Algebra/Geometry Institute Summer 2005

Lesson Plan #2- Pythagorean Theorem

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Grade Level: 8th Grade/Pre-Algebra,

1 Teaching objective(s)

3d – Solve Pythagorean Theorem problems using formulas

2 Instructional Activities

[Introduce the lesson by drawing a right triangle on the board (or chart paper).
Ask the students to discuss all of the characteristics of the triangle.
Listen for key terms like hypotenuse, adjacent angles, and legs.
If they don’t come up with the terms on their own, ask those specific questions about the legs and the hypotenuse of the right triangle.
Make sure the discussion leads to the idea of Pythagorean triples.

- The formula for Pythagorean Theorem is \( a^2 + b^2 = c^2 \), where \( a \) and \( b \) both represent the legs of the triangle and \( c \) represents the hypotenuse.
- True right triangles form what is known as Pythagorean triples
  - The square of the hypotenuse is equal to the sum of the squares of the two legs.
- Provide examples of the Pythagorean triples
- We can find Pythagorean triples by using the following formula:

For any two integers, \( u \) and \( v \), the integers \( a, b, \) and \( c \) will be Pythagorean triples if:
\[
\begin{align*}
a &= u^2 - v^2 \\
b &= 2uv \\
c &= u^2 + v^2
\end{align*}
\]

For example, let \( u = 2 \) and \( v = 1 \), then
\[
\begin{align*}
a &= u^2 - v^2 = 2^2 - 1^2 = 4 - 1 = 3 \\
b &= 2uv = 2(2)(1) = 4 \\
c &= u^2 + v^2 = 2^2 + 1^2 = 4 + 1 = 5
\end{align*}
\]
Therefore, 3, 4, 5 is a Pythagorean triple]
Provide practice; find the set of Pythagorean triples. Let $u = 3$, and $v = 1$.

Using the formula, find $a$ first,

$a = u^2 - v^2 = 3^2 - 1^2 = 9 - 1 = 8$, then find $b$,

$b = 2uv = 2(3)(1) = 6$, an now find $c$

$c = u^2 + v^2 = 3^2 + 1^2 = 9 + 1 = 10$, therefore,

the Pythagorean triples is 6, 8, 10

Complete practice problems, (See Attachment #1)

Provide guided practice of finding the missing side of a right triangle.

Consider the following problem.

If the hypotenuse is missing, use the following formula:

$a^2 + b^2 = c^2$

Use the following formula

$a^2 + b^2 = c^2$
$8^2 + 6^2 = c^2$
$64 + 36 = c^2$
$100 = c^2$
$\sqrt{100} = \sqrt{c^2}$
$10 = c$

Complete quiz using the Pythagorean theorem
3 Materials and Resources

- Chalkboard
- Chalk
- Overhead Projector
- Screen
- Teacher made activity sheets

4 Assessment

- Monitor students as they complete practice and individual activity
- Question and answer period during discussion
- Monitor boardwork
- Administer quiz (10 Questions), grade and give immediate feedback. (see Attachment #2)
Pythagorean Triples Practice Worksheet

Using the following formulas:
\[ a = u^2 - v^2 \]
\[ b = 2uv \]
\[ c = u^2 + v^2 \]

Form sets of Pythagorean triples using the following values of \( u \) and \( v \).

1. \( u = 3, \ v = 1 \)
2. \( u = 3, \ v = 2 \)
3. \( u = 4, \ v = 1 \)
4. \( u = 6, \ v = 1 \)
5. \( u = 6, \ v = 5 \)
6. \( u = 5, \ v = 2 \)

7. See how many more sets of Pythagorean Triples you can form.
If $a$ and $b$ are the sides of a triangle and $c$ is the hypotenuse, find the missing side of each of the right triangles. Round the decimals answers to the nearest tenth.

1. $a = 12, b = 16$

2. $b = 21, c = 29$

3. $b = 16, c = 20$

4. $a = 2, b = 5$

5. $a = 5, c = 10$

6. $a = 7, b = 9$

7. $b = 3, c = 7$

8. $a = 7, b = 7$

9. $b = 36, c = 85$

10. $a = 14, b = 15$