Set 1

Problem 1. What is $1 + 2 + 3 + 4 + \cdots + 100$?

Problem 2. If an equilateral triangle has an area of $9\sqrt{3}$, what is the perimeter of the triangle?

Problem 3. Miranda is picking out skirts and crop tops to wear. If she has 5 skirts and 7 crop tops, how many outfits can she make?

Problem 4. What is the least common multiple of 6 and 4?

Time limit: 40 minutes.

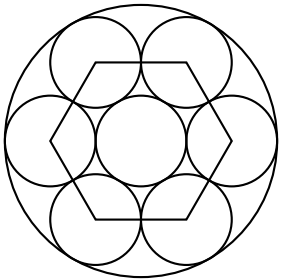
Set 2

Problem 5. Gibbons drinks $\frac{1}{3}$ of the water in a bottle, and Ogden drinks $\frac{1}{4}$ of the remaining water. If there are 8mL of water left, how much water was there to begin with?

Problem 6. I am drawing marbles out of a bag. If there are 3 red marbles and 5 blue marbles, what is the probability that the second marble I draw is red?

Problem 7. How many factors does 27 have?

Problem 8. If the radius of the larger circle is 6, and all the smaller circles are the same size, what is the side length of the hexagon?



Time limit: 40 minutes.

Set 3

Problem 9. If $A + B = 4$, $C + D = 8$, and $A + C = 7$, what is $B + D$?

Problem 10. There is a 40% chance of rain on Saturday. If it rains on Saturday, there is a 60% chance of rain on Sunday. Otherwise, there is a 30% chance of rain on Sunday. What is the probability it rains on Sunday?

Problem 11. How many ways can I seat Josh, Akshaj, Jeffery, Katherine, Michael, and Wendy at a circular table, where all the seats are distinguishable, so that Wendy and Katherine are sitting next to each other?

Problem 12. Let $ABCD$ and $EFGH$ be squares such that E lies on AB, F lies on BC, G lies on CD, and H lies on AD. If the area of $EFGH$ is $\frac{5}{9}$ of the area of $ABCD$ and $AE \geq BE$, what is $\frac{AE}{BE}$?

Time limit: 40 minutes.

Set 4

Problem 13. For an art project, Katherine is building a model of TJ. If the real auditorium is 30 feet wide but 2 inches on Katherine's model, how long in feet should the model gym be if the real gym is 75 feet long?

Problem 14. How many ways can I split 7 nondistinguishable pieces of candy among 4 distinguishable people, assuming each person gets at least one?

Problem 15. Gideon is facing trial, but he only has 10 dollars. If Wainwright offers lawyers for 3 dollars and evidence for 2 dollars each, how many combinations of lawyers and evidence can Gideon get, assuming that he needs to hire a lawyer and he does not need to spend all 10 dollars?

Problem 16. Katherine, Neeyanth, Wendy, and Ryan are arguing over who is a freshman and who is an upperclassman. Freshmen always lie, while upperclassmen always tell the truth.

Neeyanth says: Ryan is a freshman.

Ryan says: Out of Neeyanth and I, exactly one of us is a freshman.

Wendy says: There are not more freshmen than upperclassmen.

Katherine says: At most three of us are freshman.

Who is a freshman (list everyone)?

Time limit: 40 minutes.

Set 5

Problem 17. Given that the median of 7 not necessarily distinct integers in the set $\{1, 2, 3, \ldots 15\}$ is 8 and the unique mode is 9, what is the largest possible mean?

Problem 18. What is the smallest positive integer that gives a remainder of 1 when divided by 3, a remainder of 3 when divided by 5, and 5 when divided by 7?

Problem 19. Consider point P which lies outside of circle ω. A and B lie on ω, $C \neq A$ is the intersection of AP and ω, and $B \neq D$ is the intersection of BP and ω. If $AC = 7$, $AP = 9$, $BD = 10$, and $BP < DP$ what is BP?

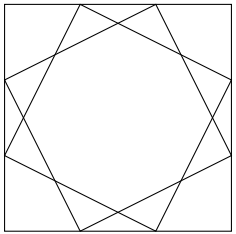
Problem 20. What is the probability that if I flip a coin 8 times in a row, I get heads at least 4 times?

Time limit: 40 minutes.

Set 6

Problem 21. If $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\cdots=\frac{\pi^2}{6}$, what is $\frac{1}{2^2}+\frac{1}{4^2}+\frac{1}{6^2}+\ldots$?

Problem 22. How many triangles are in the following figure?



Problem 23. When 2017 is multiplied by a single digit nonzero integer x, all the digits are perfect squares. What is x?

Problem 24. Let each letter represent a distinct digit. If $J = 8$ and A is even, what is the five digit number $MAGIC$?

$$\begin{array}{cccccc} & \mathrm{T} & \mathrm{J} & \mathrm{I} & \mathrm{M} & \mathrm{O} \\ + & & \mathrm{M} & \mathrm{A} & \mathrm{T} & \mathrm{H} \\ \hline & \mathrm{M} & \mathrm{A} & \mathrm{G} & \mathrm{I} & \mathrm{C} \end{array}$$

Time limit: 40 minutes.

Set 7

Problem 25. What is $\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3*4}+\cdots+\frac{1}{29\cdot 30}$?

Problem 26. Allen the alien lives on Lelan. All 52 Lelans start the day by drawing a card without replacement from a single deck of 52 cards. If they get an ace, then they get the day off, and if they get a face card, they get the afternoon off. Allen forms a group with 2 other aliens so that if any of them get time off, they secretly swap cards so that Allen gets time off. What is the probability that Allen will get time off?

Problem 27. If Franklyn can finish two crypto assignments in 10 minutes, Katherine can finish one in 30, and Will Sun can finish one in 15, how long (in hours) will it take for them working together to finish 6 assignments?

Problem 28. Consider triangle ABC. Let D, E, and F be the feet of the altitudes from A, B, and C, respectively. Let H_1, H_2, and H_3 be the intersections of AD and BE, CF and BE, and AD and CF, respectively. If the side lengths are $11+6\sqrt{3}, 11-6\sqrt{3}$, and 11, what is the area of triangle $H_1H_2H_3$? (You may use the fact that the intersection of the angle bisector of $\angle A$ and (ABC) in $\triangle ABC$ is the center of the circumcircle for cyclic quadrilateral IBI_aC).

Time limit: 40 minutes.

Set 8

Problem 29. Determine the largest integer n such that $a^n + b^n = c^n$ has a solution (a, b, c) in positive integers.

Problem 30. When I searched the term "tjimo" (on October 12, 2017 at 8:50 PM), I got G hits on Google and B hits on Bing. What is $\frac{G}{B}$? Any answer within 0.2 of the correct answer receives 0.5 points. Any answer within 0.1 of the correct answer receives 1 point. Any answer within 0.05 of the correct answer receives 2 points.

Problem 31. Pick a number from 1 through 10. Your score will be the number you pick divided by the number of people who pick that number. If you are the only one to pick a number, you will get two times the number you picked.

Problem 32. Pick an integer greater than 0. Your score will be equal to $\frac{1}{|\operatorname{Log}(\frac{\overline{x}}{x})|}$ where $\overline{x}$ is the mean of all the answers submitted and x is your answer.

Time limit: 40 minutes.