Annual Mathematics Quiz 2020

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Target India

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Rules of the Quiz

- The Quiz has 6 problems with a single problem presented at a time
- You will be given 12 minutes (720 seconds) to solve each problem
- Wrong answer or submission after 12 minutes fetches 0 points
- Points for correct answer : $15 - \frac{S}{72}$ where S is *Time Taken* in seconds
- *Time Taken* is recorded as the time at which the designated host receives the answer on Slack
- You can make multiple submissions, only the last submission will be considered
- You cannot use a browser/google/wiki/calculator etc. or write any code for the duration of the Quiz (blank sheets and pens are provided)
- Along with math skills, take Strategic Risks with speed of submission

Problem 1

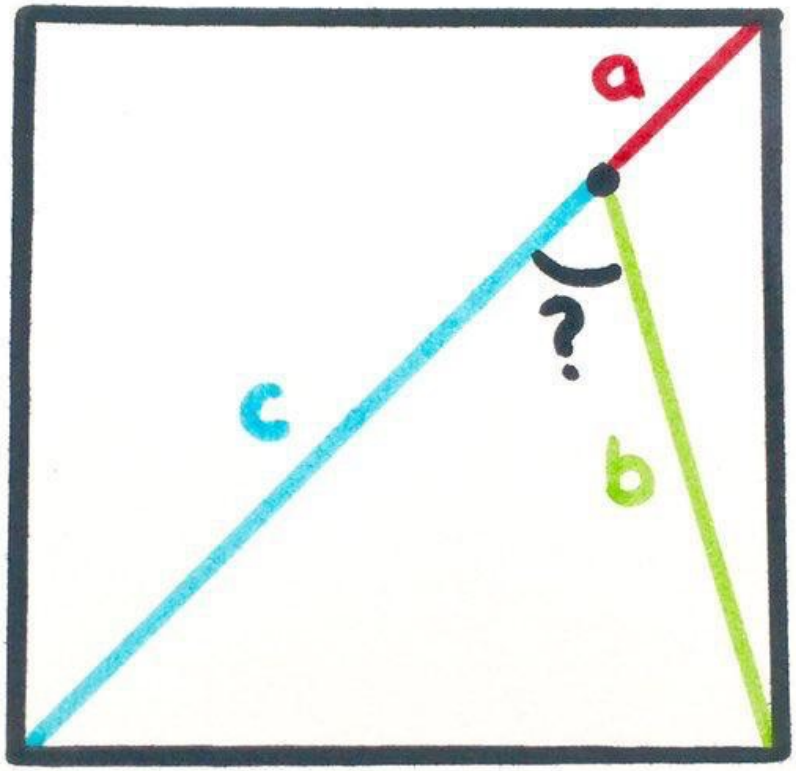
What is the remainder when $2^{123456789}$ is divided by 11?

Problem 2

You have to send 100 letters to 100 distinct people, all of whose addresses you have. So you prepare 100 envelopes with the 100 unique addresses. However, accidentally, you randomly put the letters in the envelopes. What is the expected number of recipients who get the letter intended for them?

Problem 3

If $c = a + b$ and the diagnonal of this square is $a + c$, what is the angle marked as "?"



Problem 4

What is the integer closest to $100 * (12 - \sqrt{143})$?

Problem 5

If $\frac{n}{810} = 0.d25d25d25\ldots\ldots$ where n is an integer and d is a digit, what is the value of n?

Problem 6

$$f_0(x) = \frac{1}{1-x}$$

$$f_n(x) = f_0(f_{n-1}(x)) \text{ for all } n \geq 1$$

What is $f_{2020}(2020)$?

Note: The answer is a rational number (to be submitted as $\frac{p}{q}$)