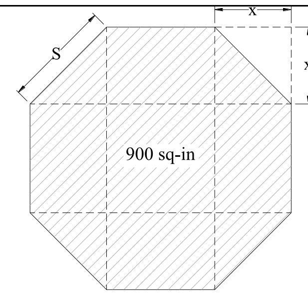
Find the dimensions of a STOP sign with a total area of 900 in^2.

Each edge is equal. We denote the edge by S. x denotes the horizontal or vertical distance cut out of each corner. Note: $x \neq S$. *Why?* Recognize that each corner is a right triangle and therefore must obey the Pythagorean Theorem. $x^2 + x^2 = S^2$. This leads to $2x^2 = S^2$ *Why?* Solving for S gives us $S = x\sqrt{2}$. *Why?* We can now find x by solving the following equation:



(*4-triangles, 4-rectangles and one square in the center = 900in^2*)

turn the sentence into an equation

substitute out S to get only 'x'

$$4x^2 + 4\sqrt{2}\,x^2 = 900$$ *combine like terms and then factor x^2*

$$(4 + 4\sqrt{2})x^2 = 900$$ *divide both sides by $(4 + 4\sqrt{2})$*

$$x^2 = \frac{900}{4 + 4\sqrt{2}} \quad x = \sqrt{\frac{900}{4 + 4\sqrt{2}}} = \sqrt{\frac{225}{1 + \sqrt{2}}}$$ *simplify*

$$S = \sqrt{2}\sqrt{\frac{225}{1 + \sqrt{2}}} \rightarrow \boxed{S = \sqrt{\frac{450}{1 + \sqrt{2}}}}$$ *substitute back to get S, $S \approx 13.65''$*

Another approach to solving the above problem would be to begin with the circumscribing square and subtract the 4 corner triangles to obtain the 900 sq-in of area: *(surrounding square − 4-triangles = 900in^2)*

$$(x + S + x)^2 - 4[(½)x^2] = 900 \qquad S = \sqrt{2}\,x \text{ and simplifying yields:}$$

$$(2x + \sqrt{2}\,x)^2 - 2x^2 = 900$$

This requires we multiply (expression) × (expression) which we shall discuss in the next section. There are numerous situations where we might want to multiply a pair of expressions. The last example presented us with the alternate problem formation leading to the need to solve $(2x + \sqrt{2}\,x)^2 - 2x^2 = 900$.

Although we can approximate $\sqrt{2}$ and combine the two terms here we shall develop a general process for multiplying (expression) × (expression). This will allow us to solve a wider array of problems.