2.10 Theorem of Pythagoras

Basic Algebra: One Step at a Time. Pages 193-200: #41, 42, 45, 46

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Regretfully, I still cannot draw pictures for this webpage. Therefore, you will have to draw and label the rectangles and triangles for each problem here.

p. 198: 41. Find the width of a rectangle whose diagonal is 25 cm. and length is 24 cm.

Solution: Let x = the width of the rectangle.
24 = the length of the rectangle.
25 = the diagonal of the rectangle.

Draw a rectangle with a diagonal, which will divide the rectangle into two triangles. The legs of the triangle are x and 24, and the hypotenuse is 25.

$$x^2 + 24^2 = 25^2$$

$$x^2 + 576 = 625$$

In order to get all the number terms on the right side, subtract 576 from each side:

$$\begin{array}{r} x^2 + 576 = 625 \\ -576 \quad -576 \\ \hline x^2 \quad = \quad 49 \end{array}$$

Take the square root of each side:

$$x = \pm 7$$

Of course, the negative answer is rejected, since the side of a rectangle cannot be negative.

Final answer: $x = 7$ cm.

p. 199: 42. Find the width of a rectangle whose diagonal is 29 cm. and length is 21 cm.

Solution: Let x = the width of the rectangle.
21 = the length of the rectangle.
29 = the diagonal of the rectangle.

Draw a rectangle with a diagonal, which will divide the rectangle into two triangles. The legs of the triangle are x and 21, and the hypotenuse is 29.

$$x^2 + 21^2 = 29^2$$

$$x^2 + 441 = 841$$

In order to get all the number terms on the right side, subtract 576 from each side:

$$\begin{array}{r} x^2 + 441 = 841 \\ -441 \quad -441 \\ \hline x^2 \quad = \quad 400 \end{array}$$

Take the square root of each side:

$$x = \pm\sqrt{400}$$

$$x = \pm 20$$

Of course, the negative answer is rejected, since the side of a rectangle cannot be negative.

Final answer: $x = 20$ cm.

p. 199: 45. A guy wire to the top of a 35 foot pole reaches the ground 18 feet from the base of the pole. How long is the wire?

Solution: Let x = the length of the wire.
35 = the height of the pole.
18 = the base of the triangle.

Draw a right triangle with base 18 and height 35. The hypotenuse will be the length of the wire, which is x. The legs of the triangle are 18 and 35, and the hypotenuse is x.

$$18^2 + 35^2 = x^2$$

$$324 + 1225 = x^2$$

Combine the number terms on the left side:

$$1549 = x^2$$

$$x^2 = 1549$$

Take the square root of each side:

$$x = \pm\sqrt{1549}$$

Use a calculator and round to the nearest hundredth:

$$x = \pm 39.36$$

The negative answer is rejected, since the side of a triangle cannot be negative.

Final answer: $x = 39.36$ feet

p. 199: 46. A guy wire to the top of a pole is 35 feet long. It reaches the ground 18 feet from the base of the pole. How tall is the pole?

Solution: Let x = the height of the pole.
35 = the length of the wire.
18 = the base of the triangle.

Draw a right triangle with base 18 and height x. The hypotenuse will be the length of the wire, which is 35. The legs of the triangle are 18 and x, and the hypotenuse is 35.

$$18^2 + x^2 = 35^2$$

$$324 + x^2 = 1225$$

Subtract 324 from each side:

$$\begin{array}{r} 324 + x^2 = 1225 \\ -324 \quad\quad -324 \\ \hline \end{array}$$

$$x^2 = 901$$

Take the square root of each side:

$$x = \pm\sqrt{901}$$

Use a calculator and round to the nearest hundredth:

$$x = \pm 30.02$$

The negative answer is rejected, since the side of a triangle cannot be negative.

Final answer: $x = 30.02$ feet