

4th Annual April Fun Round

internetolympiad.org

April 1, 2016

Welcome to the 2016 April Fun Round. You may use any aids such as calculators, computers, Wikipedia, previous NIMO fun rounds, etc. You are also free to collaborate with other students (spread the fun!) but we ask that you do so privately to give everyone a chance at the problems (say, email or chats as opposed to public forums).

You have the whole day to work on the problems. Moreover, note that you are allowed five entries per problem instead of the usual three.

Important: each answer is a *nonnegative* integer. You may have to use this fact in order to solve some of the problems. (Note that this is a change from past years.)

1 Maximal Cutoff (Evan Chen)

A finite set X of students, $|X| \geq 1$, participate in a qualifying exam. This exam consists of 25 questions, and on each question a student can earn 0, 1.5 or 6 points. A student S passes the exam if *either*

- S scores at least 100 points, or
- S scores at least as high as 95% of the students in X .

Finally, the **cutoff** of the exam is defined as

$$C = \min_{S \in X \text{ passing}} (\text{score of } S).$$

What is the largest possible value of C ?

2 What is Love? (David Altizio and Michael Tang)

For all real numbers $x \neq 2$, let $\heartsuit(x) = \frac{1}{2-x}$. If

$$\heartsuit\left(\heartsuit\left(\heartsuit\left(\dots\heartsuit\left(\frac{6}{29}\right)\dots\right)\right)\right) = -\frac{m}{n}$$

for relatively prime integers m and n , find $|m + n|$.

3 OPEN FACE (Evan Chen)



4 Time Traveling Engineer's Induction (David Altizio and Michael Tang)

What is the next (third) term in the arithmetic progression?

5 Pictionary (Michael Tang)



6 Aegean Sea (Lewis Chen)

In search of alternative ways to synthesize and rearrange a particular silver compound, you go to a place of more ancient mathematics, 2,000 years ago. The trip was quite fun, and you think you might have found a key component when you encounter a square in your discoveries! What was it?

(Come on, you expect people to get anagram from that? — Evan)

7 Adventure is Out There! (David Altizio)

The NIMO team is all ready to go on vacation after a long season of writing contests! Unfortunately, it seems that after doing math for so long, they've forgotten how to plan such a large trip. The gods of NIMO's past have put together a guide, but it only consists of a single unfinished message and a map containing a bunch of countries and letters. Can you help the NIMO team plan their vacation?

And who knows, maybe with your help they'll encounter other math-oriented students throughout their vacation! Wouldn't that be exciting?

$\frac{42}{55} \frac{49}{6} \frac{36}{22} \frac{31}{29} \frac{27}{42} \frac{38}{38} !$



8 1/0 (Lewis Chen)

(Temporary link: <http://pastebin.com/T4sXdLxr>)

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