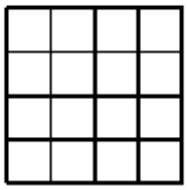
19. The 16 small squares shown in the diagram each have a side length of 1 unit. How many pairs of vertices are there in the diagram whose distance apart is an integer number of units?



A 40 B 64 C 108 D 132 E 16

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19. C There are 25 vertices in the diagram. Each vertex is part of a row of 5 vertices and a column of 5 vertices. Each vertex is therefore an integer number of units away from the 4 other vertices in its row and from the other 4 vertices in its column. This appears to give $25 \times (4 + 4) = 200$ pairs. However, counting in this manner includes each pair twice so there are only 100 different pairs.

By using the Pythagorean triple 3, 4, 5, each corner vertex is five units away from two other non-corner vertices, giving another 8 pairs. No other Pythagorean triples include small enough numbers to yield pairs of vertices on this grid.

Thus the total number of pairs is 108.