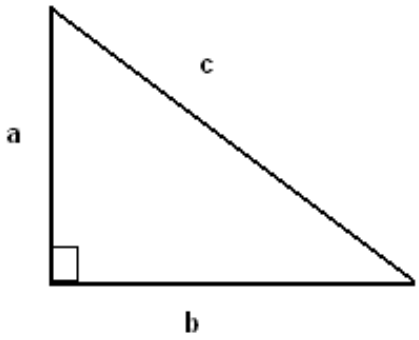
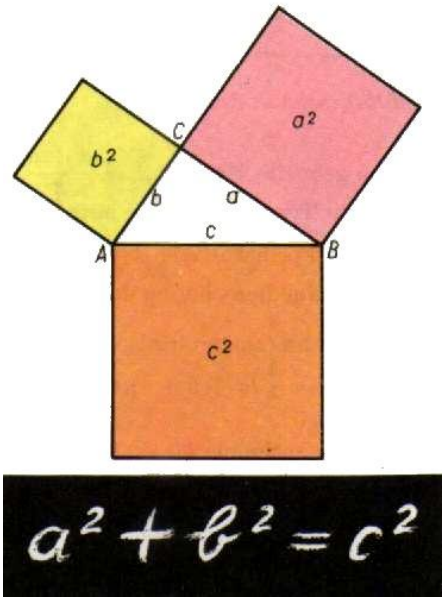
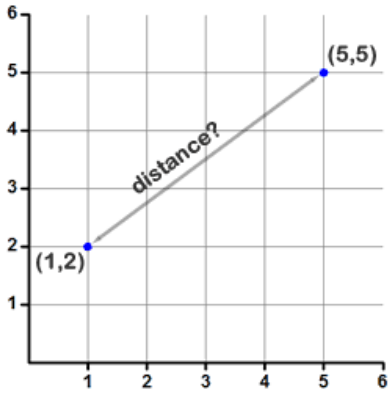
Right Triangles

Right Triangles, Pythagorean Theorem, Distance Formula







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Introduction

Topic: Right Triangles
Subject: Geometry
Grade Level: 9-11

Rationale:

Our unit plan is designed for a geometry class of grades 9-11 and covers topics such as the special cases of Right Triangles, the Pythagorean Theorem and the Distance Formula. All three topics smoothly progress from one to the next and this unit plan hopes to show the students how they are all intertwined. Math is not a bunch of distinct sections as the book breaks it up to seem, instead it all ties together and builds off of itself. It is helpful to have a solid understanding of each previous part before being exposed to the next.

Through discovery and higher order questioning the students will make their own connections about how each part of the unit relates to the next. This unit also attempts to appeal to those students who are interested in History and Language Arts by having students research Pythagoras and writing about what they know and what they have learned. This unit play caters to many different learning styles. It has students working both individually and in small groups. This unit plan includes small group discussions as well as whole class discussions. The Entrance and Exit Slips will serve as our assessment of each individual student's prior knowledge and post-lesson knowledge.

Unit Objectives

Social Studies:

A. **SS.912.W.1.1:** Use timelines to establish cause and effect relationships of historical events.

B. **SS.912.W.1.4:** Explain how historians use historical inquiry and other sciences to understand the past.

Literacy:

A. **LA.910.1.5.1:** The student will adjust reading rate based on purpose, text difficulty, form, and style.

B. **LA.910.1.6:** The student uses multiple strategies to develop grade appropriate vocabulary.

C. **LA.910.1.6.1:** The student will use new vocabulary that is introduced and taught directly;

D. **LA.910.1.6.2:** The student will listen to, read, and discuss familiar and conceptually challenging text;

E. **LA.910.1.6.5:** The student will relate new vocabulary to familiar words;

F. **LA.910.1.7.1:** The student will use background knowledge of subject and related content areas, pre-reading strategies (e.g., previewing, discussing, generating questions), text features, and text structure to make and confirm complex predictions of content, purpose, and organization of a reading selection;

G. **LA.910.1.7.6:** The student will analyze and evaluate similar themes or topics by different authors across a variety of fiction and nonfiction selections;

H. **LA.1112.6.1.1:** The student will explain how text features (e.g., charts, maps, diagrams, sub-headings, captions, illustrations, graphs) aid the reader's understanding;

I. **LA.910.1.6.4:** The student will categorize key vocabulary and identify salient features.

Math:

A. **MA.912.G.4.1:** Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular.

B. **MA.912.G.4.3:** Construct triangles congruent to given triangles.

C. **MA.912.G.4.4:** Use properties of congruent and similar triangles to solve problems involving lengths and areas.

D. **MA.912.G.5.1:** Prove and apply the Pythagorean Theorem and its converse.

E. **MA.912.G.4.8:** Use coordinate geometry to prove properties of congruent, regular, and similar triangles.

F. **MA.912.G.5.4:** Solve real-world problems involving right triangles.

G. **MA.912.G.1.1:** Find the lengths and midpoints of line segments in two-dimensional coordinate systems.

H. **MA.912.G.4.6:** Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles.

Florida Accomplished Practices:

1. Activate Background Knowledge
2. Developing Vocabulary/Word Knowledge
3. Engaging in Active Exploration of Discipline-Specific Knowledge to Construct Meaning from Text
4. Incorporating Technology and Writing
5. Promoting Critical Thinking
6. Forging Connection between Home and School

Additional Resources:

Trade books –

- What's Your Angle, Pythagoras? A Math Adventure written by, Julie Ellis
- Pythagoras and the Ratios: A Math Adventure written by, Julie Ellis
- The Missing Link Between Pythagoras and King Tut: A Short Unit on Ancient Measurement written by, Richard Charette
- Pythagoras (Biography from Ancient Civilizations) written by, Susan Sales Harkins and William H. Harkins
- Pythagoras: Pioneering Mathematician And Musical Theorist of Ancient Greece (The Library of Greek Philosophers) written by, Dimitra Karamanides
- Pythagoras Eagle & the Music of the Spheres written by, Anne Carse Nolting
- The Pythagoras Solution (The Mason Trio Math Mysteries) written by, Larry J. Galvin

Texas Instruments Downloadable Applications and Software –

- **http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=11604**
- **http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=11613**
- **http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=13149**
- **http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=13879**
- **http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=9532**
- All of these links and more applications can be found at: **http://education.ti.com/educationportal/search/Search.do?searchKey=Pythagorean%20Theorem&cid=US**

Magazine -

- **http://www.mathematicsmagazine.com/Theory/Phytagora_Theorem.php**

Math Textbook –

- **Serra, Michael. Discovering Geometry: An Investigative Approach. Key Curriculum Press. Emeryville, CA. 2008**

Unit Timeline					
Week 1	Lesson 1 Defining Triangles	Lesson 1 Terminology of Triangles	Lesson 1 Special Triangles	Lesson 2 Exploration of Right Triangles	Lesson 2 Learning with Outside Resources
Week 2	Lesson 2 Pythagorean Theorem Wrap-up	Lesson 3 Finding the Distance of Horizontal and Vertical Lines	Lesson 3 Deriving the Distance Formula from the Pythagorean Theorem	Lesson 3 The Hypotenuse Leg Theorem	Unit Review Unit Wrap-Up

Lesson 1: Special Triangles		
Day 1	Day 2	Day 3
Defining Triangles	Terminology of Triangles	Special Triangles

Lesson Focus/ Purpose:

The first part of the unit focuses on triangles and learning how to classify triangles based on edge lengths and angles. In this section we will introduce how to prove congruency in triangles and will lead into the importance of the special triangles. This will be accomplished by independent research, class discussions, and practice problems. The first day focuses on the basics of triangles and how to classify them. The next two days will be devoted to the uses of

these triangles and introduce the special triangles and how they are an important tool for solving more complex problems. This lesson includes some writing components that will be done individually, which is their homework assignment. This math lesson includes SSS from language arts because of this writing assignment.

Sunshine State Standards:

- **MA.912.G.4.1:** Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular.
- **MA.912.G.4.3:** Construct triangles congruent to given triangles.
- **MA.912.G.4.4:** Use properties of congruent and similar triangles to solve problems involving lengths and areas
- **LA.910.1.6.4:** The student will categorize key vocabulary and identify salient features

Objectives: The students will be able to…

- classify triangles based on their sides and angles.
- relate basic triangles to special triangles.
- apply these ideas to real-world situations.

Florida Accomplished Practices:

- Activate Background Knowledge
- Developing Vocabulary and Word Knowledge
- Incorporating Writing
- Forging Connection between Home and School

Materials:

- Student Handouts for each day's Entrance and Exit Slip.

Lesson Resources:

- Serra, Michael. Discovering Geometry: An Investigative Approach. Key Curriculum Press. Emeryville, CA. 2008

Content of Lesson 1 – Day 1: Defining Triangles

Teacher's Role:	**Probing Questions:**
Pass out then collect Entrance Slips. Give them about 5 minutes to answer the questions based on their previous knowledge. When the class is done, discuss what "we" know about triangles and their properties for about 5 minutes.	What do we know about triangles? What properties do they have?

<u>Classifying Triangles:</u> After the Entrance Slip, draw two triangles on the board, one acute and one obtuse. Ask them questions about the triangles and what the differences are. Lead them to the idea that the triangles have different angles. Label the triangles accordingly. Write the definition under each triangle. Acute: A triangle with all angles less than 90° Obtuse: A triangle that has an angle that is greater than 90° Ask questions about the triangles and definitions. Draw an equiangular triangle on the board and explain that this one has a special name. Ask the class what they notice about the triangle. Draw a few more examples on the board. Include an isosceles, an equilateral and a scalene triangle. Ask the class questions about these. Lead them to the lengths of the sides. Label and define. Isosceles: A triangle having two sides of equal length. Equilateral: A triangle in which all sides are of equal length. Scalene: A triangle with no sides that are of equal length. Draw two triangles that are congruent. Explain what congruent is and ask the class how they could prove that the two triangles are congruent. Lead them to the idea of the sides and angles of the triangles. <u>Exit Slip & Homework Assignment:</u> Hand out the Exit Slip and have the class answer the questions. Give the class about 5 minutes. Collect the assessment and assign the homework: Define and explain the postulates and theorems that are used to prove congruence in two triangles.	What is the difference between these triangles? Be specific. Can a triangle have more than one angle that is greater than 90°? Why? What do all of the angles have to add up to in a triangle? What do you notice about these triangles? How could we prove these two triangles are congruent?

Name:_____

Day 1 Entrance Slip:

1.) Write all that you know about triangles.

2.) What are some questions that you might have concerning triangles and their properties?

Name:_____

Day 1 Exit Slip:

1.) Draw an example of an acute, scalene triangle.

2.) Can a triangle that has two 45° angles be obtuse? Why or why not?

Content of Lesson 1 – Day 2: Terminology of Triangles

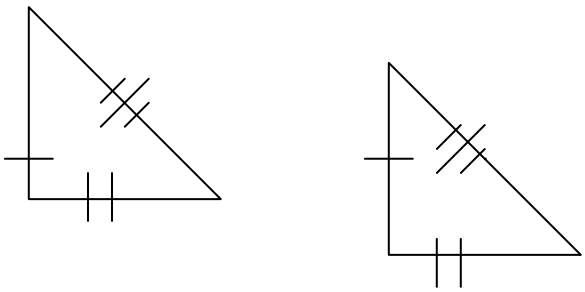
Teacher's Role:	**Probing Questions:**
Pass out then collect the Entrance Slips. Discuss the answers and review last class for about 5 minutes. <u>Terminology and Proofs</u> Discuss with the class the correct way to write proofs of congruency. Include the correct symbols to signify an angle and the correct way to show that two sides are equal both on the triangle and in "words". Ex: in the following	What did you get for question 1? (2). How did you get that answer? Does anybody know the correct symbol to indicate a line segment

triangle, Draw line segment AB and line segment AC. Is angle A congruent to angle C? (In class we would use the symbols instead of words.) Explain the symbols then ask the class to answer the question. Show how to label the triangles correctly to the class. Show the class different ways of representing this information. Explain how to show in a flow chart manner using the above triangle as an example. Follow with more examples and have the students come to the board to solve the problems. Pass out then collect the Exit Slips.	of a triangle? What is the symbol for an angle? How do we show in "words" that two segments, angles, or triangles are congruent/equal? Who can tell me the answer to the question on the board?

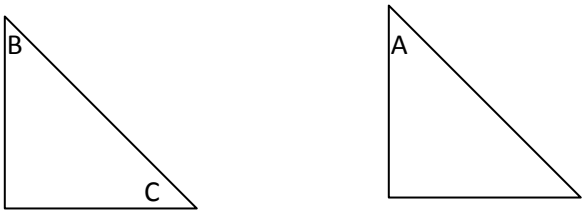
Name:_____

Day 2 Entrance Slip:

1.) Are the following triangles congruent?



2.) What is the angle, A in the drawing below, if B= 45, C= 45 and the two triangles are congruent?



Name:_____

Day 2 Exit Slip:

1. Show that the two triangles are congruent in "words"

2. Draw two triangles that are congruent and label them so someone can identify that they are congruent.

Content of Lesson 1 – Day 3: Special Triangles	
Teacher's Role:	**Probing Questions:**
Hand out warm-up worksheet and give the class about 5 minutes to answer the questions. Discuss the answers and review last class for about 5 minutes. After the warm-up, draw a right triangle. Ask the class questions. Lead them to the 90° angle if they are having trouble. Draw the correct symbol to indicate the 90° angle. Explain. Draw the three special 90° triangles. (45,45, 90), (30, 60, 90), (3, 4, 5). Explain the why they are considered "special" triangles. Write practice examples on the board using these triangles: a (6, x, 10) triangle and explain how we can get the value of the third side based on the (3, 4, 5) triangle Review the last two days and come up with ideas of how these concepts could be used to solve other more difficult problems. Relate this to the real world using different ideas that the class relates to. About 10 minutes.	What did you get for question 1? (2). How did you get that answer? What is the difference between this triangle and the triangles we learned about yesterday? How do you think we can use these triangles to solve other problems? Who can tell me the length of "x"? How did you get that answer? What types of jobs do you think use these triangles every day? How do they use these triangles? Let's recap, who can sum up what we learned in these past

Hand out assessment and let the class work on the problems for about 5 minutes. Collect the worksheets and introduce the homework assignment in the last 5 minutes: An essay on Pythagorean and his accomplishments in math. Include the history of his work and how his work has helped mathematics.	two lessons concerning triangles?

Name:_____

Day 3 Entrance Slip:

1. Draw and label two triangles that share a side. Based on your drawing, are these two triangles congruent?

2. State the correct postulate or theorem that you used to determine whether or not the two triangles were congruent.

Name:_____

Day 3 Exit Slip:

1.) Draw an example of a special right triangle.

2.) Name one way that special triangles might be used in the real world. Explain your answer.

Lesson 2: The Pythagorean Theorem

Day 4	Day 5	Day 6
Exploration of Right Triangles	Learning with Outside Resources	Pythagorean Theorem Wrap-up

Lesson Focus/Purpose:

This second part of the unit focuses on right triangles and the Pythagorean Theorem. In this section we delve into the history of Pythagoras and think about different ways math can be discovered, taught and learned. This is done by researching and participating in class discussions about how many different people in history have proved the Pythagorean Theorem many different ways, there is not just one right way. The concept is taught in multiple ways, we have a day of discovery where the students are to explore and make connections on their own, and then we have a class discussion about what we have noticed. The second day of the section the students see the concept discussed from a different view. A graduate student at the University of Georgia explains different aspects of the Pythagorean Theorem and the students are able to see things from a different angle. Then lastly, the students notice that they are able to learn the same concept in through many different paths. Hopefully this unit will help each individual student find what learning strategy works best for them. While this is a math lesson, it includes many reading and writing activities, for this reason, there is one math SSS and many language arts SSS.

Objectives: The students will be able to…

- derive the Pythagorean Theorem.
- explain in words what the Pythagorean Theorem means.
- verbalize and write down their thoughts and ideas.

Sunshine State Standards:

- **MA.912.G.5.1:** Prove and apply the Pythagorean Theorem and its converse.
- **SS.912.W.1.1:** Use timelines to establish cause and effect relationships of historical events.
- **SS.912.W.1.4:** Explain how historians use historical inquiry and other sciences to understand the past.
- **LA.910.1.5.1:** The student will adjust reading rate based on purpose, text difficulty, form, and style.
- **LA.910.1.6:** The student uses multiple strategies to develop grade appropriate vocabulary.
- **LA.910.1.6.1:** The student will use new vocabulary that is introduced and taught directly.
- **LA.910.1.6.2:** The student will listen to, read, and discuss familiar and conceptually challenging text.
- **LA.910.1.6.5:** The student will relate new vocabulary to familiar words.
- **LA.910.1.7.1:** The student will use background knowledge of subject and related content areas, pre-reading strategies (e.g., previewing, discussing, generating questions), text features, and text structure to make and confirm complex predictions of content, purpose, and organization of a reading selection.

- **LA.910.1.7.6:** The student will analyze and evaluate similar themes or topics by different authors across a variety of fiction and nonfiction selections.
- **LA.1112.6.1.1:** The student will explain how text features (e.g., charts, maps, diagrams, sub-headings, captions, illustrations, graphs) aid the reader's understanding.

Florida Accomplished Practices:

- Activate Background Knowledge
- Engaging in Active Exploration of Discipline-Specific Knowledge to Construct Meaning from the Text
- Incorporate Wring and Technology
- Promote Critical Thinking

Materials:

- Student and Teacher Math textbook.
- Writing utensils
- Overhead transparencies and student worksheets of forms:
  - Labsheet 3.2A
  - Labsheet 3.2B (All of these can be found at
  - Labsheet 3.2C the end of the unit.)
  - Triangles of Squares
  - 3-16 Finding Right Triangles
- Scissors
- Library computers
- Notebook paper
- Overhead transparency and student worksheet for Right Triangle Review
- Student Handouts for each day's Entrance and Exit Slip.

Lesson Resources:

Carr, Karen. "Pythagoras." *Kidipede*. Portland State University, 21Oct2010. Web. 14 Nov 2010. <http://www.historyforkids.org/learn/greeks/science/math/Pythagoras.htm>.

"Finding Pythagoras." *Blackline Masters*. Pearson. 103-05. Print.

Morris, Stephanie. "The Pythagorean Theorem." *Department of Mathematics Education*. The University of Georgia, n.d. Web. 14 Nov 2010. <http://jwilson.coe.uga.edu/emt669/student.folders/morris.stephanie/emt.669/essay.1/pythagorean.html>.

"Triangles of Squares." *Looking at Lines*. AIMS Education Foundation, 2005. 295. Print.

Content of Lesson 2 – Day 4: Exploration of Right Triangles	
Teacher's Role:	**Probing Questions:**
Pass out then collect Entrance Slip. Explain to the class that today we are going to apply what we have been learning about triangles to focus specifically on right triangles. Please pass forward the paper of the research you have done on Pythagoras. Let's discuss some of the interesting things you learned about Pythagoras. So Pythagoras proved that the Pythagorean Theorem was true, always. Below is a website the talks more about the history of Pythagoras. http://www.historyforkids.org/learn/greeks/science/math/pythagoras.htm Explain to the class that we are going to now going to do an explorative activity. Don't get ahead of the directions or you may make a mistake. It is important that you follow directions. Pass out Labsheet 3.2 A and scissors. Ask the students to follow the instructions. Discuss the findings. Pass out Labsheet 3.2B. Ask the students what they found. Pass out Labsheet 3.2 C. Ask the students what they found. Discuss student opinions on the overhead. Now pass out "Triangles of Squares" as a class, complete this page on the overhead. Discuss the Pythagorean Theorem and many of its proofs. Pass out then collect Exit Slip.	Who was he? When did he live? What did he do? What did you do? Why? What did you find? Did you have any trouble? With what? How were these shapes different from the first set? Did it make it easier or harder? How were these shapes different from the first set? Did it make it easier or harder? Who would like to come up and fill in the blanks on the transparency? Are the any questions? Anything that is unclear?

Name:_____

Day 4 Entrance Slip:

Write down at least four things you know about right triangles.

Name:_____

Day 4 Exit Slip:

Write at least one thing you don't understand perfectly pertaining to the Pythagorean Theorem.

Content of Lesson 2 – Day 5: Learning with Outside Resources

Teacher's Role:	**Probing Questions:**
Pass out then collect Entrance Slip. Explain to the class that today we are going to head to the library and add on to what we learned yesterday about the Pythagorean Theorem. Before we leave the classroom I want you to create a KWL chart. And title it "Pythagorean Theorem." Please write down all the information you know about the Pythagorean Theorem, be sure to have at least 5 things. Then you will list some things that you are not clear on or would like to know about pertaining to the Pythagorean Theorem in the middle column. Now we are going to head to the library and there needs to be only one person per computer. You will log on and go to the following website: http://jwilson.coe.uga.edu/emt669/student.folders/morris.stephanie/emt.669/essay.1/pythagorean.html this site discusses the Pythagorean Theorem in different ways, new ways from what we discussed in class yesterday. You need to read the different sections of the website and if you are confused or need help with something raise your hand and I will come help you. As you're reading be sure to look out for the items	Since this is a student driven activity there is minimal questioning going on. The questioning will take place next class period.

you wrote down in your "want to know" column on your KWL chart. Be thinking about what you are learning from the site that you hadn't already known. You will need to make notes of these items in the "Learned" column of your KWL chart. You have the class period to work on this and I will be coming around to check on your progress throughout the period. You should have stuff written down in your chart and I will initial off that you have participated today. Then tomorrow we will spend part of the class period discussing our KWL charts. Pass out then collect Exit Slip.	

Name:_____

Day 5 Entrance Slip:

Write the Pythagorean Theorem in WORDS.

Name:_____

Day 5 Exit Slip:

Write at least four ways you could find information outside of school about the things you learn in school.

Content of Lesson 2 – Day 6: Pythagorean Theorem Wrap-up

Teacher's Role:	**Probing Questions:**
Pass out then collect the Entrance Slip. Please take out your KWL charts from yesterday. For the first half of class we are going to have a class discussion about our KWL charts. Who would like to share with the class something they had written in their "Want to learn column that they did learn while reading the online article? Now for the rest of the period we are going to apply our master right triangle knowledge and Pythagorean Theorem skills to help us in completing worksheet "3-16 Finding Right Triangles" efficiently. It shouldn't take you too long to go through these ten triangles and find which have correct side lengths to form a right triangle and which are incorrect. You must then alter a side length to form a right triangle. Allow ten minutes for the students to work individually and then have them pair and compare. (Now you will compare what you did with the person next to you.)	What did you learn? What we helpful? What was not helpful? What do you still not understand? Did you both find the same correct right triangles? Did you both change the side lengths so that they match one another?

Name:_____

Day 6 Entrance Slip:

Will the Pythagorean Theorem help us to find the missing side lengths on all types of triangles? Why or why not? Explain.

Name:_____

Day 6 Exit Slip:

Write and solve/answer what you think a possible test question might be for this unit.

Lesson 3: Distance Formula

Day 7	Day 8	Day 9
Finding the Distance of Horizontal and Vertical Lines	Deriving the Distance Formula from the Pythagorean Theorem	The Hypotenuse Leg Theorem

Lesson Focus/Purpose: This part of the unit focuses on where the distance formula came from and how to use it with triangles, specifically right triangles. In the second part of the unit the students learned all about the Pythagorean Theorem so in this part we will use the Pythagorean Theorem to derive the distance formula. It is important for the students to know where their formulas come from and why they work so that they can remember them and actually learn their formulas instead of memorizing their formulas. In the first day we will learn how to find the distance of vertical and horizontal lines on a coordinate plane. This is important for students to know because it plays a role in why the distance formula works. On the second day we will find the distance of a slanted line on a coordinate plane, which in finding the distance we will derive the distance formula from the Pythagorean Theorem. This combines both what they learned the day before with finding the distance of horizontal and vertical lines as well as what they learned in the second part of this unit. Finally on the third day we will learn about the Hypotenuse Leg Theorem for proving congruent right triangles. This is learned through an interactive website which will help the students understand why the theorem works and how to use it in proofs. This theorem ties in everything they have learned in this unit quite beautifully.

Objectives: The students will be able to…

- find the distance of horizontal and vertical lines on a coordinate plane
- derive the distance formula from the Pythagorean theorem
- use the distance formula to find the distance of slant lines on a coordinate plane
- apply the distance formula in everyday situations
- understand the hypotenuse leg theorem
- use the hypotenuse leg theorem to prove two right triangles are congruent

Sunshine State Standards:

- **MA.912.G.4.8:** Use coordinate geometry to prove properties of congruent, regular, and similar triangles.
- **MA.912.G.5.4:** Solve real-world problems involving right triangles.

- **MA.912.G.1.1:** Find the lengths and midpoints of line segments in two-dimensional coordinate systems.
- **MA.912.G.4.6:** Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles.

Florida Accomplished Practices:

- Activate Background Knowledge
- Incorporate Writing and Technology
- Promote Critical Thinking
- Forge Connections between Home and School

Materials:

- Student Handouts for each day's Entrance and Exit Slip.
- Classroom set of computers or access to the computer lab.
- Notebook Paper

Lesson Resources:

- www.mathwarehouse.com.

Content of Lesson 3 – Day 7: Finding the Distance of Horizontal and Vertical Lines

Teacher's Role:	**Probing Questions:**
Give the students the warm-up activity for day 1. Have them work on it for about 5 minutes. When they are finished with the warm up spend another 5 minutes going over it making sure the students understand what the questions were asking them. Address any misunderstandings some students might have on the Pythagorean theorem or any other part in the warm. After the warm up draw a coordinate plane on the board or have a projection of the coordinate plane on the board. Plot the points (3, 2) and (3, 8) and draw the line segment connecting the two points. Ask the class what is the distance between these two points. Ask them to explain how they found their answer. Give a few more examples of finding the distance of a vertical line with the points (5,	Who wants to answer number one (two, three)? Did anyone answer number one (two, three) a different way? What is the distance of this line segment? Explain how you found your

1) and (5,9), (2, -3) and (2, 4), and (6, -7) and (6, 0). Have the students tell you what the distance is and have them explain to you how they found the distance. Finally plot two arbitrary points (x, y_1) and (x, y_2) and ask the students for a general formula for finding the distance of a vertical line. Next plot the points (2,5) and (7,5) and draw the line segment connecting the two points. Ask the class what is the distance between these two points. Have them explain how they found the distance. Continue a few more examples of finding the distance of horizontal lines with the points (3, 4) and (9, 4), (-3, 8) and (5, 8), and (1, -5) and (7, -5). Have the students tell you what the distance is and have them explain to you how they found the distance. Finally plot two arbitrary points (x_1 , y) and (x_2 , y) and ask the students to give you a general formula for finding the distance of a horizontal line. Have the students write in their journal about what they thought about the lesson and what questions they might have about the lesson. Give them the exit slip in the last 5 minutes of class and have them answer the questions to the best of their knowledge.	answer. Is there a general way to find the distance of a vertical line? What is the distance of this line segment? Explain how you found your answer. Is there a general way to find the distance of a vertical line?

Name:_____

Day 7 Entrance Slip:

1) ΔABC is a right triangle with a leg 4 inches long and another leg 3 inches long. How long is the hypotenuse?

2) ΔXYZ is an isosceles right triangle with a leg of 3 inches. What are the measurements of the other two sides of the triangle?

3) ΔDEF is a right triangle with a hypotenuse of 13 inches and a leg of 12 inches. What is the measure of the other leg?

Name:_____

Day 7 Exit Slip:

1) Sally starts at point (3,0) and continues walking in a straight line to point (3, -12). How far did Sally walk?

2) Matt walked from his house at point (1, 5) to his friend Mark's house at point (10, 5). How far is Matt's house from Mark's house?

3) Jane walked from her house at point (2, -3) to John's house at point (2, 3). Together they walked from John's house to the ice cream shop at point (7, 3). What is the total distance Jane walked?

Content of Lesson 3 – Day 8: Deriving the Distance Formula from the Pythagorean Theorem

Teacher's Role:	**Probing Questions:**
Give the students the warm-up activity for day 2. Have them work on it for about 5 minutes. Go over the activity making sure everyone understands what the questions are asking and the concepts. This should take about 5 minutes.	Who wants to answer number one (two, three)? How did you come up with your answer? Did anyone answer number one (two, three) a different way?
Draw a coordinate plane on the board or project it onto the board. Plot the points (2, 4) and (6, 1) and draw the line segment connecting them. Ask the students how they would find the distance between these two points. If they are having trouble giving a response, guide them towards finding the distance of vertical and horizontal lines. When someone has stated using the formulas for finding the distance of vertical and horizontal lines ask them if we can draw any on our graph that can help us find the distance of our original line. When given an answer, draw a dashed	How do we find the distance of this line segment? What formulas do we know for finding the distance of line segments? Can we draw any horizontal or vertical lines on our graph that can help us find the distance of our line

vertical line from the point (2, 4) and a dashed horizontal line from the point (6, 1). Label the coordinate where the two dashed lines intersect (2, 1). Ask them what shape have they made and what measurements do we know. Then ask them what measurement we are trying to find and what theorem do we know that will give us the missing measurement.	segment? What shape have we made with our horizontal line segment, vertical line segment, and our original line segment? How do we know it is a right triangle? What distances do we know on our right triangle? What distance are we missing on our right triangle? Do we know any theorems that could help us find the distance or our line segment?
When they give you the Pythagorean theorem, $a^2 + b^2 = c^2$, ask them on our picture what is our "a" and what is our "b". "a" should be 4 (or 3) and "b" should be 3 (or 4). "c" should then be 5 when finished solving it. Ask them then what are the general formulas for "a" and "b". They should give you $(x_2 - x_1)$ and $(y_2 - y_1)$, the general formulas for finding the distance of horizontal and vertical lines. Plug these into the Pythagorean theorem, replace c with d, and then solve for d. i.e. $d = [(x_2 - x_1)^2 + (y2 - y_1)^2]^{1/2}$ This is the distance formula and it is how you find the distance of a slant line. Have them write in their journals about how they feel about the lesson and what questions they might have about the lesson. Then give them the exit slip for day 2 and give them extra practice problems in their textbook for homework. If they do not understand a problem in the homework then have them rewrite it in their own words.	In our example what is our "a"? Our "b"? What would our "c" be then? For arbitrary points, (x_1, y_1) (x_2, y_2), what would be our "a"? Our "b"?

Name:_____

Day 8 Entrance Slip:

1) What is the distance from point (9,-5) to point (9, 4)?

2) What is the distance from point (5,1) to point (11, 1)?

3) ΔLMN is a right triangle with a leg 9 inches long and a hypotenuse 15 inches long. How long is the other leg?

Name:_____

Day 8 Exit Slip:

1) What is the distance from point (2, 8) to point (14, 3)?

2) The top of a ladder is at point (0, 6) and the bottom of the ladder is at point (8, 0). How long is the ladder?

3) The vertices of a triangle are (-1, 3), (-1, 7), and (2, 3). What are the measurements of the sides of the triangle?

Content of Lesson 3 – Day 9: The Hypotenuse Leg Theorem

Teacher's Role:	**Probing Questions:**
Give the students the warm-up activity for day 3. Have them work on it for about 5 minutes. Go over the activity making sure everyone understands what the questions are	Who wants to answer number one (two, three)?

asking and the concepts. This should take about 5 minutes.	How did you come up with your answer? Did anyone answer number one (two, three) a different way?
Have your students tell you what has to be true in order for two triangles to be congruent. If they are having difficulties telling you this then lead them towards the right direction by asking questions about congruent line segments and congruent angles. Write their responses on the board. If you have a classroom set of computers then pass them out to your students at this time. If you do not have a classroom set of computers then you need to have class in the computer lab or the library where your students have a computer. Explain to them that they are going to explore a theorem today for proving two right triangles are congruent. The theorem is called Hypotenuse Leg Theorem. Have the students go to the website www.mathwarehouse.com. Click on Geometry then scroll down until you see the icon for proving triangles congruent and click on it. Next have them click on the link for Hypotenuse Leg Theorem. It may be helpful to write these steps on the board so that everyone can see them.	If ΔABC is congruent to ΔDEF then what must be true? If line segment AB is congruent to line segment CD then what is true? If angle ABC is congruent to angle DEF then what is true? What is a triangle made up of? Does anyone have any questions?
Have your students read what the theorem states in the blue box and go through all of the examples and interactive proofs. It would be very beneficial for the students to take notes on what they are reading. When everyone is finished with the examples and the interactive proofs ask if they have any questions on what they just learned. When you feel like they have a good understanding on the Hypotenuse Leg Theorem then have them click on the hypotenuse leg worksheet link which is underneath the blue box containing the theorem at the top of the page. Have them answer all of the questions on the worksheet on a separate sheet of paper to turn in at the end	What is the Hypotenuse Leg Theorem? Can this work for an acute triangle (equiangular triangle, obtuse triangle)? Why not?

when they are finished.	Does anyone have any questions on the Hypotenuse Leg Theorem?
Have them write in their journal what they thought about the lesson and what questions they had when going through the lesson. Then have them do the exit slip for day 3.	

Name:_____

Day 9 Entrance Slip:

1) What is the distance between points (5, 8) and (6, 3)?

2) The vertices of a triangle are (-2, 4), (-2, 8), and (3, 8). What are the measurements of the sides of the triangle?

3) The hypotenuse of ΔABC is 39 inches and a leg is 36 inches. What is the measurement of the other leg?

Name:_____

Day 9 Exit Slip:

1) ΔABC has a leg that is 5 inches long and a leg that is 12 inches long. What must the measurement of the legs and hypotenuse of ΔDEF be in order for ΔDEF be congruent to ΔABC?

2) ΔXYZ and ΔTUV are congruent right triangles. If the leg of ΔXYZ is 8 inches and the hypotenuse of ΔTUV is 10 inches, what is the measurement if the hypotenuse in ΔXYZ and the leg in ΔTUV?

3) If ΔFGH has a leg of 3 inches and a hypotenuse of 5 inches and ΔLMN has a leg of 3 inches and a hypotenuse of 5 inches, are these two triangles congruent? Explain why or why not.

Content of Unit review – Day 10: Right Triangles Review

Lesson Focus/Purpose: The purpose of this final lesson is to make the final connections between all three parts of the unit through playing a class-wide game of Jeopardy where every student is involved every step of the way. By having the students show the teacher their answers on their whiteboards, the teacher can gauge each student's understanding.

Objectives: The students will be able to…

- classify triangles based on their sides and angles.
- derive the Pythagorean Theorem.
- derive the distance formula from the Pythagorean theorem

Sunshine State Standards:

Social Studies:

A. **SS.912.W.1.1:** Use timelines to establish cause and effect relationships of historical events.

Literacy:

A. **LA.910.1.6.1:** The student will use new vocabulary that is introduced and taught directly;

B. **LA.910.1.6.2:** The student will listen to, read, and discuss familiar and conceptually challenging text;
C. **LA.910.1.6.5:** The student will relate new vocabulary to familiar words;

Math:

A. **MA.912.G.4.1:** Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular.
B. **MA.912.G.4.3:** Construct triangles congruent to given triangles.
C. **MA.912.G.4.4:** Use properties of congruent and similar triangles to solve problems involving lengths and areas.
D. **MA.912.G.5.1:** Prove and apply the Pythagorean Theorem and its converse.
E. **MA.912.G.4.8:** Use coordinate geometry to prove properties of congruent, regular, and similar triangles.
F. **MA.912.G.5.4:** Solve real-world problems involving right triangles.
G. **MA.912.G.1.1:** Find the lengths and midpoints of line segments in two-dimensional coordinate systems.
H. **MA.912.G.4.6:** Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles.

Florida Accomplished Practices:

- Activate Background Knowledge
- Develops Vocabulary/Word Knowledge
- Engaging in Active Exploration in Discipline-Specific Knowledge to Construct Meaning from Text.
- Incorporate Writing and Technology
- Promote Critical Thinking

Materials:

- Student Handouts for each day's Entrance and Exit Slip.
- Computer with Powerpoint
- Teacher Jeopardy Key
- Whiteboards
- Dry erase markers

Lesson Resources:

Teacher's Role:	**Probing Questions:**
Pass out then collect the Entrance Slips. As a class play Jeopardy using the Powerpoint application and have the students write and hold up their answers to each question on their whiteboards. Discuss the reasoning	See Powerpoint.

for each of the answers. Pass out then collect the Exit Slips.	

Name:_____

Day 10 Entrance Slip:

1. State the theorems and postulates for congruency.

2. State the Pythagorean Theorem.

3. State the Hypotenuse Leg Theorem.

Name:_____

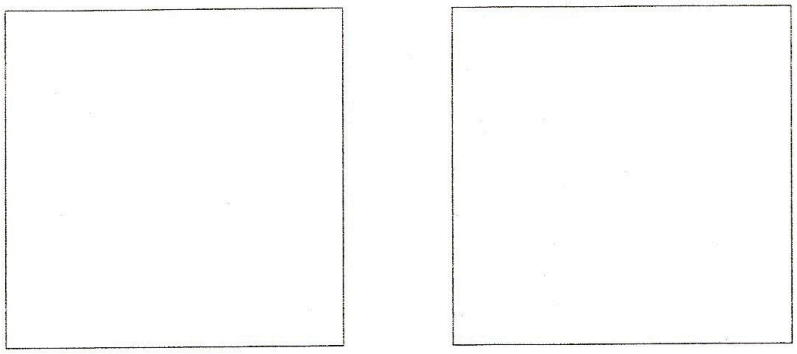
Day 10 Exit Slip:

Create and answer a possible test question that incorporates all three lessons on right triangles.

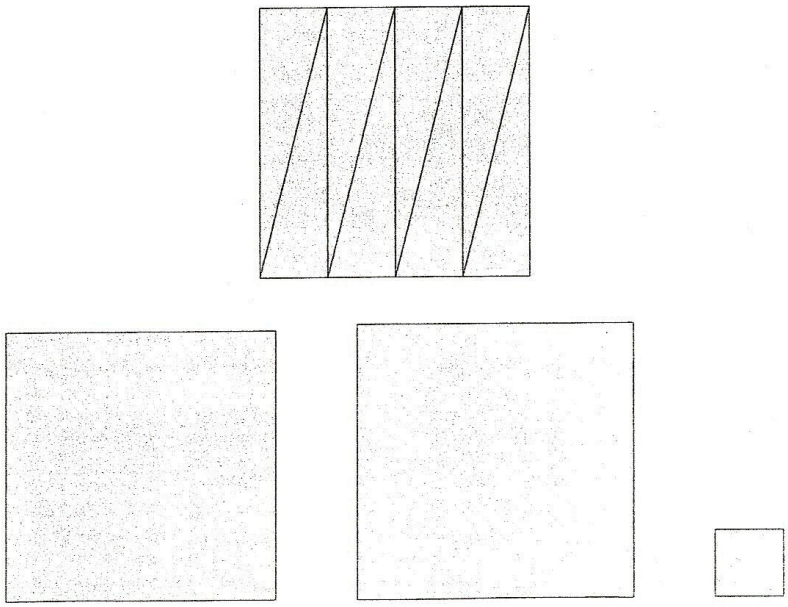
Labsheet 3.2A

Puzzle Frames and Puzzle Pieces, Set A

Cut out the puzzle pieces. Arrange them to fit in the puzzle frames.



Puzzle frames

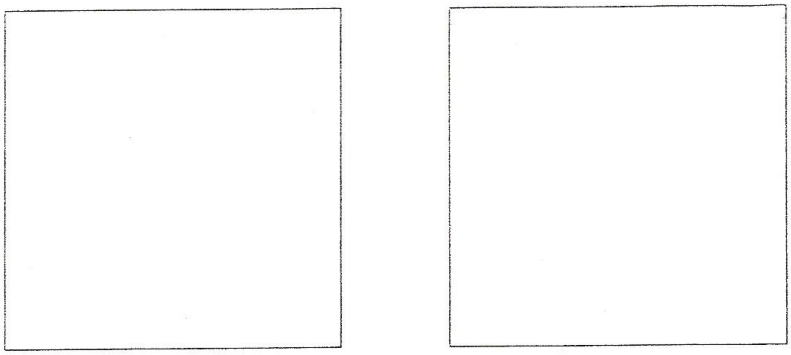


Puzzle pieces

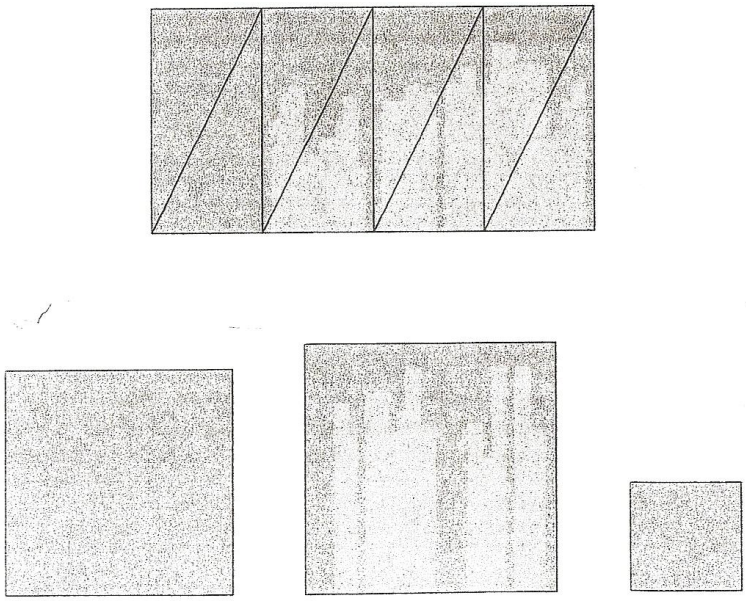
Labsheet 3.2B

Puzzle Frames and Puzzle Pieces, Set B

Cut out the puzzle pieces. Arrange them to fit in the puzzle frames.



Puzzle frames

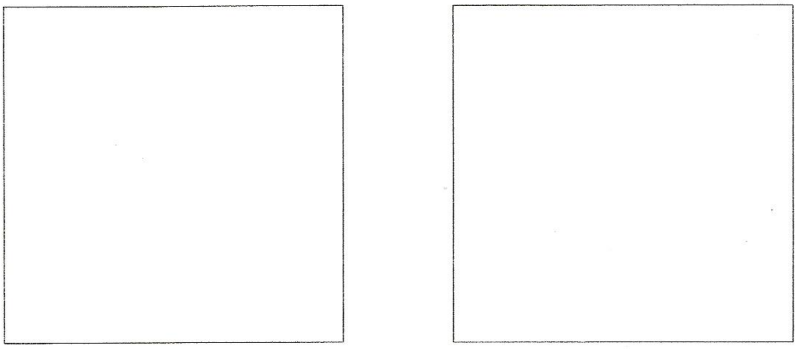


Puzzle pieces

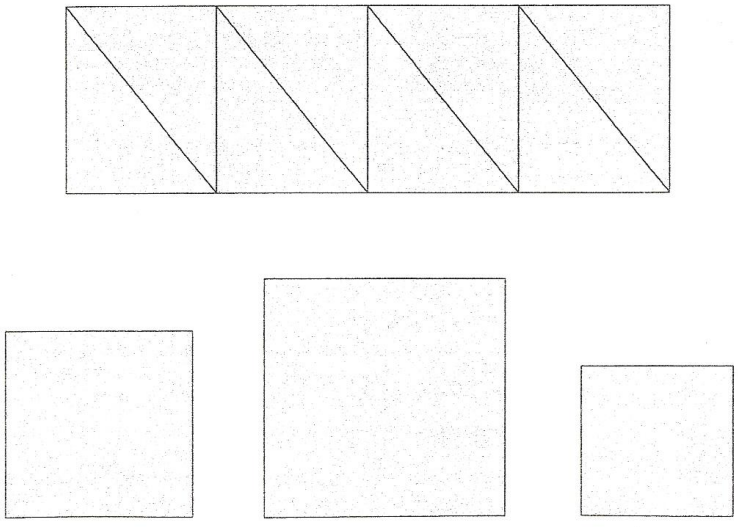
Labsheet 3.2C

Puzzle Frames and Puzzle Pieces, Set C

Cut out the puzzle pieces. Arrange them to fit in the puzzle frames.



Puzzle frames



Puzzle pieces

TRIANGLES OF SQUARES

Make all the possible different size triangles you can out of 2,3,4, and 5 cm squares. Record the dimensions and complete the chart.

Length of Sides			Squares on Sides			Type of Triangle	
Shortest Side a	Mid-length Side b	Longest Side c	Sum of squares on shorter sides a^2+b^2	< > =	Area of square on longest side c^2	By Angles Acute Right Obtuse	By Sides Equilateral Isosceles Scalene

Pythagorean Theorem

NAME _____ DATE _____

3–16 FINDING RIGHT TRIANGLES

Of the ten sets of sides of triangles below, five form right triangles. Identify each of these triangles. Then change the length of a leg of each of the other triangles so that the triangle will be a right triangle. Note: All lengths of legs should be whole numbers.

1. 3 4 5 _____
2. 5 12 13 _____
3. 9 33 41 _____
4. 11 35 37 _____
5. 12 16 20 _____
6. 15 37 39 _____
7. 20 21 29 _____
8. 20 89 101 _____
9. 57 63 87 _____
10. 468 595 757 _____

Jeopardy Review PowerPoint Key

Classifying Triangles	Pythagoras	Distance Formula	Special Triangles	Hypotenuse Leg Theorem
A drawing with one angle greater than 90°.	Greece	The distance formula.	15	Right triangles
Equilateral	The Pythagorean Theorem	5	Varied answers.	State the theorem.
Obtuse	Right triangles	12	Varied answers.	13
Varied answers	Approx. 500BC	Sqrt(40)	60° and 90°	No.
The two are the same.	The square of the hypotenuse.	3, 4, 5	Varied answers.	No.