

$$B > \frac{1}{n} \sum_{i=1}^n x_i$$

(Be greater than average)

Individual – 8<sup>th</sup> Grade

**Instructions:** Problems 1–10 are multiple choice and count towards your team score. Answer by putting the appropriate letter in the blank on the answer sheet. Problems 11–30 count towards your individual score but not your team score.

- A camp coordinator wants to plan activities for the “leisure time” so that leisure time will end between 5:40pm and 6:00pm. If leisure time begins at 2:00pm, and no activities may overlap, which of the following activities should **not** be included?
 

(A) Archery (50 minutes)  
 (B) Horse Riding (55 minutes)  
 (C) Swimming (45 minutes)  
 (D) Calculator Wars (25 minutes)  
 (E) Capture the Flag (1 hour, 20 minutes)
- In the ordered pair  $(A, B)$ , let  $A$  = the original cost of a Four Directions ticket in a particular city, and let  $B$  = the sale price of a ticket the day before the concert. For which of the following did the cost decrease by the greatest percentage?
 

(A) (\$60, \$45)      (B) (\$45, \$30)      (C) (\$210, \$150)  
 (D) (\$145, \$100)      (E) (\$75, \$45)
- How many unique ways can the letters in the word “TWELFTHMEN” be arranged?
 

(A) 151,200      (B) 907,200      (C) 1,814,400      (D) 3,628,800      (E) None of these
- The size of a television is usually measured by the length of the rectangular screen’s diagonal. Which of the following strange televisions, given its length ( $L$ ) and width ( $W$ ), would be considered to be the largest?
 

(A)  $L = 20, W = 40$       (B)  $L = 15, W = 45$       (C)  $L = 50, W = 10$   
 (D)  $L = 30, W = 30$       (E)  $L = 25, W = 35$
- Which of the following expressions has the greatest value?
 

(A)  $2^{105}$       (B)  $2^{104} + 2^{104}$       (C)  $4^{52}$       (D)  $(2^{53})^2$       (E)  $32^{20}$
- “Superprimes” are prime numbers that are also the  $N^{\text{th}}$  prime number, such that  $N$  is prime. For example, 2 is not a superprime because it is the 1<sup>st</sup> prime number, and 1 is not prime. On the other hand, 3 is a superprime because it is the 2<sup>nd</sup> prime number, and 2 is prime. If 3 is the first superprime, what is the sixth superprime?
 

(A) 31      (B) 37      (C) 41      (D) 43      (E) 47

7. Consider the 180 digits that are needed to write all of the two-digit positive integers. These digits are listed out in increasing order. What is the median of the numbers in this list?  
(A) 3      (B) 4      (C) 4.5      (D) 5      (E) 6
8. What is the  $y$ -intercept of the curve defined by  $y = 2(x - 3)^2$ ?  
(A) (4, 2)      (B) (0, 3)      (C) (0, 0)      (D) (3, 0)      (E) (0, 18)
9. What is the greatest number of circles with an area of  $4\pi$  that can be drawn, without any overlap, into a square with an area of 64?  
(A) 4      (B) 16      (C) 32      (D) 64      (E) infinite
10. Which of the following sets of numbers has the greatest mean?  
(A) 2-digit prime numbers      (B) 2-digit square numbers      (C) 2-digit cube numbers  
(D) 2-digit multiples of 10      (E) 2-digit multiples of 5
11. Two classes of 33 students each are going on a field trip to the zoo. If four students can ride in each car and a student from one class cannot sit in the same car as a student from the other class, what is the minimum number of cars that will be needed to transport the students to the zoo?
12. What is the next number in the following sequence?

1, 6, 16, 36, 76, \_\_

13. Find the smallest value of  $x$  that will make the following inequality true.

$$1 + 2 + 3 + 4 + \dots + x > 500$$

14. How many unique positive four-digit integers exist such that none of the digits is zero and the sum of the digits is 6?
15. The temperature in degrees Celsius ( $C$ ) can be converted into degrees Fahrenheit ( $F$ ) by using the equation  $F = \frac{9}{5}C + 32$ . What is the temperature, in degrees Celsius, if the temperature outside is 50 degrees Fahrenheit?
16. The 48 elementary students at Fitness Prep Academy were able to do an average of 64 push-ups. The 36 secondary students, on average, were able to do an astonishing 148 push-ups. What was the average number of push-ups out of all of the students at Fitness Prep Academy?
17. A local pie store, owned by mathematicians, chose to pass out the profits in an odd manner. Andrew gets  $\frac{1}{3}$  of the profits, Bruce gets  $\frac{1}{4}$  of what is left after Andrew takes his share, and Carol gets half of what is left after Bruce takes his share. What percentage of the profit is left over after Carol takes her share?

18. The sock drawer has returned! This time, young Charlie has 20 brown socks, 20 white socks, and 20 black socks in his drawer. How many socks would he have to pull randomly from his drawer in order to ensure that he has 5 pairs of socks (10 socks) that are all of the same color?
19. The numbers 1, 2, 3, 4, and 5 are placed into one jar, and the numbers 3, 4, 5, and 6 are placed into a second jar. If a number is randomly selected from each jar, what is the probability that the sum of the two numbers is even? **Express your answer as a reduced fraction.**
20. Paula needed to make some copies of her poster advertising her new television show, "Spongebob Quadrilateral Pants". The first 25% of the copies cost \$0.50 each and the remaining copies cost \$0.25 each. If the total bill was \$10, how many copies did she make?
21. Lee Puh received an extraordinary new pogo stick in the mail: it can leap in perfect semi-circles from one point to another. He draws 9 dots with a piece of chalk on a straight line on the ground, such that consecutive dots are separated by 1 inch. If Lee then uses the pogo stick to hop from one dot to another, landing on each dot exactly once, and covering the greatest possible total distance, how many inches has he traveled in the air? **Express your answer to the nearest inch.**
22. Most license plates in Washington now have seven characters – 3 letters followed by 4 digits. If the 4 digits are chosen randomly, with replacement, what is the probability that a license plate will have the digits 1 and 2 adjacent to each other in that order? **Express your answer to the nearest percent.**
23. What is the positive difference between  $2314_6$  and  $2215_6$ , expressed in base 6?
24. Find the value of  $x$  that satisfies the system of equations:

$$\begin{aligned} 0.2x + 0.7y &= 10 \\ 3x - 4y &= 5. \end{aligned}$$

25. Ten fourth grade students at Margaret Mead Elementary wanted to form two Ultimate Frisbee teams. If their teacher, Mr. Ocean, were to choose two team captains beforehand, how many different arrangements of the remaining students into 2 teams of 4 are possible?
26. How many four-digit numbers have 6, 8, and 10 as three of their factors?
27. What is the sum of all of the positive fractions that have an integral numerator and denominator, both less than or equal to 9? Note that whole numbers, such as  $\frac{1}{1}$ , and unreduced fractions, such as  $\frac{2}{4}$ , should be included in your sum. **Express your answer to the nearest whole number.**
28. How many positive integral factors does 2015 have?
29. Suppose that two points are randomly selected on the circumference of a circle. What is the probability that the arc measure between the two points will be less than or equal to 30 degrees? **Express your answer as a reduced fraction.**

30. A regular hexagon is drawn within another regular hexagon by connecting the midpoints of the each of the six sides. If the outer hexagon has a side length of 4, what is the area of the inner hexagon? **Express your answer to the nearest tenth of a square unit.**