

## Exercise 75

A pen in the shape of an isosceles right triangle with legs of length  $x$  ft and hypotenuse of length  $h$  ft is to be built. If fencing costs \$5/ft for the legs and \$10/ft for the hypotenuse, write the total cost  $C$  of construction as a function of  $h$ .

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### Solution

Multiply the given lengths by the respective costs of construction and then add them together to get the total.

$$C = 5x + 10h$$

Because this is a right triangle, the sides are related by the Pythagorean theorem.

$$x^2 + x^2 = h^2$$

$$2x^2 = h^2$$

$$x^2 = \frac{h^2}{2}$$

$$x = \frac{h}{\sqrt{2}}$$

$$x = \frac{h\sqrt{2}}{2}$$

Therefore, the cost of construction as a function of  $h$  is

$$\begin{aligned} C(h) &= 5x + 10h \\ &= 5\left(\frac{h\sqrt{2}}{2}\right) + 10h \\ &= \left(\frac{5\sqrt{2}}{2} + 10\right)h \\ &= \frac{5}{2}(\sqrt{2} + 4)h \\ &\approx 13.5h. \end{aligned}$$