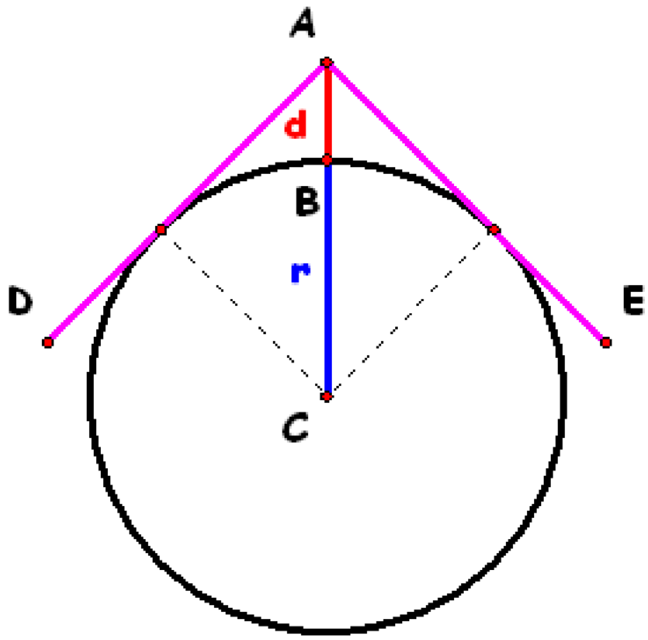
Pipe Problem



Using the fact that a right angled isoceles triangle is formed by the center of the circle C, the corner A of the carpenter's square and the point of tangency of the square to the circle we have:

$$(d+r)^2 = r^2 + r^2$$

$$(r+d)^2 = 2 \cdot r^2$$

Expanding, placing all terms on the left hand side of the equation and collecting terms gives a quadratic equation in r:

$$\text{expand}\left((r+d)^2 = 2 \cdot r^2, r\right)$$

$$r^2 + 2 \cdot d \cdot r + d^2 = 2 \cdot r^2$$

$$ans - 2 \cdot r^2$$

$$-\left(r^2\right) + 2 \cdot d \cdot r + d^2 = 0$$

Solving this equation for r in terms of d with d > 0 and r > 0 gives:

$$\text{solve}\left(-\left(r^2\right) + 2 \cdot r \cdot d + d^2 = 0, r\right) \mid d > 0 \text{ and } r > 0$$

$$r = d \cdot \left(\sqrt{2} + 1\right)$$

The above result is the exact answer. An approximation that could be used in the real situation would be:

$$r = \left(\sqrt{2} + 1.\right) \cdot d$$

$$r = 2.41421 \cdot d$$