1. Find two consecutive integers whose product is 110.
   Solution: \( x \): first integer
   \( x + 1 \): next consecutive integer
   \( x(x + 1) = 110 \)
   \( x^2 + x = 110 \)
   \( x^2 + x - 110 = 0 \)
   \( (x + 11)(x - 10) = 0 \)
   The solutions are -11 and -10 or 10 and 11

2. Find two consecutive odd integers whose product is 195.
   Solution: \( x \): first odd integer
   \( x + 2 \): next consecutive odd integer
   \( x(x + 2) = 195 \)
   \( x^2 + 2x = 195 \)
   \( x^2 + 2x - 195 = 0 \)
   \( (x + 15)(x - 13) = 0 \)
   The solutions are -15 and -13 or 13 and 15

3. One positive number is 4 more than the other, and the sum of their squares is 208. What are the numbers?
   Solution: \( x \): positive number
   \( x + 4 \): the other positive number
   \( x^2 + (x + 4)^2 = 208 \)
   \( x^2 + (x + 4)(x + 4) = 208 \)
   \( x^2 + x^2 + 4x + 4x + 16 = 208 \)
   \( 2x^2 + 8x + 16 = 208 \)
   \( 2x^2 + 8x - 192 = 0 \)
   \( x^2 + 4x - 96 = 0 \)
   \( (x + 12)(x - 8) = 0 \)
   The positive numbers are 8 and 12
4. A couple wants to buy a rug for a room that is 20 ft long and 15 ft wide. They want to leave an even strip of flooring uncovered around the edges of the room. How wide a strip will they have if they buy a rug with an area of 234 ft²?

Length of Rug: 20 – 2x
Width of Rug: 15 – 2x

\[(20 - 2x)(15 - 2x) = 234\]
\[300 - 40x - 30x + 4x^2 = 234\]
\[300 - 70x + 4x^2 = 234\]
\[4x^2 - 70x + 66 = 0\]
\[2x^2 - 35x + 33 = 0\]
\[(2x - 33)(x - 1) = 0\]

The Strip is 1 ft wide

5. A rectangular 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 ft². How wide will the strip be?

Area of strip = area of large rectangle – area of small rectangle

\[336 = (30 + 2x)(20 + 2x) - 20(30)\]
\[336 = 600 + 60x + 40x + 4x^2 - 600\]
\[336 = 4x^2 + 100x\]
\[0 = 4x^2 + 100x - 336\]
\[0 = x^2 + 25x - 84\]
\[0 = (x + 28)(x - 3)\]

The strip is 3 ft wide

6. A 13-ft ladder is leaning against a house. The distance from the bottom of the ladder to the house is 7 ft less than the distance from the top of the ladder to the ground. How far is the bottom of the ladder from the house?

Pythagorean Theorem \[a^2 + b^2 = c^2\]
\[(x - 7)^2 + x^2 = 13^2\]
\[(x - 7)(x - 7) + x^2 = 169\]
\[x^2 - 7x - 7x + 49 = 169\]
\[x^2 - 14x - 120 = 0\]
\[(x - 20)(x + 6) = 0\]
\[x = 20 \text{ or } x = -6\]

The bottom of the ladder is 20 – 7 = 13 ft from the house
7. A walkway will have the shape of a right triangle with one leg 700 yd longer than the other and the hypotenuse 100 yd longer than the longer leg. Find the total length of the walkway.

![Diagram of right triangle with legs labeled x + 700 and x + 800, and hypotenuse labeled x.]

Pythagorean Theorem

\[(x + 700)^2 + x^2 = (x + 800)^2\]

\[(x + 700)(x + 700) + x^2 = (x + 800)(x + 800)\]

\[x^2 + 1400x + 490000 + x^2 = x^2 + 1600x + 640000\]

\[2x^2 + 1400x + 490000 = x^2 + 1600x + 640000\]

\[x^2 - 200x - 150000 = 0\]

\[(x - 500)(x + 300) = 0\]

Total length = 500 + 1200 + 1300

= 3000 yds

8. The average cost for tuition and fees at public colleges from 1997-2006, in dollars, can be modeled by the equation

\[y = -6.31x^2 + 494.6x + 8438\]

where \(x = 0\) corresponds to 1997, \(x=1\) to 1998, and so on. What was the cost in 2002?

Based on this model, for what year was the cost $12,400?

Solution:

\[y = -6.31(5)^2 + 494.6(5) + 8438\]

\[y = 10,753.25 \text{ in 2002}\]

\[12,400 = -6.31x^2 + 494.6x + 8438\]

\[0 = -6.31x^2 + 494.6x - 3962\]

By the quadratic Formula

\[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\]

\[x = \frac{-494.6 \pm \sqrt{494.6^2 - 4(-6.31)(-3962)}}{2(-6.31)}\]

\[x = 9.05 \text{ and } 69.33 \text{ The solution 69.33 is too big since this is the year 2067. The solution is the year } 1997 + 9 = 2006.\]