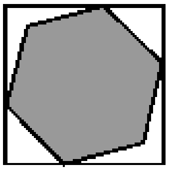
21. The diagram shows a regular hexagon, with sides of length 1, inside a square. Two vertices of the hexagon lie on a diagonal of the square and the other four lie on the edges.



What is the area of the square?

A $2 + \sqrt{3}$ B 4 C $3 + \sqrt{2}$ D $1 + \frac{3\sqrt{3}}{2}$ E $\frac{7}{2}$

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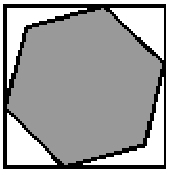
21. **A** The hypotenuse of one of the small right-angled triangles is parallel to the diagonal and hence makes angles of 45°. Since the hypotenuse has length 1, the other two sides have length $\frac{1}{\sqrt{2}}$, by Pythagoras' Theorem. As the internal angle of a regular hexagon is 120°, drawing a diagonal from NW to SE forms two triangles, bottom right, each with angles 45°, 120° and 15°. (The sum of the angles in a triangle is 180°).



Let the square have length y units. Using the Sine Rule gives $\frac{y - \frac{1}{\sqrt{2}}}{\sin 120°} = \frac{1}{\sin 45°}$.

Hence $y - \frac{1}{\sqrt{2}} = \frac{\sqrt{3}}{2} \div \frac{1}{\sqrt{2}} = \frac{\sqrt{3}}{\sqrt{2}}$ and therefore $y = \frac{\sqrt{3} + 1}{\sqrt{2}}$.

Hence the area of the square is $y^2 = \left(\frac{\sqrt{3} + 1}{\sqrt{2}}\right)^2 = \frac{4 + 2\sqrt{3}}{2} = 2 + \sqrt{3}$.