2015 Joe Holbrook Memorial Math Competition
4th Grade Exam

The Bergen County Academies Math Team

October 11th, 2015

Instructions

DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

The Joe Holbrook Memorial Math Competition is a 90-minute, 50-question exam. Each question has exactly one correct answer; writing two different answers, EVEN IF ONE IS CORRECT, is worth no credit. In addition, **only answers written on the answer sheet provided will be graded.**

Be advised that proctors cannot answer any questions about terminology, notation or the questions.

On the JHMMC, you may only use writing utensils, erasers, and scrap paper provided by the proctors. You MAY NOT use calculators, compasses, protractors, straightedges, or your own scrap paper.

All answers must be fully simplified and exact. For example:

- Write $2\sqrt{2}$, rather than $2.83\ldots$
- Write $\frac{4}{3}$, rather than $1\frac{1}{3}$ or $1.33\ldots$

In addition, know that $[A_1A_2\cdots A_n]$ denotes the area of n-gon $A_1A_2\cdots A_n$.

1. What is $13 + 12 + 10 + 7 + 4 + 3 + 1$?
2. AJ drank two water bottles in the morning, three water bottles at lunch, and five water bottles during dinner. How many water bottles did he drink in total?
3. Zack is 100 inches tall and Thomas is 86 inches tall. How tall would they be in inches if Thomas stood on Zack's head?
4. What is $2015 + 201 + 20 + 2 - 15 - 5$?
5. Jen loves multiplying numbers. Every time you tell her two numbers, she multiplies them and shouts out the answer. I told Jen the numbers five and six. What number does she shout out?
6. A textbook weighs 5 pounds. While holding the textbook, Thomas weighs 350 pounds. How much does Thomas weigh without the textbook in pounds?
7. What is $14 + 4 \times \frac{15}{3} - 9$?
8. How many times does the Sun set between noon on Saturday and noon on the following Thursday?
9. Moonbeam is sixteen years old, while Sunshine is twenty. Of the two, who was born second?
10. Nemo has 11 goldfish in his fish tank. Each goldfish needs to eat 19 goldfish flakes daily. How many goldfish flakes, in total, does Nemo need each day to be able to feed all 11 goldfish?
11. Find the 100th member of the following sequence: $1, 4, 7, 10, \ldots$
12. Sung Hyup was fifteen years old four years ago. Sung Hyun is three years younger than him. How old will Sung Hyun be in two years?
13. If Rebecca can bike at 12 miles per hour and walk at 4 mph, how many minutes can she save by biking instead of walking to her school 3 miles away?
14. Songpai decides to plant bonsai trees in the front of his lawn. He measures and finds out that his lawn measures 30 meters. He wants to plant a bonsai tree every 5 meters, and he wants to plant as many as possible. How many bonsai trees will he need?
15. Thomas the Mouse wants to eat cheese and crackers. He has 3 kinds of cheese and 4 kinds of crackers. How many ways are there to choose 1 cheese and 1 cracker?
16. The mean of 2015 consecutive integers is 2. What is the median?
17. Kelvin the Frog is having trouble finding his way around college. He knows that the cafeteria is 20 hops away from his dorm, while the gym is 10 hops away. What is the difference, in hops, between the longest possible distance from the cafeteria to the gym and the shortest possible distance?
18. Young Guy likes to play League of Legends. For every whole hour of League of Legends he plays, he must do 30 minutes of math the following day. If Young Guy did one and a half hours of math on Sunday, at most how many hours of League of Legends did he play on Saturday?
19. How many positive integers less than 100 are divisible by 7?

20. If $a@b$ is defined as $ab - a + b$, evaluate $(5@6)@5$.

21. Young decides to count all the even integers from 1 to 200. Guy, always one to show his superiority, counts all the odd integers from 1 to 300, just to put Young in his place. How many more integers does Guy count than Young?

22. What is the sum of the number of faces and edges of a pyramid with an octogonal base?

23. After returning home from school, Zack wants to watch his favorite TV show, *The Adventures of Super Matthew*. If each episode is twenty minutes long, and Zack gets home at 5:00, how many complete episodes can he watch before he must begin his homework at 7:29?

24. Jungle Jim, the proprietor of the jungle gym, is charging admission. If the admission fee for Matt is \$20, but he has a coupon for a 10% discount, and the admission fee for Tanny is \$25, but he has a coupon for a 15% discount on every dollar after \$5 that he pays, who pays more, and how much does he pay?

25. It takes Chef Hyeongmin 5 minutes to cut 10 blocks of cheese into 70 slices (he cuts each block of cheese into the same number of slices, and each slice is parallel). How many seconds does it take Chef Hyeongmin to make a single cut?

26. What is the least product one could obtain by multiplying two numbers in the set $\{-7, -5, -1, 1, 3\}$?

27. Young Guy is selecting toppings for ice cream. There are 3 options: sprinkles, whipped cream, and fudge. If he is allowed to select any number of toppings, or no toppings at all, how many different ways can he have ice cream?

28. What is the sum of the possible perimeters of an isosceles triangle whose side lengths include 7 and 15?

29. Find the sum $10 + 11 + \cdots + 100$.

30. Jungle Jim is now actively preventing people from entering the jungle gym! To enter, Zack and Erik now have to scale and descend two completely vertical walls in succession. They start at sea level, and climb over a wall that is 10 feet high and 0.5 feet thick, which leads to an area of elevation 2 feet. They go forward 25 feet, and climb over a wall that is 11 feet high (relative to sea level) and 1.5 feet thick. This leads to an area which is at elevation 1 foot above sea level. They go forward 10 feet, and have reached the jungle gym! What is the total length of their path, in feet?

31. Esther rolls two fair dice each with faces numbered 1 through 6. What is the probability that the product of the two rolled numbers is odd?

32. Alex the Kat is chasing Thomas the Mouse, who has a 20 foot lead. Mice run at 1 foot every two seconds, whereas Alex the Kat runs at 1 foot every one second. How many seconds does it take for Alex the Kat to catch Thomas the Mouse?

33. If 75 Puzzle = 10 Dragons and 2 Dragons = 5 YoungGuys, then 1 YoungGuy is how many Puzzle?

34. A square and a regular hexagon have the same perimeter. The square has side length 18. What is the side length of the hexagon?

35. When Hannah adds 9 to her favorite number and triples the result, she gets the fourth power of the smallest odd prime number. What is half of Hannah's favorite number?

36. Kelvin the Frog has 2 cubic dice. One of them is labeled with $1, 2, 2, 3, 3, 4$, and the other is labeled $1, 3, 4, 5, 6, 8$. What is the probability of getting a sum of 5 when he rolls the dice?

37. If $1 \leq x \leq 2015$ and $5 \leq y \leq 403$, what is the minimum possible value of $\frac{x+y}{xy}$?

38. How many distinct arrangements are there of the letters JHMMC?

39. Kang Myung has already written 30 lines of code to be submitted to Dr. Nevard. However, he refuses to hand in code unless the number of lines he has written is a multiple of 17 and it is 11:57 PM. He writes exactly 6 lines of code each morning. If it is currently noon three days before the deadline, how many days late will he submit his code?

40. What is the area of a polygon that has vertices at $(1, 1)$, $(2, 3)$, $(4, 4)$, $(5, 3)$ and $(6, 2)$?

41. If Arkun Lars loses 1 pencil at the end of each day but finds 4 pencils at once at the end of every 5 days, and he found 4 pencils yesterday, what is the minimum number of pencils that he needs to have at the start of today in order to have a pencil every day for 22 days?

42. When Zi Xuan (David) Ni tries to group the chairs in the auditorium by 5, he has 2 remaining, and when he tries to group them by 7, he has 4 remaining. If there are less than 35 chairs, how many chairs are in the auditorium?

43. Alex the Kat is going on a road trip after his retirement. He travels the first 300 miles at 60 miles per hour, the next 90 miles at 90 miles per hour, and the last 360 miles at 40 miles per hour. What is his average speed throughout the trip?

44. The graphs of $y = \frac{1}{x}, y = 1, y = x$ and $y = x^2$ cut the plane into how many pieces?

45. What is the probability that out of three people at least two have birthdays on the same day of week?

46. In a 3×3 array, the integers 1 through 9 are placed so that the odd numbers are placed in the four corners and the center, and the even numbers take the remaining spaces. If the sum of the rows, columns, and diagonals of the array is 122, what is the number in the center?

47. Each of Jon, Alex, Mike, Soonho and Claire is either a Liar or a Truth-teller.

    - Jon says, "There are no Liars here."
    - Alex says, "There is at least one Liar here."
    - Mike says, "Jon and Claire are both Liars."
    - Soonho says, "There are no more than 4 Liars."
    - Claire says, "Jon and Mike are both Liars."

    How many Liars are there among the five?

48. Young Guy seems to have caught himself in quite a predicament! Up at the board in his math class, he has been asked by his teacher, Dr. Lal, to compute the product of two numbers a and b, not necessarily distinct, each between 1 and 9, inclusive. But alas, Young Guy has forgotten which two numbers he was assigned, and decides to choose a random pair of numbers and carry out the multiplication. What is the sum of all possible products $a \times b$ Young Guy can reach?

49. Max is making a cake out of A, B, C, D, E, and F. The recipe requires that B be added after A, C be added after B, and for E and F to be added after D. If the ingredients are added one at a time how many ways can Max make the cake?

50. Alex the Kat and Ryan the π take the same 7-question math test. Alex the Kat gets two questions right, and Ryan the π gets three right. What is the probability that they have at least one correct question in common?