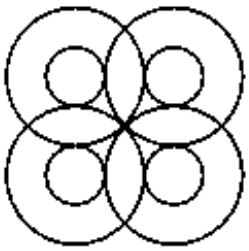
17. The diagram shows eight circles of two different sizes. The circles are arranged in concentric pairs so that the centres form a square. Each larger circle touches one other larger circle and two smaller circles. The larger circles have radius 1. What is the radius of each smaller circle?



A $\frac{1}{3}$ B $\frac{2}{5}$ C $\sqrt{2}-1$ D $\frac{1}{2}$ E $\frac{1}{2}\sqrt{2}$

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17. C Let the radius of each of the smaller circles be r and let the centres of the circles be A, B, C and D in order. We are given that $ABCD$ is a square. When two circles touch externally, the distance between their centres equals the sum of their radii. Hence AB and BC have length $r + 1$ and AC has length $1 + 1 = 2$. By Pythagoras' Theorem $(r+1)^2 + (r+1)^2 = 2^2$, so $2(r+1)^2 = 2^2 = 4$ and therefore $(r+1)^2 = 2$. Square rooting both sides gives $r + 1 = \sqrt{2}$, as we must take the positive root, and so $r = \sqrt{2} - 1$.