1. What is $10^{10} + 10^8 + 10^6 + 10^4 + 10^2 + 10^0$?

2. What number is exactly halfway between $\dfrac{1}{6}$ and $\dfrac{1}{4}$?

3. If I add 21 to $\dfrac{1}{4}$ of a number, the result is $\dfrac{3}{5}$ of the number. What is this number?

4. A palindrome is a word that reads the same backwards as forwards, such as "eye", "race car", and "qwertyytrewq". How many letters are in the smallest palindrome containing the letters b, o, g, t, r, and o, not necessarily in that order and not necessarily adjacent?

5. What is the probability that a randomly chosen word of this sentence has exactly four letters?

6. Today (October 12th, 2014) is a Sunday. What day of the week will October 12th, 2015 be?

7. Let $a\#b$ be defined as $ab - a - 3$. For example, $4\#5 = 20 - 4 - 3 = 13$. Compute $(2\#0)\#(1\#4)$.

8. What multiple of 9 is closest to 169?

9. Let $P(x) = (x+1)(x+2)(x+3)\ldots(x+2013)(x+2014)$. What is $\dfrac{P(1)}{P(0)}$?

10. Find the sum of the greatest common factor and the least common multiple of 12 and 18.

11. If 2 darps is equal to 4 derps, and 3 derps is equal to 5 dirps, then how many dirps is equal to 6 darps?

12. A cubic box has a surface area of 294. What is the length of each edge of the box?

13. A bank contains 70 coins consisting of nickels and dimes. The total value of the coins is \$5.55. What is the positive difference between the number of dimes and the number of nickels?

14. The sum of two integers is 8, and the sum of the squares of these two integers is 34. What is the product of the two integers?

15. Find all possible values of x such that $\dfrac{x^2+1}{x-1} = \dfrac{x^2-1}{x+1}$.

16. Rita the painter rolls a fair 6-sided die that has 3 red sides, 2 yellow sides, and 1 blue side. Rita rolls the die twice and mixes the colors that the die rolled. What is the probability that she has mixed the color purple?

17. Lev's farm has alpacas and 2-headed chickens. One day, Lev counts 94 heads and 238 legs (alpacas have 4 legs, while 2-headed chickens have 2). How many animals does Lev have on his farm?

18. For how many positive integer values of x is $4^x - 1$ prime?

19. The side length of a cube is increased by 20%. The surface area of the cube is thus increased by $x\%$, and the volume is increased by $y\%$. Compute $5(y - x)$.

20. Four distinct positive integers satisfy the equations $a + b + c + d = 11$ and $ab + cd = 11$. Compute the product of all four integers.

21. Kelvin the Frog and Alex the Kat play a game. Kelvin the Frog goes first, and they alternate rolling a standard 6-sided die. If they roll an even number or a number that was previously rolled, they win. What is the probability that Alex wins?

22. Ryan bikes for two miles at the rate of 10 mph, then swims for three miles at the rate of 12 mph. If he wants to complete the entire 6-mile trip at an average speed of 6mph, how many minutes should he spend walking the final mile?

23. If a triangle has three altitudes of lengths 6, 6, and 6, what is its perimeter?

24. How many ways can 3 distinguishable boys and 4 distinguishable girls sit in a line such that nobody is sitting next to someone of the same gender?

25. Kelvin the Frog calls a number "friendly" if the sum of its digits is equal to the product of its digits. How many 3-digit numbers are friendly?

26. What is the smallest positive integer with exactly 7 factors?

27. A spinner is divided into 4 equal sections, and 2 non-adjacent ones are painted black. Alex the Kat divides every white section into 3 equal regions, and paints the middle one black. Kelvin the Frog then divides every black section, including the ones just formed by Alex, into 3 equal regions and paints the middle one white. Alex then spins the spinner. What is the probability it lands on a black region?

28. Compute $102^4 - 8 \cdot 102^3 + 24 \cdot 102^2 - 32 \cdot 102 + 16$.

29. The pages of a book are numbered in order starting with **zero**. If exactly 2014 digits were printed, how many pages are in the book?

30. Three unit circles are each externally tangent to each other. Find the area of the smallest equilateral triangle that contains each of these circles.

31. On a circle of radius 6, with diameter $\overline{AB}$, Zack the Orangutan decides to draw a point C on the circumference of the circle to form triangle ABC. What is the maximum possible area of this triangle?

32. If x is a positive integer such that $x^2 = 2^{64}$, y is a number such that $x^x = 2^y$, and z is a number such that $y = 2^z$, compute z.

33. Points D, E, F, and G lie outside unit square $ABCD$ such that ADB, BEC, CFD, and DGA are all equilateral triangles. Find the area of square $DEFG$.

34. A figure consists of a 4x4 grid of unit squares with a 2x2 hole in the middle. Kelvin the Frog starts at corner A, and wishes to reach the opposite corner B by a series of hops, each of which are either 1 unit to the right or 1 unit down. In how many ways is this possible? One possible path is shown below:
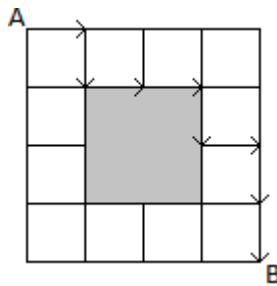
35. Everyday, Soonho Kwon watches 30 minutes of one episode of his favorite TV show, Running Man, each of which is 2 hours long and releases a new episode every Sunday. Because he has been very busy lately, he is 10 episodes behind. If he starts watching Running Man again today, Sunday, October 12, 2014, then on what date will Soonho first have no more episodes left to watch?

36. An unfair coin is flipped 2015 times. If the probability of getting heads exactly twice is equal to the probability of getting heads exactly three times, what is the probability of getting heads on any given flip?

37. Kelvin the Frog has 42 lilypads arranged in a line. He needs to choose 2 pairs of adjacent lilypads to build houses on. Of course, the same lilypad cannot be part of multiple houses. In how many ways can Kelvin the Frog build his houses?

38. Find the area of an equiangular hexagon with side lengths 4, 2, 4, 2, 4, and 2.

39. Kelvin the Frog and Zack the Orangutan stand on opposite corners of a square of side length 1. They both have poor vision and can only see things within 1 unit of themselves. AJ the Denace the Mennis randomly throws a stone into the square. What is the probability that both Kelvin and Zack can see the stone?

40. Two circles with centers O_1 and O_2 have radii 5 and 3, respectively. They intersect at points A and B, and point C lies on AB such that A is the midpoint of B and C. Find $CO_1^2 - CO_2^2$.

41. Let $f(x) = x^2 - 6x + 5$ and $g(x) = x^2 - 7x + 12$. Find the sum of all x satisfying the equation $(f(x) + g(x))^2 - (f(x) - g(x))^2 = 0$.

42. $\triangle ABC$ is a right triangle with right angle B, and regular hexagons P_1, P_2, P_3 are constructed outside ABC such that AB is a side of P_1, BC is a side of P_2, and P_3 is a side of CA. If the area of P_1 is 16 and the area of P_2 is 36, find the area of P_3.

43. Songpai is building a rectangular pen for his pet mouse, Thomas. He has 12 meters of fencing, and he will use his infinitely long wall as one side of the pen. What is the maximum area that Songpai can make for Thomas?

44. Let $s(n)$ represent the sum of the digits of n. For example, $s(109) = 1+0+9 = 10$ and $s(3) = 3$. Calculate $s(s(s(2014^2)))$.

45. Alex the Kat gives Kelvin the Frog three positive integers a, b, and c, and challenges Kelvin to find the value of $a^b - a^c$. Kelvin, being a frog, instead finds the value of a^{b-c}. Incredibly, Kelvin is still correct! Find $a + b + c$.

46. Determine the sum of all **real** roots of the polynomial $P(x) = (x^2 - 17x + 1)(x^2 - 17x + 2)(x^2 - 17x + 3)...(x^2 - 17x + 99)(x^2 - 17x + 100)$.

47. Triangle ABC has medians AX, BY, CZ. Points X', Y', and Z' are the reflections of X, Y, and Z through A, B, and C, respectively. If $[ABC] = 44$, then what is $[X'Y'Z']$?

48. ABC is a right triangle with right angle B, $AB = 10$, and $BC = 24$. Let M be the midpoint of AC. Circle O_1 is inscribed in triangle ABM, and circle O_2 is inscribed in triangle BCM. Let r_1 be the radius of O_1, and let r_2 be the radius of O_2. Find the value of $r_1 r_2$.

49. Kelvin the Frog is playing with his infinite row of lilypads, each of which have a quarter facing heads up on them. Every minute, he flips the coin on the lilypad he is standing on. If it is heads, he hops to the right, and if it is tails, he hops to the left. He continues until he reaches a lilypad with a tail on it, at which point he goes to sleep. What is the expected number of minutes before Kelvin the Frog goes to sleep?

50. The land of Frogtopia is an infinite cartesian plane. There is a house at every lattice point with $0 \leq x, y \leq 2014$ (so the houses form a 2015×2015 grid of points). Kelvin the Frog's home is at the origin. AJ the Dennis the Menace buys all of the houses on the line $x = 2014$, which Kelvin is unhappy about. Thus Kelvin shoots of peas in every possible direction from his house. A pea will destroy the first house it comes in contact with, then evaporate. How many of AJ's houses will stay intact?