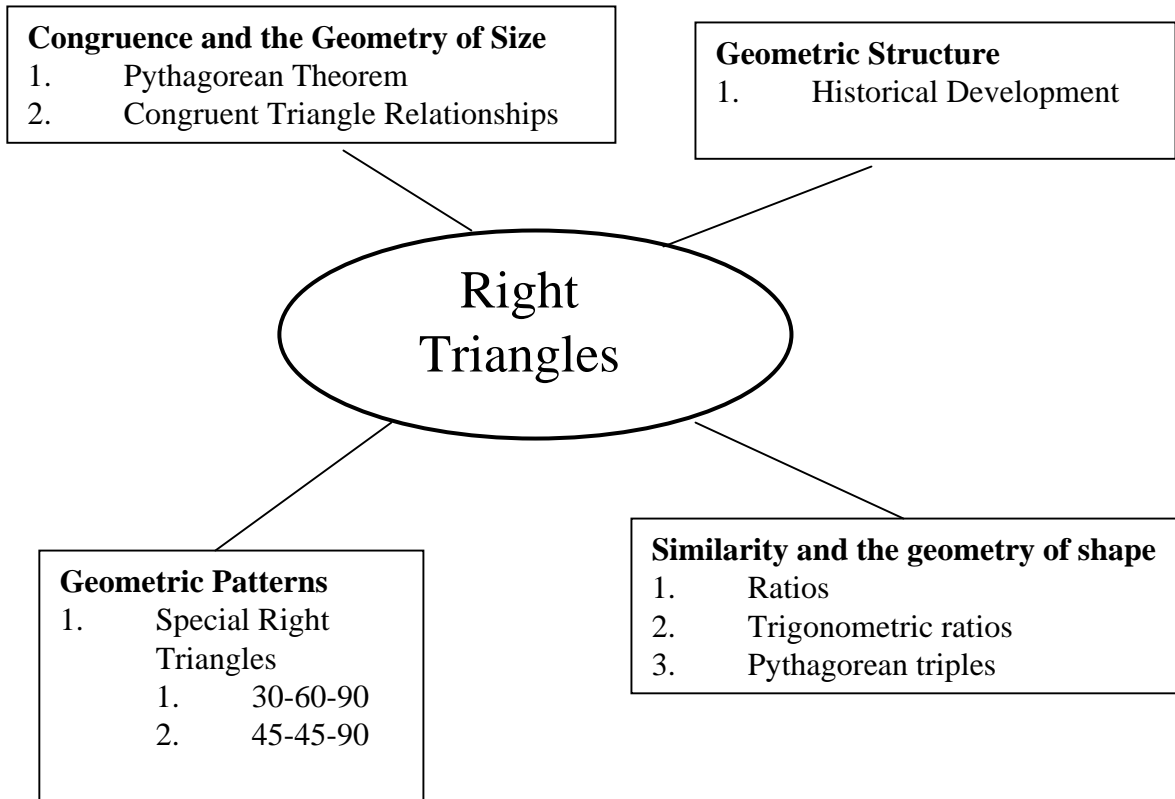


# Unit Planner

Unit Title: Right Triangles

Conceptual Lens: Measurement

Time: 3 weeks



**Unit Overview**

You need to buy 3 cables that will support a cell phone transmitter tower. You know how tall the tower is and where the cables will attach. How can you determine how many feet of cable that you need to buy?

Designer(s): Ghere, David

Grade Level: Geometry

## Enduring Understandings

(generalizations)

Std.

1. Geometry can be used to simplify the process of finding missing information about objects in a real world setting. Geometric shapes can be measured. The measure of the shapes can lead to the verification of similarity or congruence.
2. Similarity can be shown using geometric patterns. Measure of the shapes can be used to show proportionality

## Guiding Questions

Std.

1. What do all right triangles have in common.
2. Why are all right triangles not congruent to each other?
3. Are all right triangles similar to each other?
4. How can we determine missing information of right triangles.
5. What methods can we use that we already know?
6. To use our known methods, what type of information do we need to be given?
7. How will knowing an angle of the triangle help you find a given size.

AC=Assessment Code:

Q – Quizzes

P – Prompts

T – Tests

O – Observations

WS – Work Samples

D - Dialogues

## Critical Content and Skills:

### Students will know...

1. the history of the Pythagorean Theorem.
2. how to apply the Pythagorean Theorem to identify patterns developed by Pythagorean Triples.
3. how to use the properties of the Special Right Triangles to solve problems.
4. how the trigonometric ratios **Sine**, **Cosine**, and **Tangent** are used to find unknown angles, sides, and find the ratios of sides in right triangles.

Std. AC

Gb1B

Q

Gc3

WS

Ge1c,  
Gf3WS,  
TGc1,  
Gf3WS,  
O, T

Std. AC

### Key Skills...

1. The student uses the Pythagorean Theorem to solve problems involving right triangles.
2. The students will use the special right triangles to solve problems involving Right Triangles.
3. The students will be able to calculate missing information using the trigonometric ratios **Sine**, **Cosine**, and **Tangent**.

Std. AC

Gc3

WS

Ge1c,  
Gf3WS,  
TGc1,  
Gf3WS,  
O, T

Std. AC

# Task Planner

**What:** Investigate... how triangle similarity is applied in a surveying setting.

**Why:** In order to understand that... geometry can be used to simplify the process of finding missing information about objects in a real world setting.

**How:** (Engaging Scenario-Performance)

1. The students will work in groups to determine the height of an object (tree, light pole, flag pole, etc.) using the concept of triangle similarity.
2. The students will pick 1 student and measure their height and the length of their shadow.
3. The group will then measure the length of the shadow produced by the object that they wish to find the height of.
4. The students will then draw pictures setting up the problem using right triangles and use the skills learned in the unit to calculate the height of the object.

## Mathematics Performance Assessment Rubric

Part a) Correct Solution YES NO

Criteria	4	3	2	1
Part b) <b>Conceptual Knowledge</b>	<p><b>Attribute(s) of concept(s)</b> Correctly identifies attributes of the problem, which leads to correct inferences.</p> <p><b>Inferences</b> Combines the critical attributes of the problem in order to describe correctly the mathematical relationship(s) inherent in the problem.</p>	<p><b>Attribute(s) of concept(s)</b> Correctly identifies attributes of the problem, which leads to correct inferences.</p> <p><b>Inferences</b> Combines the critical attributes of the problem, which leads to a partial identification of the mathematical relationship(s) inherent in the problem.</p>	<p><b>Attribute(s) of concept(s)</b> Identifies some of the attributes of the problem, which leads to partially correct inferences.</p> <p><b>Inferences</b> Combines the identified attributes of the problem, which leads to a partial identification of the mathematical relationship(s) inherent in the problem.</p>	<p><b>Attribute(s) of concept(s)</b> Lacks identification of any of the critical attributes of the problem.</p> <p><b>Inferences</b> Combines few of the attributes of the problem which leads to an incomplete identification of the mathematical relationship(s) inherent in the problem.</p>
Part c) <b>Procedural Knowledge</b>	<p><b>Appropriate strategy</b> Selects and implements an appropriate strategy.</p> <p><b>Representational form</b> Uses appropriate representation to connect the procedure to the concept of the problem.</p> <p><b>Algorithmic competency</b> Correctly implements procedure to arrive at a correct solution.</p>	<p><b>Appropriate strategy</b> Selects and implements an appropriate strategy.</p> <p><b>Representational form</b> Uses appropriate representation to connect the procedure to the concept of the problem.</p> <p><b>Algorithmic competency</b> Implements selected procedure but arrives at an incorrect solution.</p>	<p><b>Appropriate strategy</b> Selects and implements an appropriate strategy.</p> <p><b>Representational form</b> Uses inconsistent or insufficient representation for the selected solution strategy.</p> <p><b>Algorithmic competency</b> Implements selected procedure but arrives at an incorrect or correct solution. (See Part a above)</p>	<p><b>Appropriate strategy</b> Selects and implements an inappropriate strategy.</p> <p><b>Representational form</b> Uses incorrect representations.</p> <p><b>Algorithmic competency</b> Makes significant errors.</p>
Part d) <b>Communication</b>	<p><b>Justification</b> Fully answers the question of “why” for the strategy selection; explains procedure; and/or evaluates reasonableness of solution.</p> <p><b>Terminology</b> Uses appropriate terminology and notation.</p>	<p><b>Justification</b> Fully answers the question of “why” for the strategy selection; explains procedure; and/or evaluates reasonableness of solution.</p> <p><b>Terminology</b> Uses some appropriate terminology or notation.</p>	<p><b>Justification</b> Incompletely answers the question of “why” for the strategy selection; explains procedure; and/or evaluates reasonableness of solution.</p> <p><b>Terminology</b> Uses some appropriate terminology or notation.</p>	<p><b>Justification</b> Provides very little or no explanation of what was done and why.</p> <p><b>Terminology</b> Uses limited or inappropriate terminology or notation.</p>



## Unit Resources

1. TEXTTEAMS High School  
Geometry
2. TAKS Mathematics Preparation  
Guide Grade 10

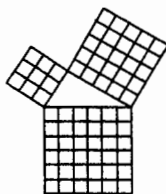
## Teacher Notes

### Activity 2: Pythagorean Theorem – More or Less

*Each group needs grid paper, scissors, rulers and tape. Have them cut out squares with the area described in the activity sheet.*

**Using grid paper, cut out squares with areas of 9, 16, 25, 36, 81, 100, 121, 144, 169 and several more of your choosing. Use three of the squares to construct a triangle as shown below. Tape the squares in position.**

*Ask: Can a triangle always be formed for any choice of the three squares? No, the sum of two sides (not the square of the side) must be greater than the third side.*



**Determine if the triangle formed is acute, right or obtuse by measuring the angles. Record your data in the accompanying chart. Repeat this process with at least two more sets of squares and enter the data into your chart. Fill in the remainder of your chart with data from neighboring groups. In your data find a pattern similar to the Pythagorean Theorem which describes the relationship between the squares of the lengths of the sides of a triangle and the type of triangle formed.**

*Students complete the chart on the activity sheet by collecting data from neighboring groups making certain they have at least 1 right triangle, 2 acute triangles and 2 obtuse triangles. In the data, they find a pattern similar to the Pythagorean Theorem to describe the relationship between the squares of the lengths of the sides of a triangle and the type of triangle formed.*

*By examining the data in the chart, we can determine the following answers to the questions accompanying the chart.*

- 1. For what type of triangle is  $c^2 = a^2 + b^2$ ?**  
Pythagorean Theorem is always true for right triangles.
- 2. If  $c^2 \neq a^2 + b^2$ , for what kind of triangle is  $c^2 < a^2 + b^2$ ?**  
If  $c^2 < a^2 + b^2$  is true, the triangle must be an acute triangle.
- 3. If  $c^2 \neq a^2 + b^2$ , for what kind of triangle is  $c^2 > a^2 + b^2$ ?**  
If  $c^2 > a^2 + b^2$  is true, the triangle must be an obtuse triangle.

**4. In your own words, state the “Un Pythagorean Theorem”.**

Although answers may vary, it might be stated that in a triangle with side lengths  $a$ ,  $b$ , and  $c$  (the longest side),

$c^2 = a^2 + b^2$  if the triangle is right.

$c^2 < a^2 + b^2$  if the triangle is acute.

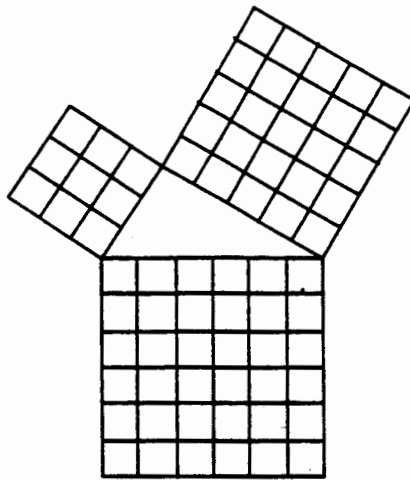
$c^2 > a^2 + b^2$  if the triangle is obtuse.

*Note: Many textbooks refer to the Pythagorean Theorem as  $a^2 + b^2 = c^2$ . In this activity, we purposefully use  $c^2 = a^2 + b^2$  so that the relationship is more obvious.*

**Summary:** *Students use patty paper to develop the Pythagorean Theorem. Students then extend this to find the relationship between the square of the sides of acute and obtuse triangles.*

### Activity 2: Pythagorean Theorem- More or Less

Using grid paper, cut out squares with areas of 9, 16, 25, 36, 81, 100, 121, 144, 169 and several more of your choosing. Use three of the squares to construct a triangle as shown below. Tape the squares in position.



Determine if the triangle formed is acute, right or obtuse by measuring the angles. Record your data in the accompanying chart. Repeat this process with at least two more sets of squares and enter the data into your chart. Fill in the remainder of your chart with data from neighboring groups. In your data find a pattern similar to the Pythagorean Theorem which describes the relationship between the squares of the lengths of the sides of a triangle and the type of triangle formed.

Triangle side lengths in increasing order $a, b, c$	Area of the largest square $c^2$	Area of one of the smaller squares $a^2$	Area of the remaining square $b^2$	$a^2 + b^2$	Is the triangle formed acute, right or obtuse?
5, 6, 10	100	25	36	61	Obtuse

1. For what type of triangle is  $c^2 = a^2 + b^2$ ?
2. If  $c^2 \neq a^2 + b^2$ , for what kind of triangle is  $c^2 < a^2 + b^2$ ?
3. If  $c^2 \neq a^2 + b^2$ , for what kind of triangle is  $c^2 > a^2 + b^2$ ?
4. In your own words, state the “Un Pythagorean Theorem”.

