9.4 Formulas and Further Applications

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OBJECTIVES:

- Solve formulas for variables involving squares and square roots.
- Solve applied problems using the Pythagorean theorem.
- Solve applied problems using area formulas.
- Solve applied problems using quadratic functions as models.

Solving for Variables Involving Squares or Square Roots

Solve the formula for E.

$$n = \frac{ab}{E^2}$$

Solving for Variables Involving Squares or Square Roots

Solve the formula for a.

$$s = 30\sqrt{\frac{a}{p}}$$

Solving for Variables Involving Squares or Square Roots

Solve the formula for t.

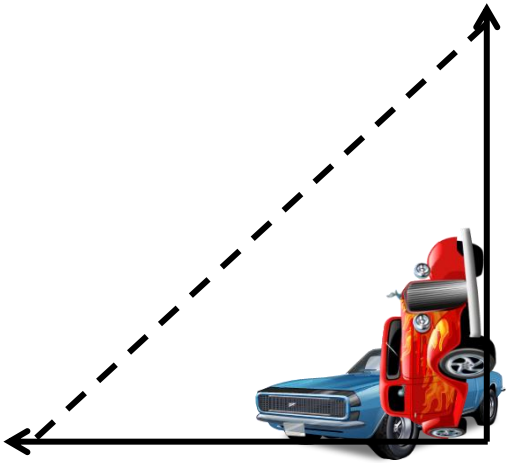
$$2t^2 - 5t + k = 0$$

Steps to Solving an Applied Problem

- **READ** the problem carefully until you understand what is given and what is to be found.
- **ASSIGN A VARIABLE** to represent the unknown value, using diagrams or tables as needed. Write down what the variable represents. If necessary, express any other unknown values in terms of the variable.
- **WRITE AN EQUATION** using the variable expression(s).
- **SOLVE** the equation.
- **STATE THE ANSWER.** Does it seem reasonable?
- **CHECK** the answer in the words of the *original* problem.

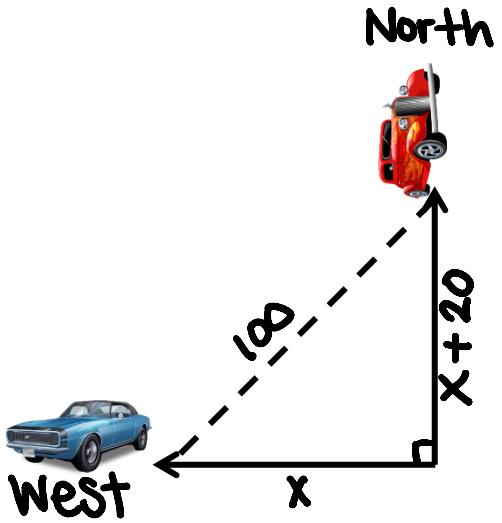
Using the Pythagorean Formula

- Two cars left an intersection at the same time, one heading due north, the other due West. Some time later, they were exactly 100 miles apart. The car headed north had gone 20 miles farther than the car headed west. How far had each car traveled?



Solve the equation.

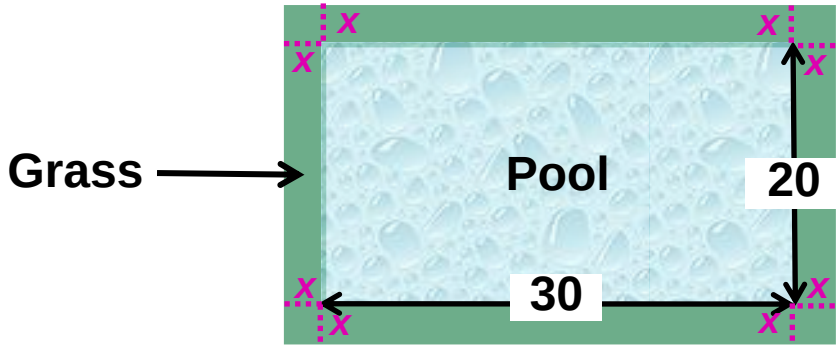
$$x^2 + (x + 20)^2 = 100^2$$

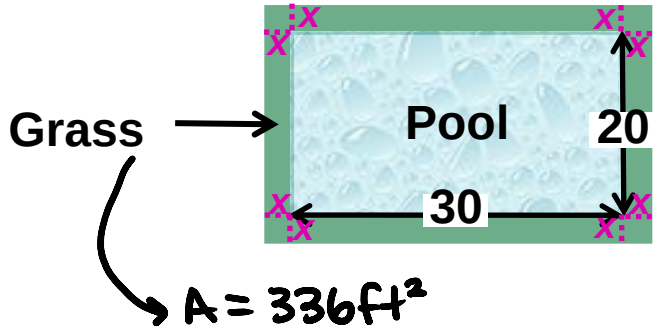


Solving an Area Problem

- A rectangular reflecting pool in a park is 20 ft wide and 30 ft long. The park gardener wants to plant a strip of grass of uniform width around the edge of the pool. She has enough seed to cover 336 ft^2. How wide will the strip be?

***x* = the unknown width of the grass strip**





$A = 336 ft^2$

$$(30+2x)(20+2x) - (30)(20) = 336$$

Solving an Applied Problem

- A ball is projected upward from the ground. Its distance in feet from the ground at *t* seconds is

$$s(t) = -16t^2 + 64t$$

At what times will the ball be 32 ft from the ground?

$$16t^2 - 64t + 32 = 0$$

Using a Quadratic Function to Model the CPI

- The Consumer Price Index (CPI) is used to measure trends in prices for a "basket" of goods purchased by typical American families. This index uses a base year of 1967, which means that the index number for 1967 is 100. The quadratic function defined by

$$f(x) = -0.065x^2 + 14.8x + 249$$

approximates the CPI for the years 1980 – 2005, where x is the number of years that have elapsed since 1980.

a) *Use this model to approximate the CPI for 2000, to the nearest whole number.*

b) *In what year did the CPI reach 450? (Round down for the year.)*

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$$f(x) = -0.065x^2 + 14.8x + 249$$

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$$x = \frac{-14.8 \pm \sqrt{166.78}}{-0.13}$$