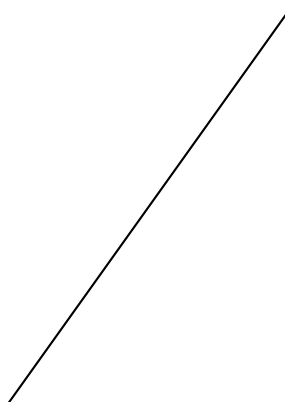


Directions: You have 30 minutes to complete these 15 problems. All answers must be written in accordance with the conventions on the Conventions page on the MMM webpage. A decimal answer is required for all problems. All answers are positive real numbers. Write all of your answers on the answer sheet. You may only use scratch paper provided by the MMM. No calculators allowed.

1. Let's play Colonel Blotto! Allocate 1,000,000 troops to 5 fields. Exceeding 1,000,000 results in your submission being disqualified. For each field: You gain $200000/P$ points if your ranking on a field is P . That is, if you place the most soldiers out of any participant on a certain field, you get 200,000 points. If you place 4th largest number of soldiers, you get 50,000 points, and so on. Please enter your submission as an ordered quintuplet (a, b, c, d, e) .
2. Estimate $\ln 3$.
3. Points A , B , and C are on a circle with radius 5 such that $AB = 8$ and $AC = 7$. Estimate the length of BC .
4. On the Fall 2012 Mission San Jose High School Stanford/Berkeley Math Tournament Team Placement/Selection Test Math Tournament (MSJHSSBMTTPSTMT) Estimation Round, participants were asked to estimate the number of views "Charlie Bit My Finger – Again!" had, as of December 10, 2012 (the answer was 500,630,881). It was noted that the video "Gangnam Style" had 923,003,408 views while "Baby" had 810,176,066 views. How many views do these three videos have in total, at the time that this test is graded (within 3 days of now)?
5. A recurrence is defined as follows: $a_1 = a_2 = a_3 = a_4 = 1$ and $a_{i+4} = a_{i+3} + a_i$ for every positive integer i . Find the sum of digits of a_{2014} .
6. Every day, Jerry has a 20% chance of saying a single "Ding!", and he does not say multiple "Ding!"s in a day. In a 29-day month, what is the probability that he says at most 7 "Ding!"s?
7. How many milliliters are in one cubic light year?
8. Let $\zeta(n) = \sum_{i=1}^{\infty} \frac{1}{i^n}$. It is well-known that $\zeta(2) = \frac{\pi^2}{6}$; indeed, $\zeta(2k) = q_k \pi^{2k}$, where q_k is some rational number dependent on the choice of k . For reference, $q_2 = \frac{1}{6}$, $q_4 = \frac{1}{90}$, and $q_6 = \frac{1}{945}$. Determine q_{16} .
9. In triangle ABC , the incircle is tangent to sides BC , CA , and AB at points D , E , and F respectively. Let F' be the point on the incircle diametrically opposite to F , and let G be the intersection point of lines DF' and EF . If $BC = 20$, $AB = 13$, and $AC = 14$, estimate the length of CG .
10. The Wikipedia Multilingual Statistics page reports 2,567,509 articles were on the English Wikipedia on October 1st, 2008. There were 264 languages listed in the same table that this statistic was found, two of which (Tokipona and Herero) had zero articles. As a percentage to 5 significant digits, what fraction of all Wikipedia articles across all languages does this table list as being on the English Wikipedia?

11. Bisect the following segment. Thick, weird, or illegible marks will be interpreted in the way that gives you the fewest number of points, so don't try it.



12. Compute

$$\frac{\text{Planck Energy}}{\text{Pressure at the Earth's Core}} \times \frac{\text{Prius Combined EPA Mileage}}{\text{Minimum Width of the English Channel}}.$$

The pressure of the Earth's Core will be based on the value in the Handbook of Chemistry and Physics, 2007. The mileage should be based on the 2012 Prius. Calculations are conducted with two significant figures for each part. (Hint: The answer is not π !)

13. Write down as many digits of π as you can. Your score will be $1000000 - 800000 \cdot (0.9)^d$, where d is the number of correct digits that you write, and your score on this problem will be halved if you write an incorrect digit, and all digits after the first incorrect digit will be ignored. (You can either round or truncate at the end.)
14. What is twice the geometric mean of all answers submitted to this problem? Positive real numbers only! (Recall that the geometric mean of n numbers is the n^{th} root of the product of the numbers.)
15. Let's play Reaper! You may physically come up to the front and "ask for a clarification" on Problem 15. This counts as a reap. You gain the number of points equivalent to 500 multiplied by the number of seconds that passes between the previous reap and your reap (or the start of the contest if you're the first to reap). You want to maximize the number of seconds you reap.