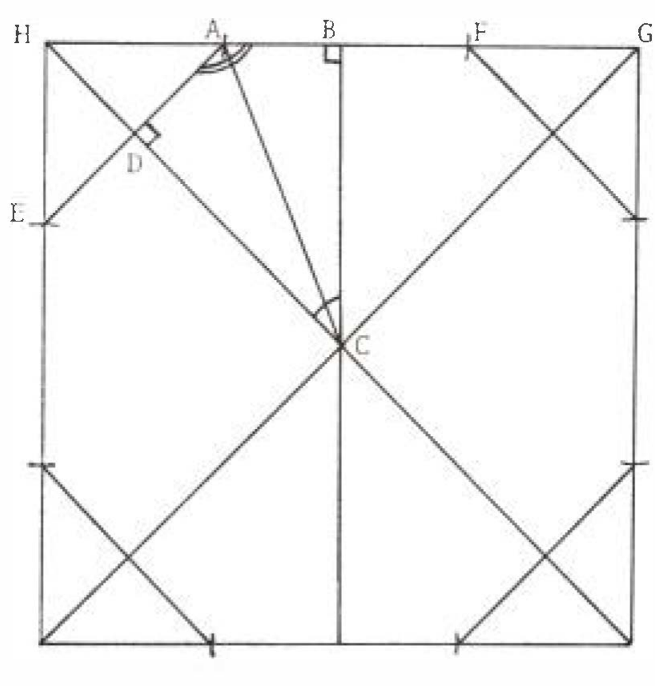
# How to Draw an Octagonal Figure Quickly

*William J. Bruce*

The following method, commonly used by a carpenter, is well within the understanding of students of elementary plane geometry.

Method:
1. Draw both diagonals of a square to intersect in the centre C as shown in the accompanying diagram.
2. With each corner of the square as centre and with radii equal to the length of a semi-diagonal, draw arcs to intersect all sides of the square.
3. The points of intersection in (2) are the corners of the required octagon. (See proof below.)




Proof: From the figure, B is a point of bisection of a side of the square. By construction, $\Delta ACG$ is isosceles with $AG \equiv CG$. $\angle AGC = 45^\circ$, so $\angle ACG = \angle CAG = 67\frac{1}{2}^\circ$. $\angle BCG = \angle HCB = 45^\circ$, so $\angle ACB = \angle ACD = 22\frac{1}{2}^\circ$. Thus $\angle CAD = 67\frac{1}{2}^\circ$ also. Therefore, by a.s.a., $\triangle$'s ABC and ADC are congruent. So $AB \equiv \angle AD$. But $AF = 2AB$ and $AE = 2AD$, by construction. Hence $AF \equiv AE$, as required for an octagon.

*Note:* If $s$ units is the length of a side of the square and $h$ units is the length of a side of the octagon, it is easy to obtain $h = s \tan 22\frac{1}{2}^\circ$ and, from the appropriate half-angle trigonometric identity, that $h = s(\sqrt{2} - 1)$.