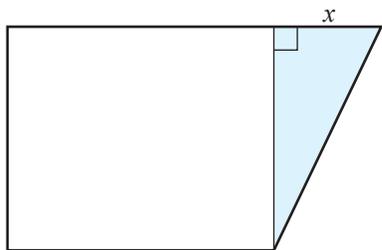## Chapter 11 Project

Building a Dog Pen

An activity to demonstrate the use of the Pythagorean Theorem and quadratic equations in real life.

Justin's house sits on a lot that is shaped like a trapezoid. He decides to make the back part of the lot usable by building a triangular dog pen for his dog Blackjack. On his lunch break at work he decides to order the materials but realizes that he forgot to write down the actual dimensions of that area of the lot. He wants to get the pen done this weekend because his buddies are coming over to help him, so he has to order the materials today in order for them to arrive on time. He remembers that one of the sides is 5 feet more than the length of the shortest side and the longest side is 10 feet more than the shortest side. Can he figure out the dimensions of the triangular pen so that he can order the materials today?

1. Using the diagram of the lot below and the variable x for the length of the shortest side of the dog pen, write an expression for the other two sides of the triangular pen and label them on the diagram.

2. Using the Pythagorean Theorem, substitute the three expressions for the sides of the triangle into the formula and simplify the resulting polynomial. Be sure to move all terms to one side of the equation with the other side equal to zero. (Remember that the longest side is the hypotenuse in the formula. Make sure your leading term has a positive coefficient and that your squared binomials result in a trinomial.)

3. Use the equation from Problem 2. Factor the resulting quadratic equation into two linear binomial factors. Set each linear factor equal to zero and solve for x.

   a. Factor the resulting quadratic equation into two linear binomial factors.

   b. Find the two solutions to the equation from Part **a.** using the zero-factor law.

c. Do both of these solutions make sense? Explain your reasoning.

d. Using the solution that makes sense, substitute this value for x and determine the dimensions of the dog pen.

4. To fence in the dog pen, Justin plans to purchase chain link fencing at a cost of $1.90 per foot.

   a. How much fencing will he need?

   b. How much will the fencing cost?

5. How much area will the dog pen have?

6. Justin decides to also put a dog house in the pen to protect Blackjack in bad weather. The dog house is rectangular in shape and measures 2.5 feet by 3 feet. Once the dog house is in the pen, how much area will Blackjack have to run in?

7. The sides of the pen form a right triangle and the measurements of the sides of the pen were found using the Pythagorean Theorem. Any three positive integers that satisfy the Pythagorean Theorem are called a **Pythagorean triple**. There are an infinite number of these triples and numerous formulas that can be used to generate them. Do some research on the internet to find one of these formulas and use the formula to generate three more sets of Pythagorean triples. Verify that they are Pythagorean triples by substituting them into the Pythagorean Theorem.

8. Another way to generate a Pythagorean triple is to take an existing triple and multiply each integer by a constant. Take the Pythagorean triple $(3, 4, 5)$ and multiply each integer in the triple by the factors below and verify that the result is also a Pythagorean triple by substituting into the Pythagorean Theorem.

   a. Multiply by 3:

   b. Multiply by 5:

   c. Multiply by 8: