

Let $a_3(n)$ be the least $k > n$ such that nk or nk^2 is a cube, and let $A299117$ be the image of $a_3(n)$.

$$a_3(1) = 8$$

$$a_3(2) = 4$$

$$a_3(3) = 9$$

$$a_3(4) = 16$$

$$a_3(5) = 25$$

$$a_3(6) = 36$$

$$a_3(7) = 49$$

$$a_3(8) = 27$$

$$a_3(9) = 24$$

Question. Is there another way to characterize what integers are in $A299117$?

Note. $A299117$ contains every cube, because $a(n^3) = (n+1)^3$.
 $A299117$ contains the square of every prime, because $a(p) = p^2$.

Related.

1. Does $A299117$ contain every square?
2. Does $A299117$ contain any squarefree number?
3. What about the generalization: the image of a_β where $a_\beta(n)$ is the least $k > n$ such that $nk, nk^2, \dots, nk^{\beta-2}$, or $nk^{\beta-1}$ is a β -th power? Prime β is an injection—is this well behaved?

References.

<https://oeis.org/A277781>

<https://oeis.org/A299117>