graph, t-chart and equation.

Standards Addressed: This unit addresses the entire “Functions” domain.
8.F.1 *Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.*

8.F.2 *Compare properties of two function each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*

8.F.3 *Interpret the equation y=mx+b as defining a linear function, whose graph is a straight line;*

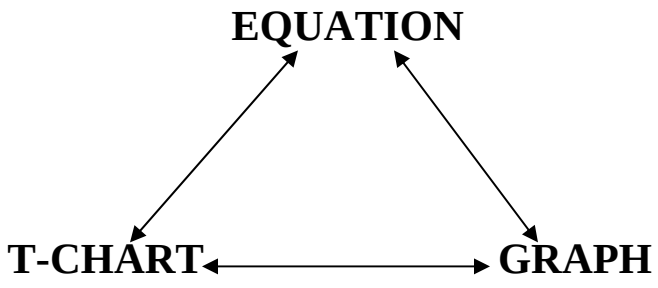
8.F.4 *Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or table of values.*

8.F.5 *Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g where the function is increasing or decreasing, linear or non-linear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.*

Materials:
Graph Paper
Ruler
“What’s My Rule?” Blackline Master
Magic Money Machine Blackline Master
Two different colors of crayons or markers (one for the slope and one for the y-intercept)

Time Line: 3-6 days

Rationale: Students need to understand that there are three representations of linear equations and that they can flexibly go between the representations for different purposes.



Created By: Victoria Williams, Monroe 2-Orleans BOCES, Spring, 2011

Day 1: T-chart to Equation

Tell the students that you are giving them a magic money machine. It's magic because if you put money into the machine, a different amount might come out. The machine has an LCD screen that shows the machine's settings, but the screen is broken. However, the dial still works so we can change the settings if we want, we just don't know what will happen until we test the machine. The way it works is to put some money into the machine, press the "start" button and see what happens.

SMART Board connection: go to www.harveyshomepage.com and download "Function Man."

Draw one of the t-charts on the board. Tell students that in order to organize what's happening, we will use a t-chart to separate what we put into the machine from what comes out of the machine. Use the suggested scenarios below or make up your own for your students. Use a different t-chart for each new scenario. Be sure to draw students' attention to the repeating pattern in the OUT column (y-values) and document it (this is the slope and we want the students to be able to identify it later). Help students formalize each equation into y = mx + b form. This is explained by telling them "The amount that comes out (y) is equal to the amount that goes in (x) times a certain number (m) plus whatever happened when I didn't put any money into the machine (b) and just pressed the start button." You may need to remind them that the repeated addition in the t-chart is the same thing as multiplication.

Some possible scenarios for the Magic Money Machine:

Scenario 1: *Y = 3X*

I drop in $0 and no money comes out.
I drop in $1 and $3 comes out.
I drop in $2 and $6 comes out.
I drop in $3 and $9 comes out.
How much will come out when I drop in $10? How much will come out when I drop in $100?
What is happening to the money inside the machine?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and $33 came out. How much got dropped in? How do you know?

Scenario 2: *Y = 2X + 3*

I drop in $0 and $3 comes out.
I drop in $1 and $5 comes out.
I drop in $2 and $7 comes out.
I drop in $3 and $9 comes out.
How much will come out when I drop in $10? How much will come out when I drop in $100?
What is happening to the money inside the machine?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and $43 came out. How much got dropped in? How do you know?

Scenario 3: Y = 5X -2

I drop in $0 and a pair of handcuffs come out and lock me to the machine until I pay it $2!!
I drop in $1 and $3 comes out.
I drop in $2 and $8 comes out.
I drop in $3 and $13 comes out.
How much will come out when I drop in $10? How much will come out when I drop in $100?
What is happening to the money inside the machine?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and $173 came out. How much got dropped in? How do you know?

Scenario 4: Y = -3X-2

I drop in $0 and a pair of handcuffs come out and lock me to the machine until I pay it $2!!
I drop in $1 and I owe the machine $5!
I drop in $2 and I owe the machine $8!
I drop in $3 and I owe the machine $11!
What happens if I drop in $10? What happens when I drop in $100?
What is happening to the money inside the machine?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and she owed the machine $62!.
How much got dropped in? How do you know?

Scenario 5: $Y = X^2$

I drop in $0 and no money comes out.
I drop in $1 and $1 comes out.
I drop in $2 and $4 comes out.
I drop in $3 and $9 comes out.
I drop in $4 and $16 comes out.
How much will come out when I drop in $10? How much will come out when I drop in $100?
What is happening to the money inside the machine? How was this different than the others?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and $400 came out. How much got dropped in? How do you know?

Scenario 6: Y = 1/2X +4

I drop in $0 and $4.
I drop in $1 and $4.50 comes out.
I drop in $2 and $5 comes out.
I drop in $3 and $5.50 comes out.
I drop in $4 and $6 comes out.
How much will come out when I drop in $10? How much will come out when I drop in $100?
What is happening to the money inside the machine? How was this different than the others?
(help students to generalize it into an equation form on the line below the t-chart)
My friend dropped in some money when I wasn't looking and $40 came out. How much got dropped in? How do you know?

Students can also make up their own scenarios to share with friends.

Day 2: T-Chart to Graph

On day 2, show students how to plot the x and y values on a graph. Refer back to each equation and draw their attention to the coefficient in front of X in the equation and ask them where they see it on the graph. Color-code that number with one of your colors on both the equation and the graph. Ask if they see it in the t-chart and color it in the same color as well. Draw their attention to the constant in the equation and ask them where they see that number in the graph. Color code those with the other color and ask students to find it in the t-chart as well.

Help them to formally define slope and y-intercept. Students should note the distinguishing factors of each (document student responses on chart paper and save it for future days of the unit)

Give them practice t-tables to practice writing equations, then graph them. Students should color-code the slope and y-intercepts on each practice problem.

Day 3: Equation to T-Chart to Graph

Explain to students that when we know the equation, we can always substitute in values (x) and solve for y or vice versa. The easiest way to do this is to pick easy dollar amounts to try. Typically, we choose $0, $1, $2 and $3 as our in values (x) and figure out the out amount (y). Give students practice equations and let them practice creating t-charts. It's a great time to have a discussion about the infinite possibilities of amounts we could plot, including negative values, even though they may not make sense with our money machine scenarios. Once they have created t-charts for each equation, have the students color code the slope and y-intercept on both the equation and on the t-chart. After that, students should graph their lines by plotting the points from the t-chart. Finally, they should color-code the graphed line with the slope and y-intercept.

Day 4: Equation to Graph without a T-Chart

Give students a sample equation and ask them to identify the slope and y-intercept with using the color-coding strategy. Ask students where we saw the slope and y-intercept on the graph in previous days lessons. Tell them that a short-cut to making a t-chart is to simply graph the y-intercept then use what I know about slope to create the next few points. Draw a straight line. They can always fall back on the t-chart to check if their points are correct by plugging in x values and determining whether their y-values were correct. Give students examples of equations to graph. Students should continue to color-code the slope and y-intercept. Be sure to address what happens when Y = a number and X = a number. What happens to the lines in these cases? Why?

Day 5: Graph to Equation

Explain to students that we can also go the other way—if we can see the graph, we can usually derive the slope and y-intercept from it. Using the color-coding system, have students identify the slope and y-intercept in each graph. Look back at previous days' equations and ask students what features are always present in those equations (the y, the = sign, the X and usually a + or – sign). Since those are always present, I can fill in the missing pieces which are the repeating stair-step pattern (slope) which we know gets multiplied by x since repeated addition is the same as multiplication, and the point at which the line crosses the y-axis is the y-intercept. Show students where those belong in the equation. Ask them what they might do if they were asked to identify more points on the graph than what is shown. Give students some graphs to practice writing equations from.

Day 6: Graph to T-Chart

Sometimes the equation may not be readily apparent to the student and/or the student may have a question that asks them to identify a certain number of points on the graph but the picture only shows a couple of them. Help students to use the picture to put the information from the graph into the t-chart. Ask them to identify what would happen when x is 0, -1, -2, and -3. Remind them that we did something similar on day 3 when we choose easy numbers for our t-charts. Explain that these are often numbers we use when we are asked to graph the part of a line that doesn't necessarily have a positive x value, which doesn't make sense for our money machine, but is important for other possible scenarios.

Drop the color-coding system as students become more fluent with identifying the slope and y-intercept. Eventually, they should be able to pick these out form any representation without color-coding.

Extensions:

1. What happens to the slope and y-intercept in each representation when the lines are parallel? What about perpendicular? Give an example of a set of parallel lines on a graph, then identify their equations and t-charts. Do the same for a set of perpendicular lines.

2. What happens when I graph two equations on the same piece of graph paper? Explore graphing systems of equations using the same strategies in this unit. You can also use the same strategies for linear inequalities.

3. If students have learned Pythagorean theorem, have them graph lines that will form right triangles then determine the length of each side using the coordinate grid and Pythagorean theorem. For example, "graph these three equations on the same piece of graph paper:

$X = 3$ $\qquad$ $Y = 3$ $\qquad$ $Y = -\frac{1}{2}X + 10$

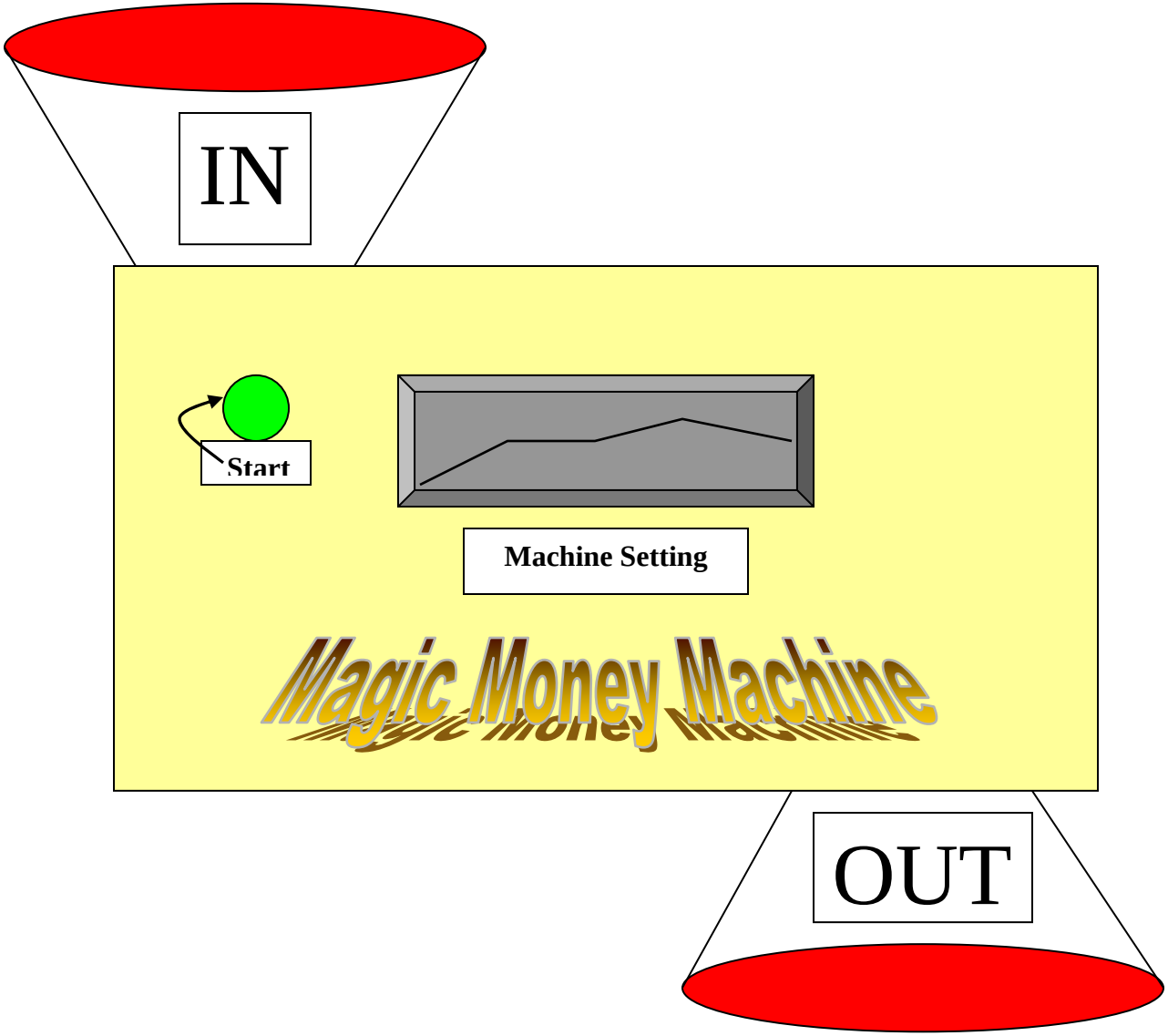
Daily Assessment Idea:

Use the old state tests to find examples of each day's concept. Copy one of these problems per day and give it to the students as an "exit slip" to determine who does and does not get that type of representation.

Resources

Make Your Own Graph Paper Resource:
http://www.incompetech.com/graphpaper/

Resources for Daily Practice Problems:
http://www.kutasoftware.com/free.html
District approved text-books


IN
Start
Machine Setting
Magic Money Machine
OUT

What's My Rule?

Scenario 1:

In	Out

Rule: _____

Scenario 2:

In	Out

Rule: _____

Scenario 3:

In	Out

Rule: _____

Scenario 4:

In	Out

Rule: _____

Scenario 5:

In	Out

Rule: _____

Scenario 6:

In	Out

Rule: _____

Free Plain Graph Paper from http://incompetech.com/graphpaper/plain/

The Pythagorean Theorem

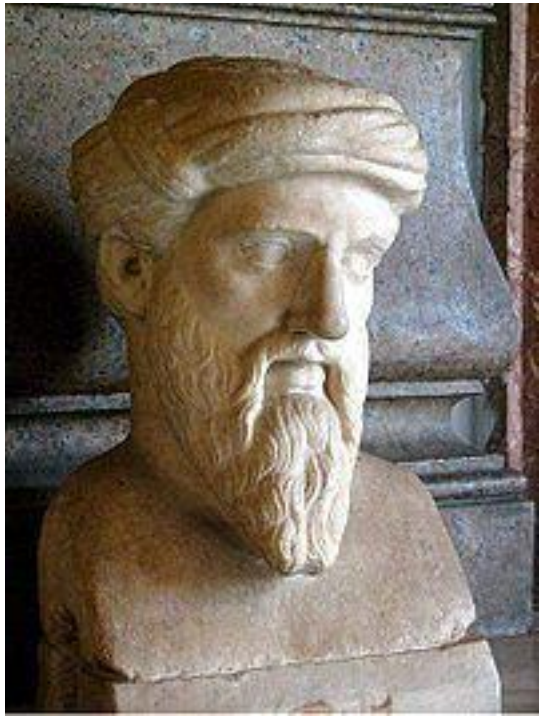
As you've never seen it before

Jillian Dunkleberger – Hannibal CSD

Blair Madore – SUNY Potsdam

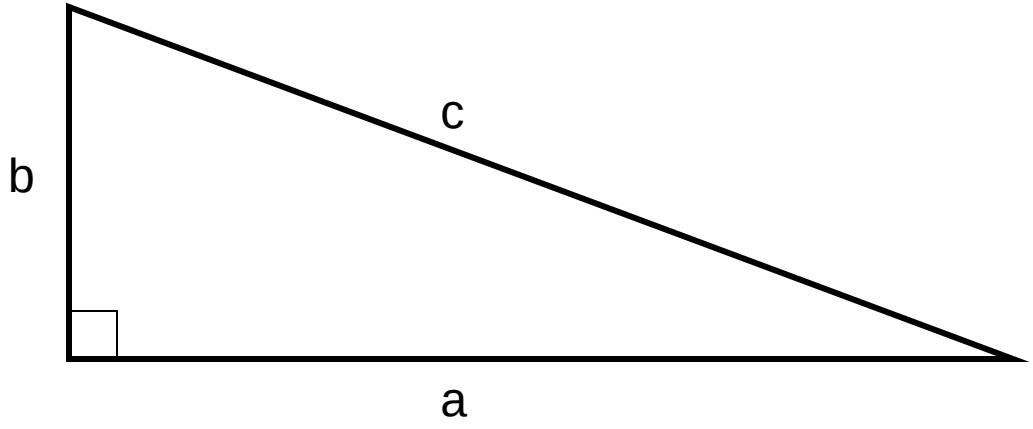
Pythagoras

- 560BCE-480BCE
- Born on the Isle of Samos to a gem cutter named Mnesarchus
- Studied and travelled to Syros and Egypt.
- Founded new society in Croton (Italy)
- After a rebellion moved to Metapontum where he died

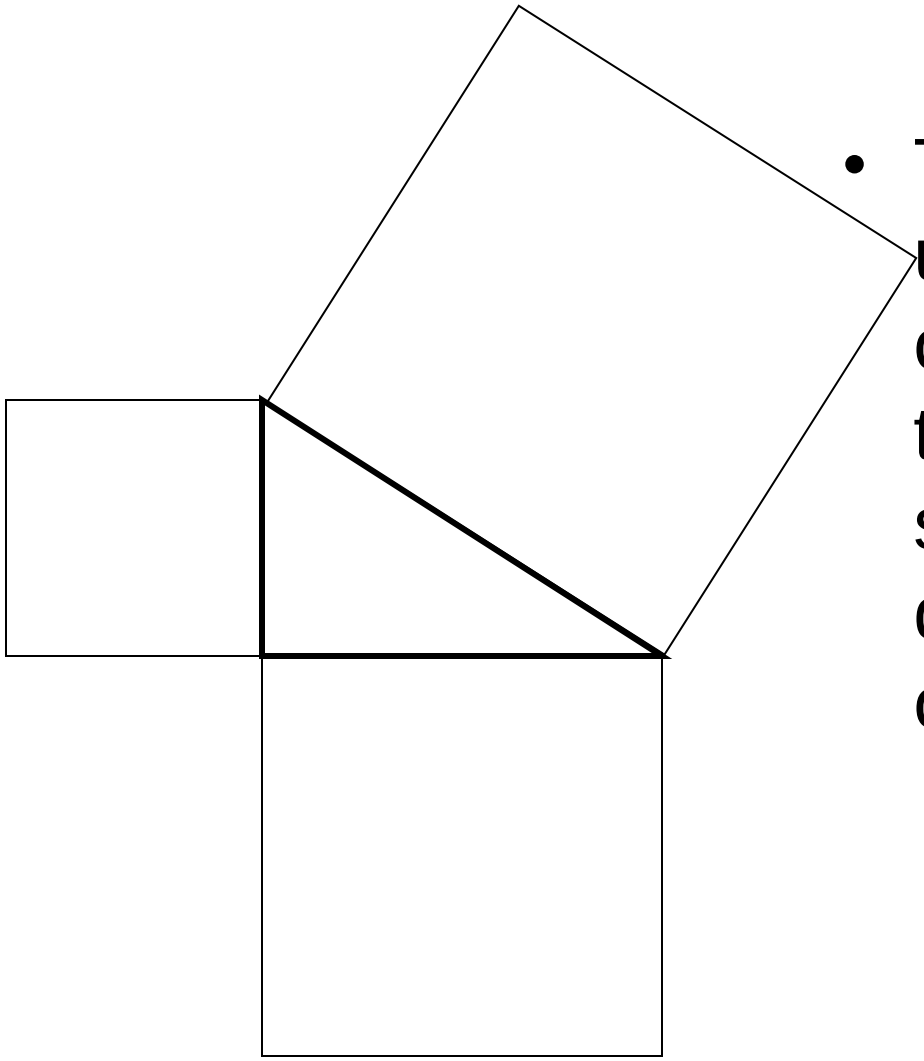


Pythagorean Theorem

- In a right angled triangle with sidelengths a, b and c, where c is opposite the right angle, $a^2+b^2=c^2$.

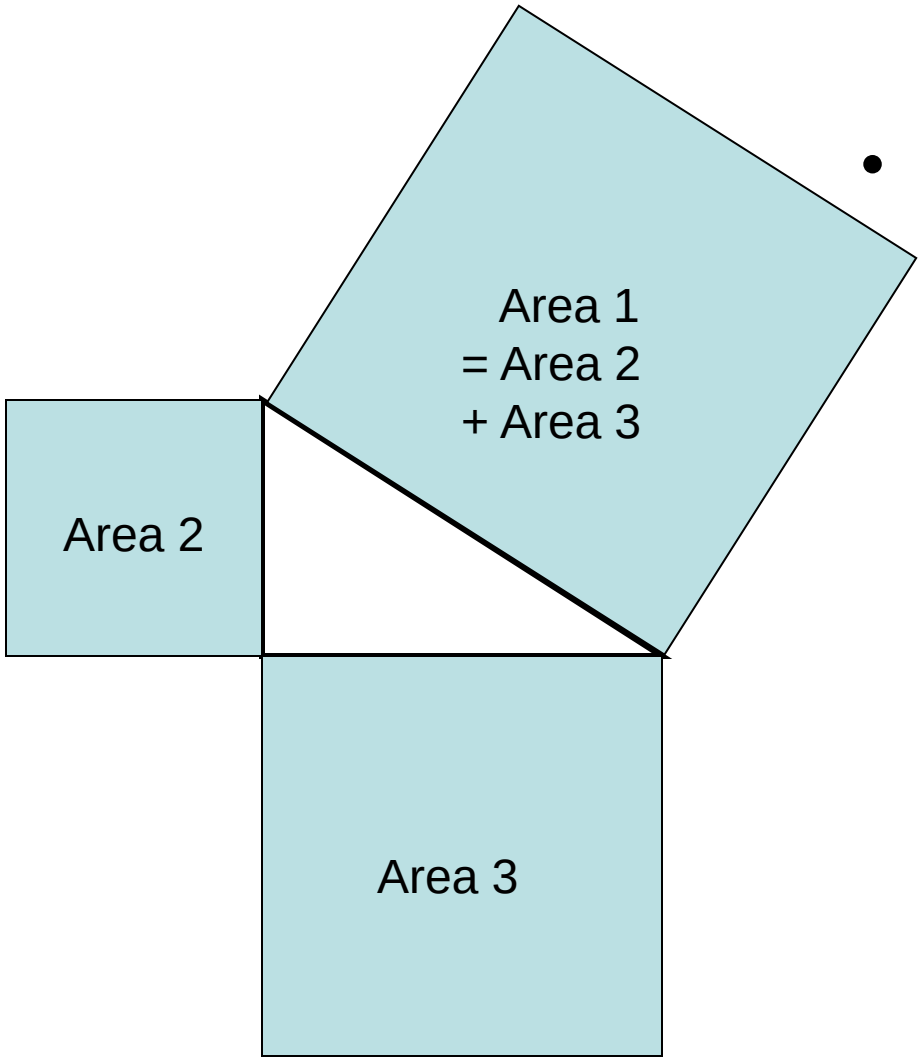


A Nice Theorem from Egypt



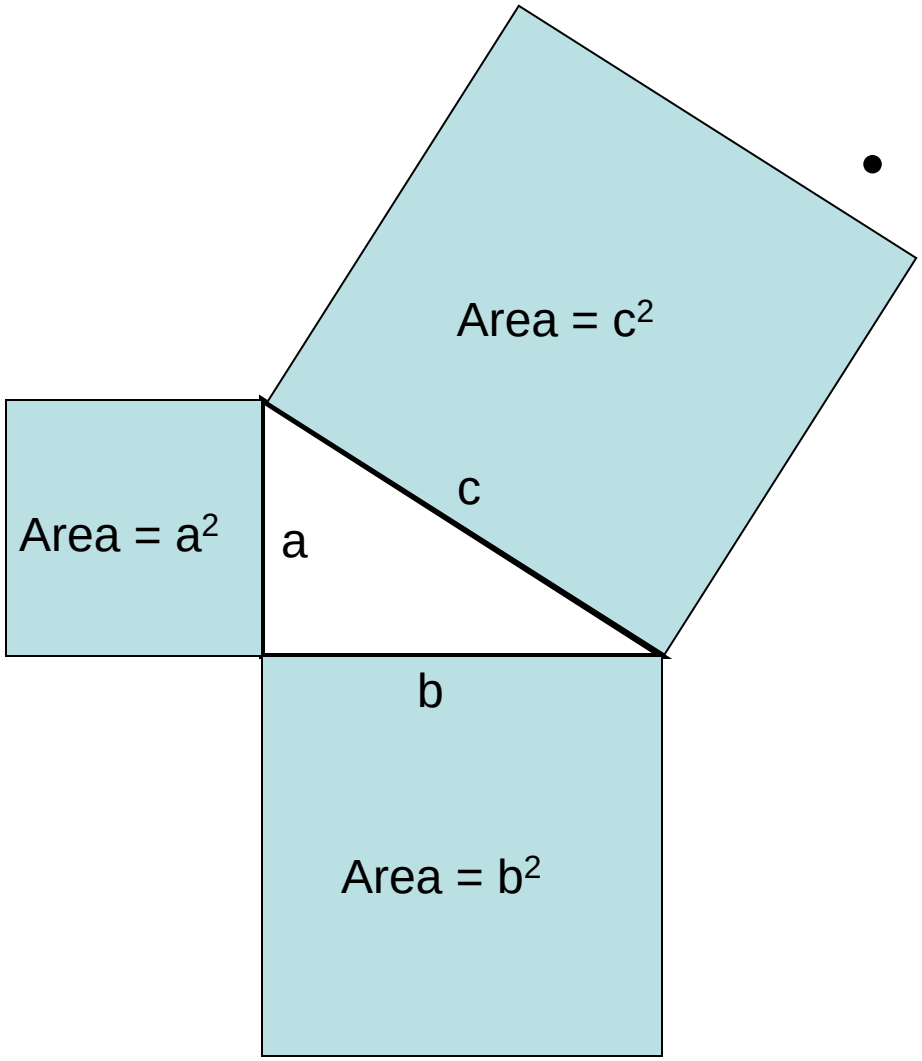
- The square described upon the hypotenuse of a right-angled triangle is equal to the sum of the squares described upon the other two sides

A Nice Theorem from Egypt



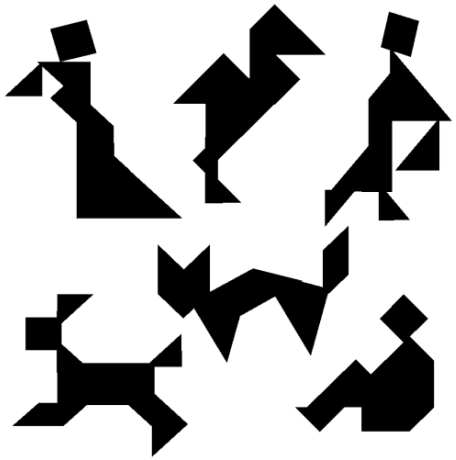
- The square described upon the hypotenuse of a right-angled triangle is equal to the sum of the squares described upon the other two sides

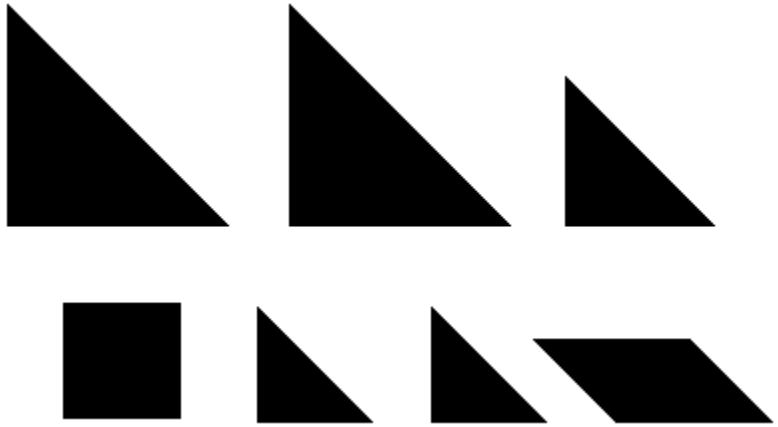
A Nice Theorem from Egypt



- The area of the square on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides $c^2=b^2+a^2$

Tangrams

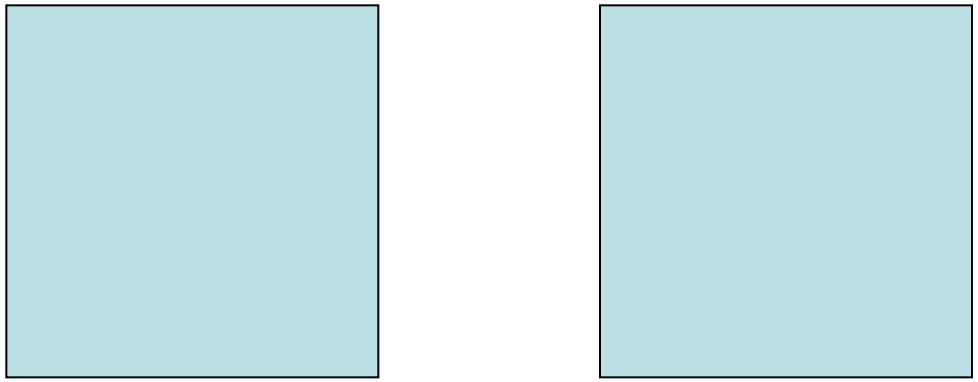




- Chinese Puzzle created about 1800
- First puzzle craze
- Swept the world in the 1820’s

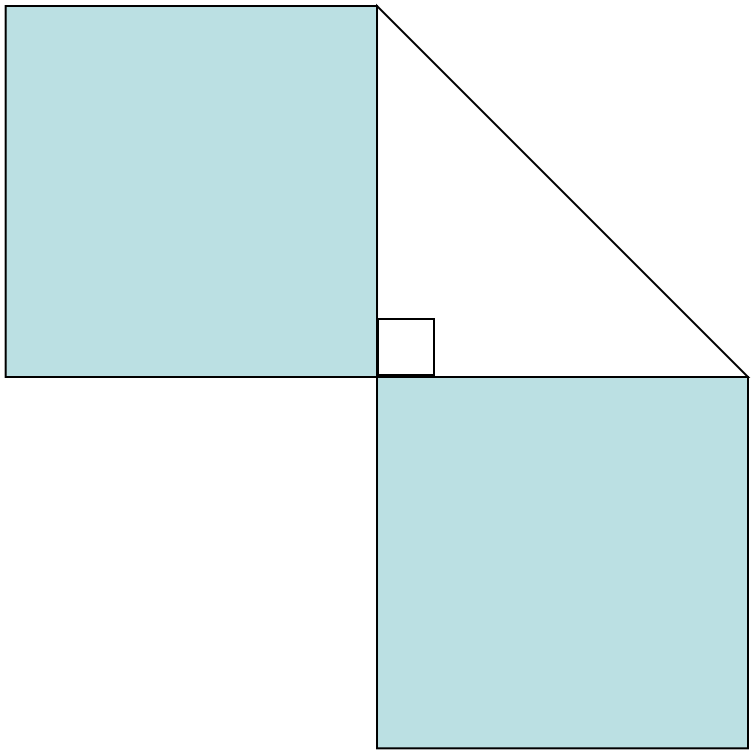
Tangram Proof

- Can you use ALL 7 tangram pieces to make two congruent squares?

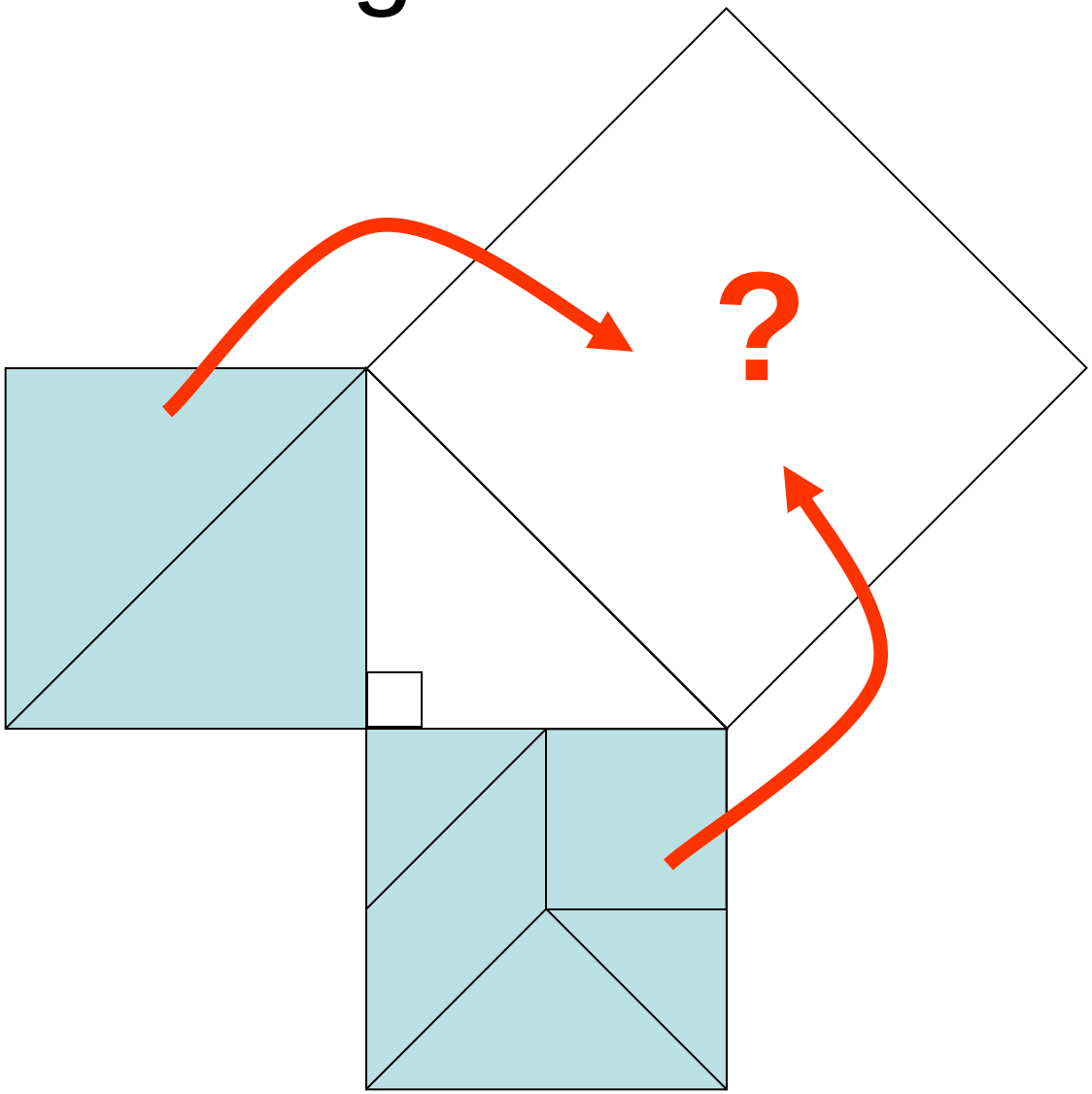


Tangram Proof

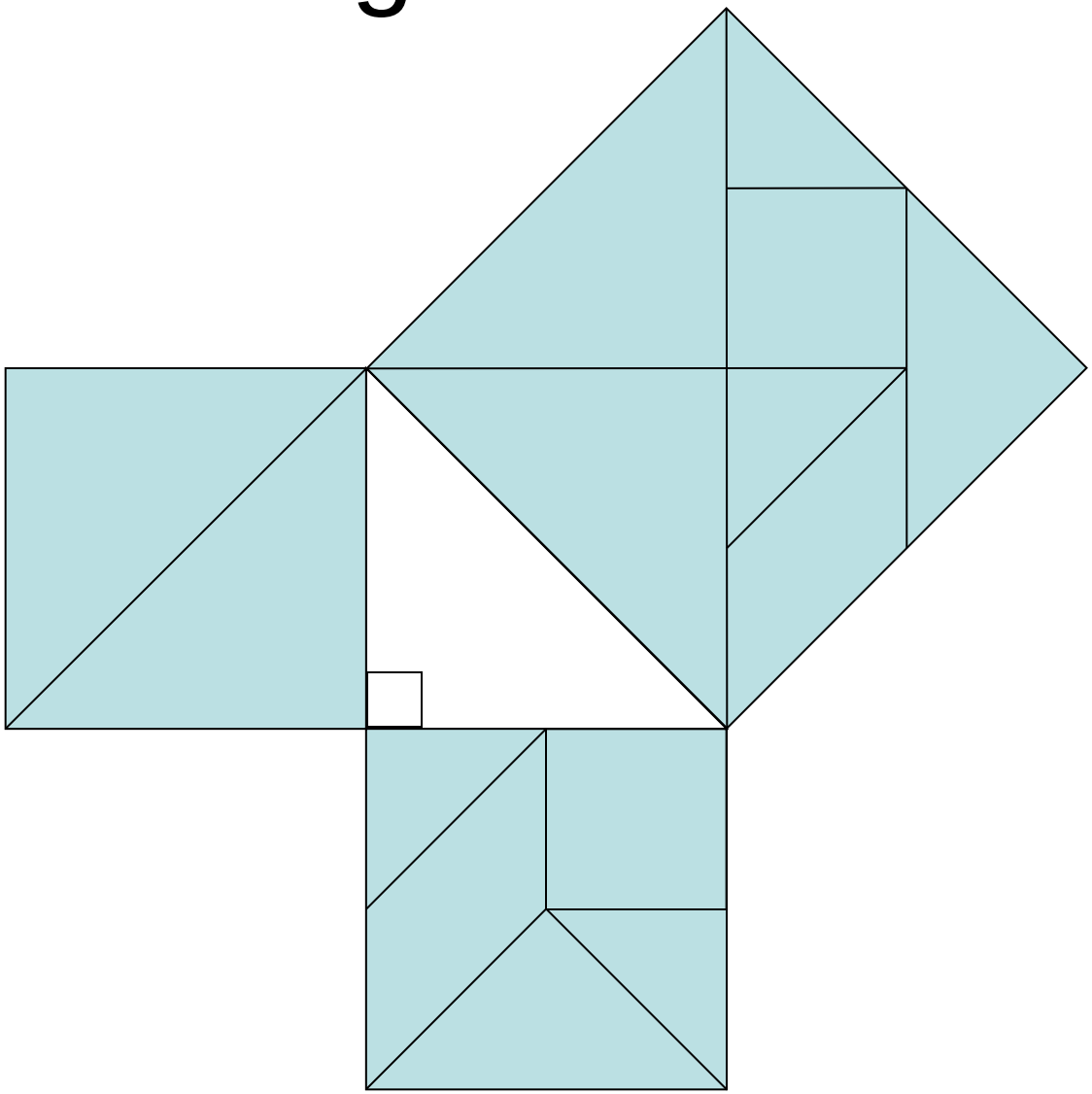
- Now, using the same seven pieces make one square, the square on the hypotenuse.



Tangram Proof

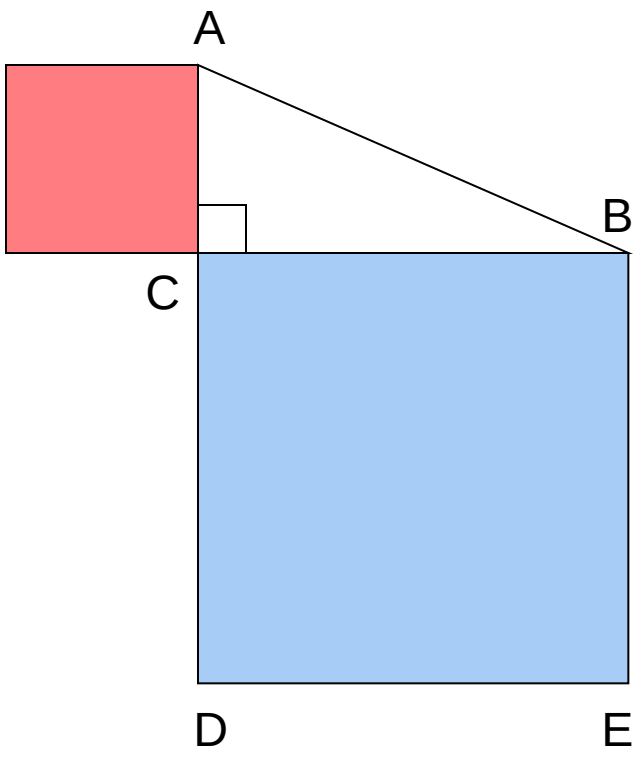


Tangram Proof



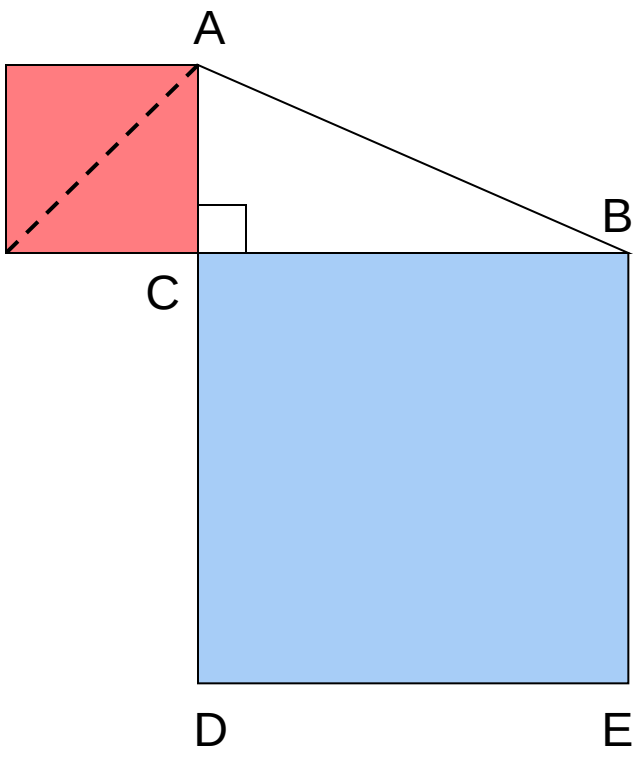
A Dissection Proof Attributed to Liu Hui (300 C.E.)

- Draw any right triangle and the squares on the legs.
- Ensure the smallest square (red) is to the left and above the other square (blue).



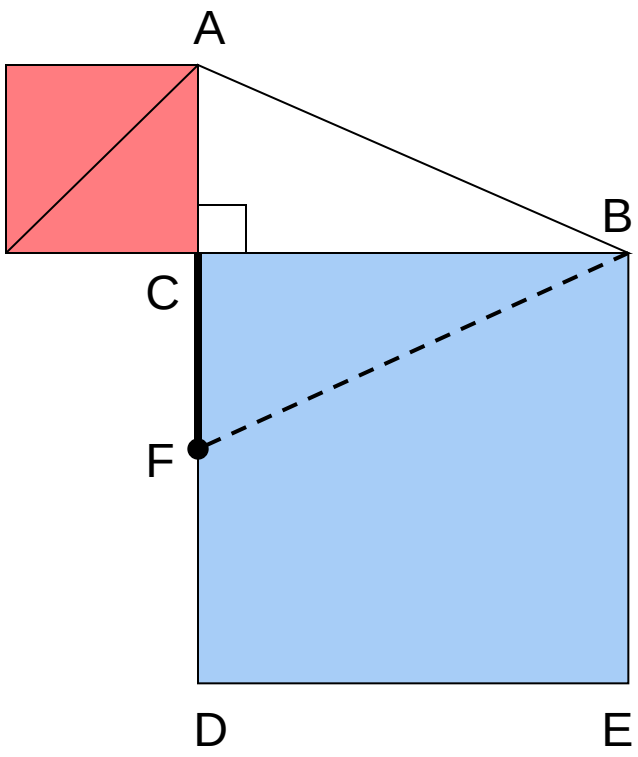
A Dissection Proof Attributed to Liu Hui (300 C.E.)

- Divide the red square along the diagonal.



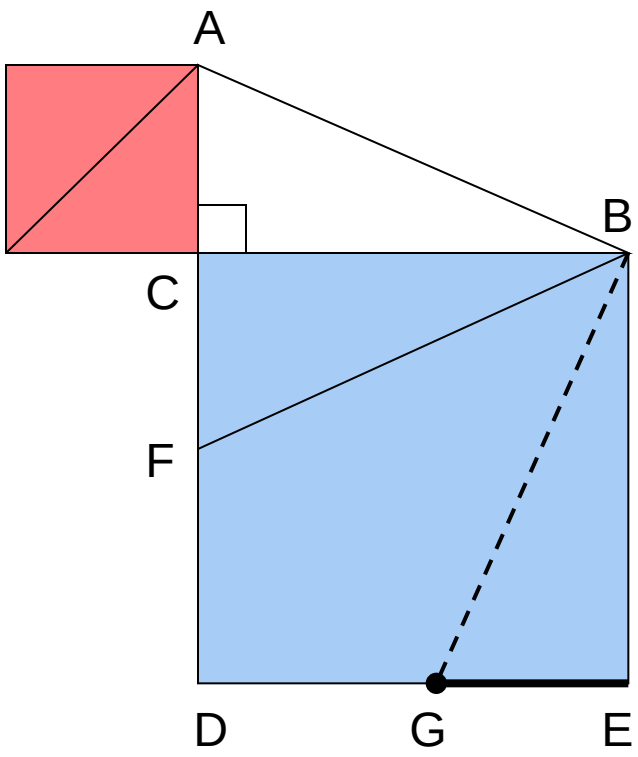
A Dissection Proof Attributed to Liu Hui (300 C.E.)

- Mark off a point F on the left side of the blue square so that AC=FC
- Connect F to B.



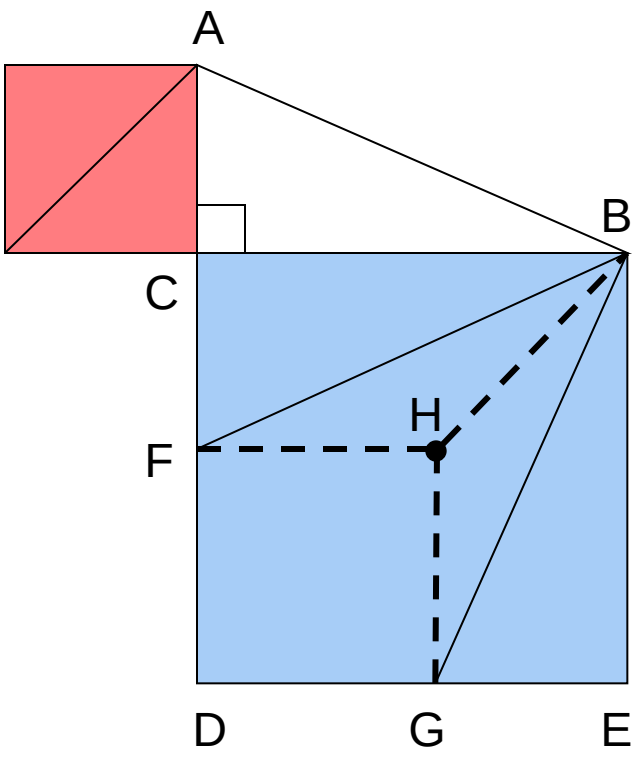
A Dissection Proof Attributed to Liu Hui (300 C.E.)

- Mark off a point G on the bottom of the blue square so that GE=AC
- Connect G to B



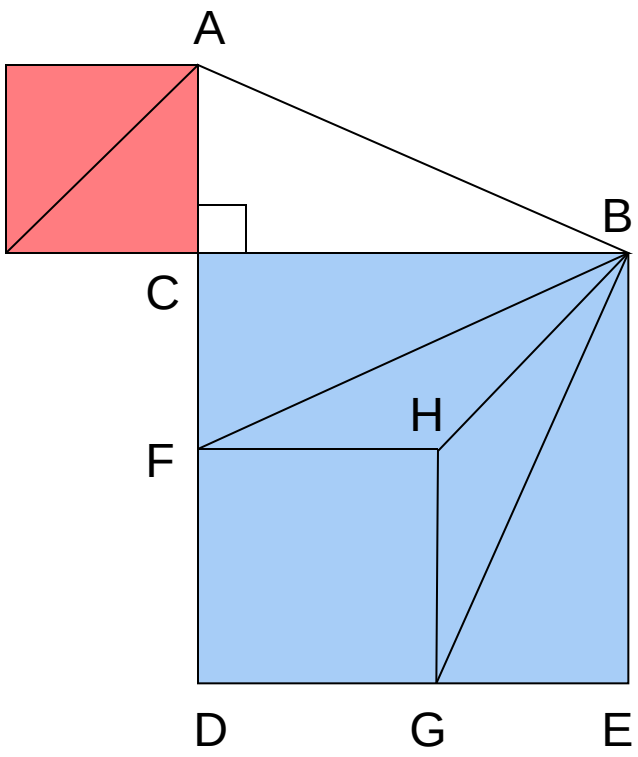
A Dissection Proof Attributed to Liu Hui (300 C.E.)

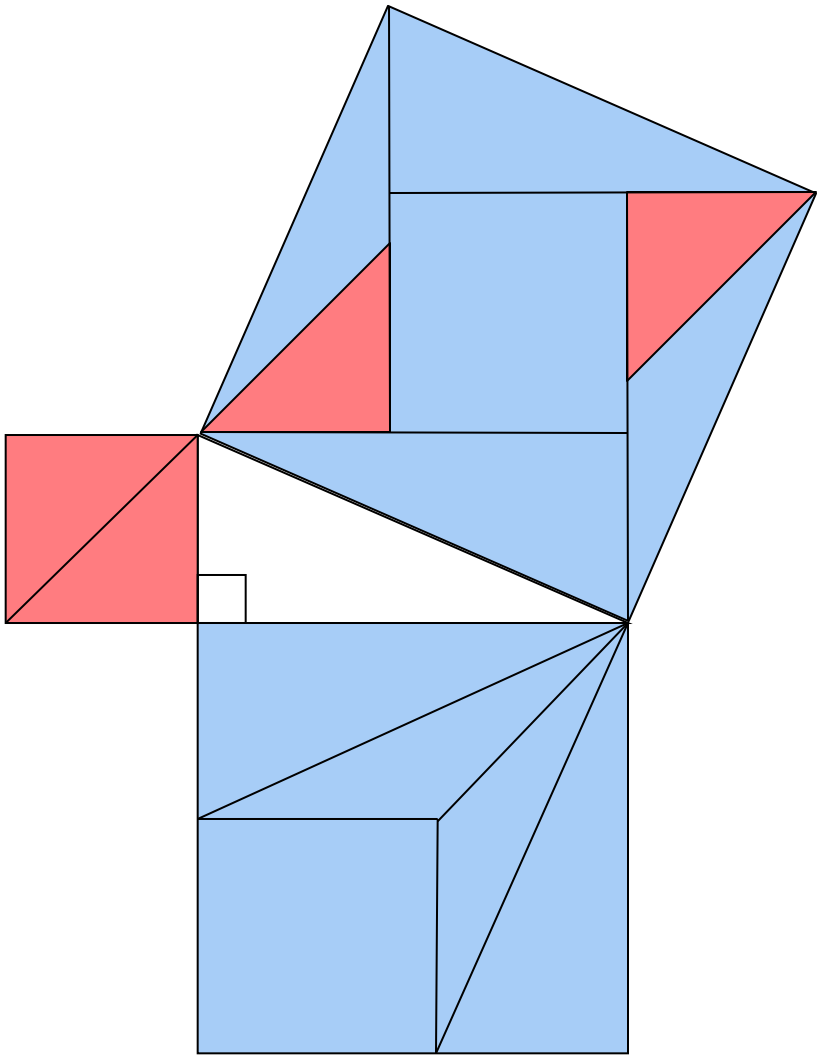
- Construct a point H so that DFGH is a square.
- Connect H to B, F and G.



A Dissection Proof Attributed to Liu Hui (300 C.E.)

- Cut out the red and blue pieces and rearrange them to form the square on the hypotenuse.

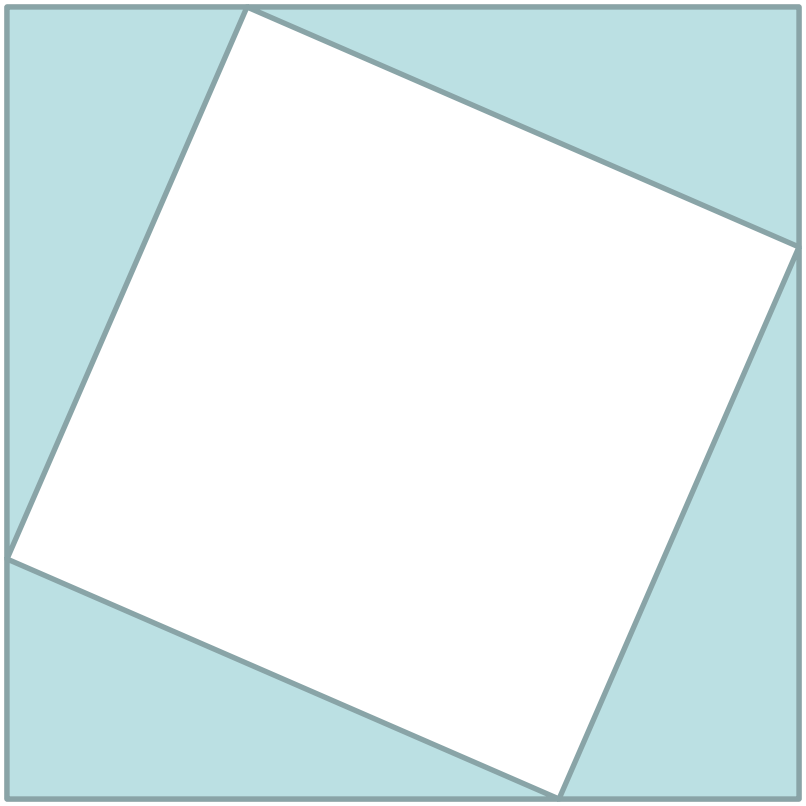




A Dissection Proof Attributed to Liu Hui (300 C.E.)

Chou Pei Suan Ching

anonymous, 200 B.C.E.



Chou Pei Suan Ching

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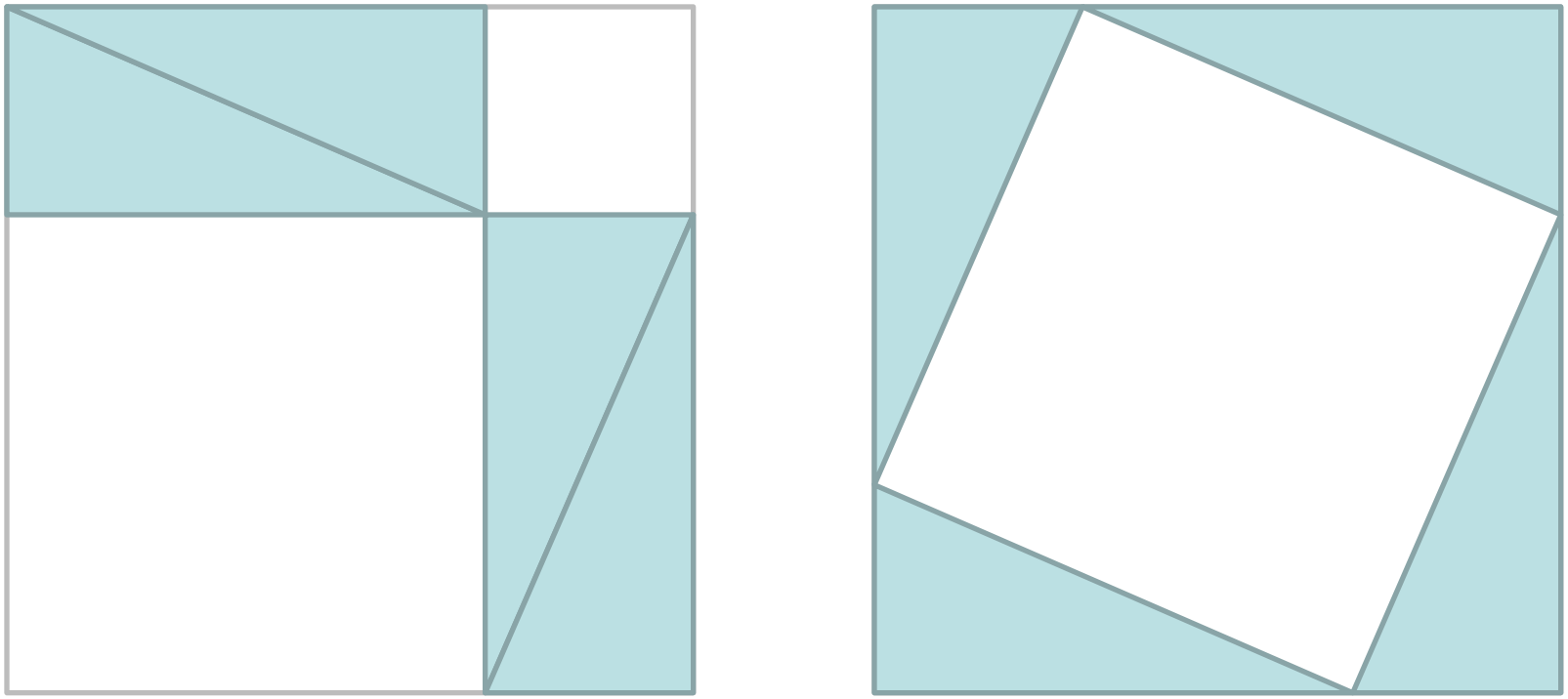

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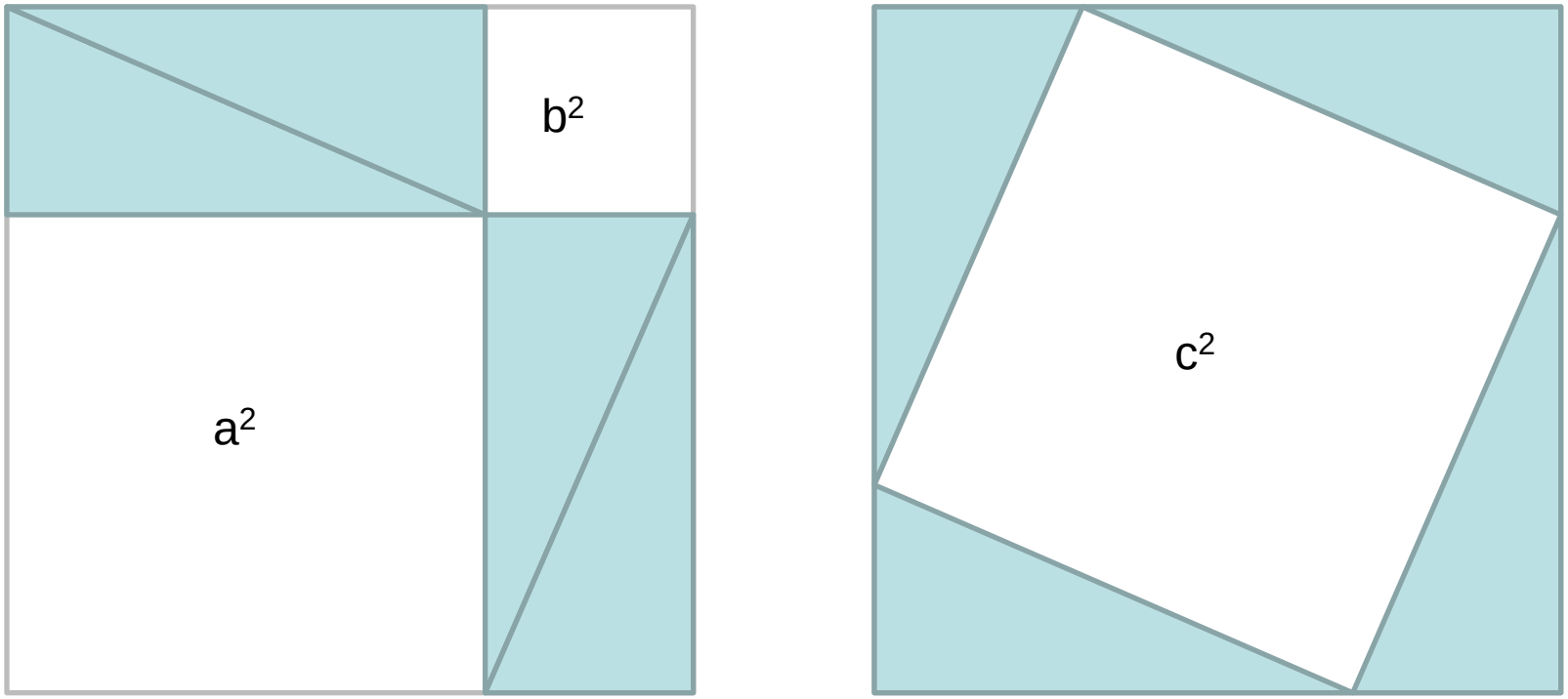
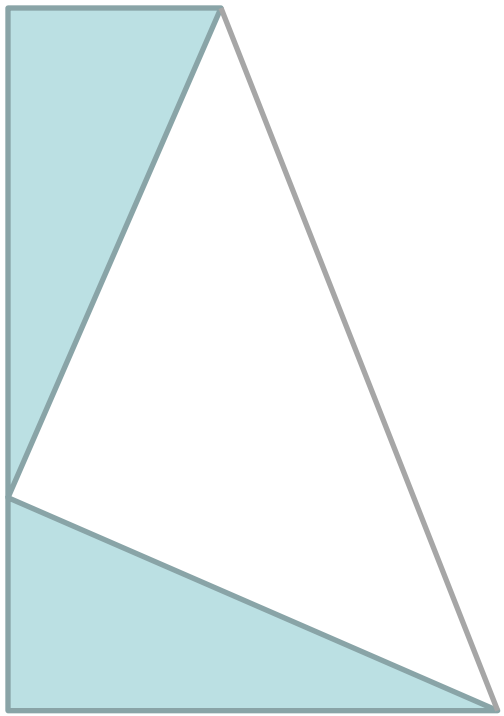
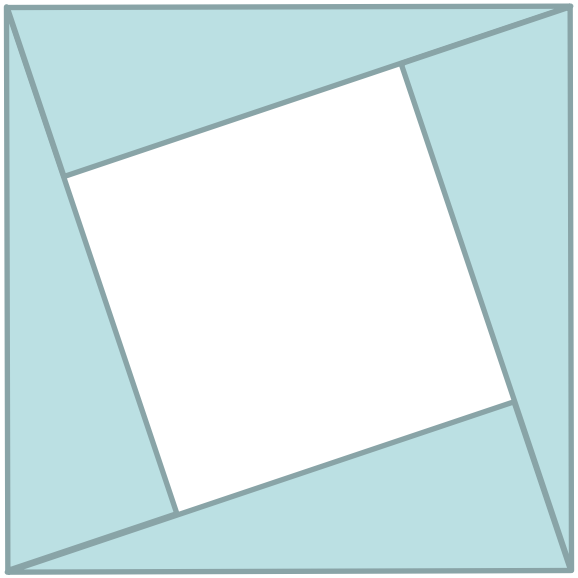
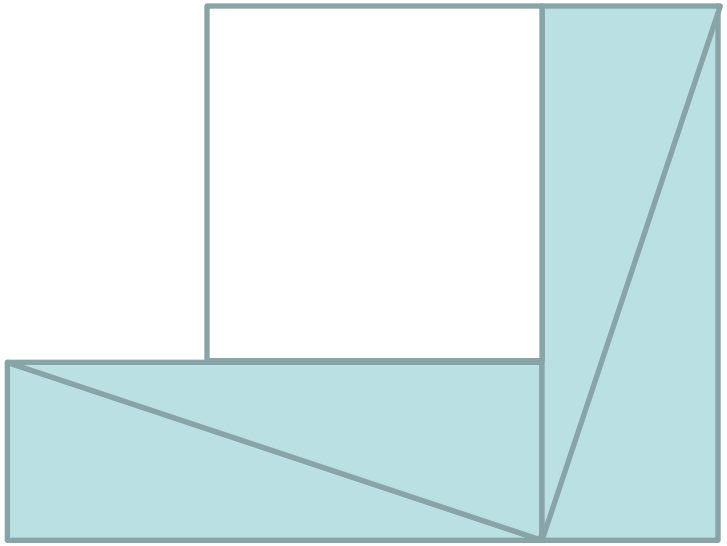


Garfield’s Proof



Bhaskara – BEHOLD!





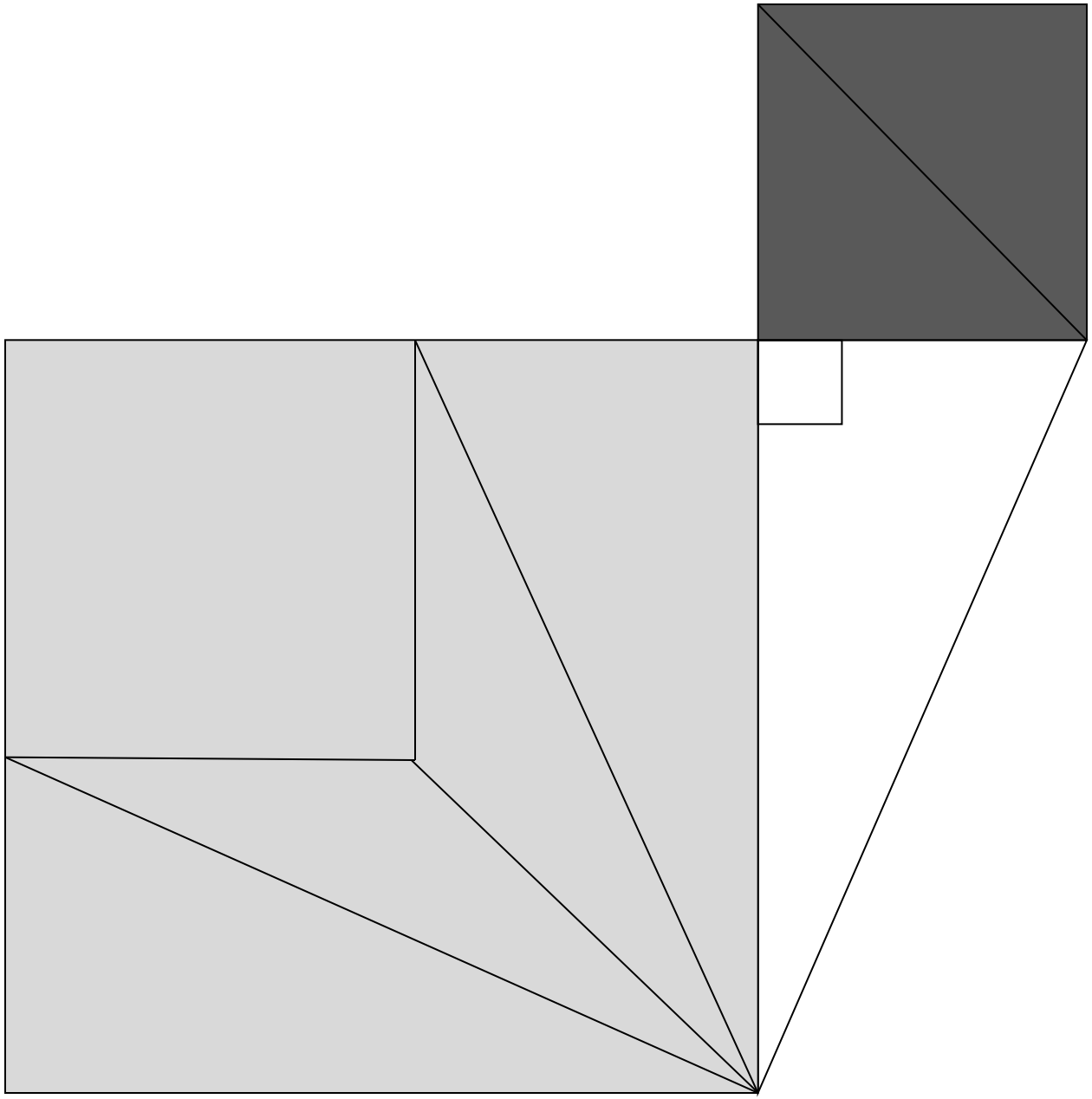
Famous Story

Three Indian women are sitting around in their tipi, just shooting the breeze. The first woman points to the hide she's sitting on and says, "See this hide? My son killed this bear with his own two hands. It's worth quite a bit." The second woman nods, and points to the hide she's sitting on. "This is a bear hide, too, and MY son killed it with his own hands as well. I imagine it's worth at least as much as yours."

Finally, the third, and oldest, woman speaks up. "See this hide?" she cackles. "This is a hippopatamus hide! I killed this hippo with MY own two hands, and it's worth easily what both those bear hides are worth together."

Moral of the Story

- *The squaw on the hippopotamus is equal to the sons of the squaws on the other two hides.*

References

- Meet the Philosophers of Ancient Greece by Patrica O’Grady
- Proof Without Words, Roger B. Nelsen, MAA.
- Proof Without Words II, Roger B. Nelsen, MAA.
- www.cut-the-knot.org/pythagoras