NKNU MATH

WELCOME BACK TO SCHOOL!

NKNU MATH

數學解題方法

TEAM2

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ARML美國高中數學聯賽

Amy adds some positive numbers together and gets 17.
Bella multiplies those same positive numbers together and gets N.
Compute the least positive integer that cannot be N.
請求出N的最大值即可。

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eg. $17=\underbrace{1+1+\cdots\cdots+1}_{17個}\Rightarrow 1^{17}=1$

$17=\underbrace{2+2+2}_{3個}+\underbrace{3+3}_{2個}+5\Rightarrow 2^3\times 3^2=72$

ANSWER

$$\left(\frac{17}{6}\right)^6 \approx 517.351873$$

SOLUTION

$$\left(\frac{17}{1}\right)^{1} = 17$$

$$\left(\frac{17}{2}\right)^{2} \approx 72.25$$

$$\left(\frac{17}{3}\right)^{3} \approx 181.96$$

$$\left(\frac{17}{4}\right)^{4} \approx 326.25$$

$$\left(\frac{17}{5}\right)^{5} \approx 454.35$$

$$\left(\frac{17}{6}\right)^{6} \approx 517.35$$

$$\left(\frac{17}{7}\right)^{7} \approx 498.26$$

相似題1

Amy adds some positive numbers together and gets 20.
Bella multiplies those same positive numbers together.
Bella有可能得到2000嗎？如果可以，請舉例；如果不行，請證明。

ANSWER

NO

SOLUTION

$$\left(\frac{20}{1}\right)^1 = 20$$

$$\left(\frac{20}{2}\right)^2 = 100$$

$$\left(\frac{20}{3}\right)^3 \approx 296.29$$

$$\left(\frac{20}{4}\right)^4 = 625$$

$$\left(\frac{20}{5}\right)^5 = 1024$$

$$\left(\frac{20}{6}\right)^6 \approx 1371.74$$

$$\left(\frac{20}{7}\right)^7 \approx 1554.26 < 2000$$

$$\left(\frac{20}{8}\right)^8 \approx 1525.87$$

相似題2

Amy adds some positive numbers together and gets 17.
Bella multiplies those same positive numbers together and gets N.
Bella有可能找出N為517以下所有正整數的組合方式嗎？
如果可以，請舉例；如果不行，請證明。

SOLUTION

Since $\sqrt[6]{k}\times 6$ is creasing $\forall k \geq 0$, and $\sqrt[6]{517}\times 6 \approx 16.998 < 17$,

when $k = 1, 2, \cdots, 517$, we can use $\sqrt[6]{k}+\sqrt[6]{k}+\sqrt[6]{k}+\sqrt[6]{k}+\sqrt[6]{k}+\sqrt[6]{k}+(17-\sqrt[6]{k}\times 6)=17$,

then $\sqrt[6]{k}\times\sqrt[6]{k}\times\sqrt[6]{k}\times\sqrt[6]{k}\times\sqrt[6]{k}\times\sqrt[6]{k}=k$.

Therefore, we prove that Bella can find all $1\sim 517$ combinations.

參考資料

HTTPS://WWW.ARML.COM/ARML/ARML_2019/PUBLIC_ACTUAL_DOCUMENTS/ARML%20LOCAL%202020%20SOLUTIONS.PDF
(題目來源：2020ARML 1-8)

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