# **Lesson 31: System of Equations Leading to Pythagorean Triples**

## Classwork

#### **Exercises**

- 1. Identify two Pythagorean triples using the known triple 3, 4, 5 (other than 6, 8, 10).
- Identify two Pythagorean triples using the known triple 5, 12, 13.
- Identify two triples using either 3, 4, 5 or 5, 12, 13.

Use the system  $\begin{cases} x + y = \frac{t}{s} \\ x - y = \frac{s}{t} \end{cases}$  to find Pythagorean triples for the given values of s and t. Recall that the solution in the form of  $\left(\frac{c}{b}, \frac{a}{b}\right)$  is the triple a, b, c.

4. s = 4, t = 5



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5. 
$$s = 7, t = 10$$

6. 
$$s = 1, t = 4$$



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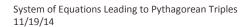
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7. Use a calculator to verify that you found a Pythagorean triple in each of the Exercises 4–6. Show your work below.



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### **Lesson Summary**

A Pythagorean triple is a set of three positive integers that satisfies the equation  $a^2 + b^2 = c^2$ .

An infinite number of Pythagorean triples can be found by multiplying the numbers of a known triple by a whole number. For example, 3, 4, 5 is a Pythagorean triple. Multiply each number by 7, then you have 21, 28, 35, which is also a Pythagorean triple.

The system of linear equations,  $\begin{cases} x + y = \frac{t}{s} \\ x - y = \frac{s}{t} \end{cases}$  can be used to find Pythagorean triples, just like the Babylonians did 4,000 years ago.

#### **Problem Set**

- Explain in terms of similar triangles why it is that when you multiply the known Pythagorean triple 3, 4, 5 by 12, it generates a Pythagorean triple.
- Identify three Pythagorean triples using the known triple 8, 15, 17.
- 3. Identify three triples (numbers that satisfy  $a^2 + b^2 = c^2$ , but a, b, c are not whole numbers) using the triple 8. 15. 17.

Use the system  $\begin{cases} x + y = \frac{t}{s} \\ x - y = \frac{s}{t} \end{cases}$  to find Pythagorean triples for the given values of s and t. Recall that the solution in the

form of  $\left(\frac{c}{h}, \frac{a}{h}\right)$  is the triple a, b, c.

4. 
$$s = 2, t = 9$$

5. 
$$s = 6, t = 7$$

6. 
$$s = 3, t = 4$$

Use a calculator to verify that you found a Pythagorean triple in each of the Problems 4–6. Show your work below.



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