The positive integer just greater than $(1 + 0.0001)^{10000}$ is

(a) 4 (b) 5 (c) 2 (d) 3

Answer: (d)

Solution:

$(1 + 0.0001)^{10000}$ which is similar to the form $(1 + 1/n)^n$ where n = 10000.

Using binomial expansion, we have

$(1 + 0.0001)^{10000} = (1 + 1/n)^n$

$= 1 + n \times 1/n + n(n-1)/2! \times 1/n^2 + [n(n-1)(n-2)]/3! \times 1/n^3 + \ldots\ldots$

$= 1 + 1 + 1/2!(1 - 1/n) + 1/3!(1 - 1/n) + (1 - 2/n) + \ldots\ldots$

$< 1 + 1/1! + 1/2! + 1/3! + \ldots..+1/(9999)!$

$= 1 + 1/1! + 1/2! + 1/3! + \ldots\ldots\infty$

$= e < 3$