22. Given that $S = (x + 20) + (x + 21) + (x + 22) + \ldots + (x + 100)$, where x is a positive integer, what is the smallest value of x such that S is a perfect square?

A 1 B 2 C 4 D 8 E 64

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22. C There are 81 terms in the series, so, using the formula $S = \frac{1}{2}n(a + l)$ for an arithmetic series:

$$S = \frac{81}{2}(x + 20 + x + 100) = 81(x + 60).$$

Now 81 is a perfect square, so S is a perfect square if and only if $x + 60$ is a perfect square. As x is a positive integer, the smallest possible value of x is 4.