**2008 IMSA Junior High Math Competition**

7th Grade Individual Contest

1. What is the greatest prime factor of 2006+2007+2008?
2. It is the year 2008 and Stephanie wants to buy shurikens. On the first day of the year she buys one; two on the second day and so on. How many shurikens will she have by the time the year is over?
3. A pop quiz has ten multiple-choice questions. Each question has two choices. Darby guesses randomly; what is the probability he will receive exactly 50% on the quiz? Assume that he answers all the questions without leaving any blank. Express answer as a simplified fraction.
4. Harry takes three hours to finish a five-page paper and Harriet takes thirteen hours to finish a ten-page paper. How long would it take them to finish a twenty-page paper, assuming that each works at a constant rate? Express answer as a mixed number in simplest form.
5. Catrina has thirteen different pairs of shoes, seven different tops, and five different pants. On Monday, she chooses one pair of shoes, one top and one pair of pants. On Tuesday she goes only with pants and a top (no shoes). How many less potential outfits could she choose from on Tuesday as compared to Monday?
6. Fitzwilliam likes to measure his waistline. This year, he gains 10,000 pounds. Each year, he gains half of the pounds of the previous year. What is his maximum possible weight, if he starts at a weight of 15,000 pounds this year?
7. Yolanda makes trail mix out of pretzels, nuts and yogurt chips. Initially, the mix is 1/3 pretzel, 1/3 nut and 1/3 yogurt chip by weight. She adds five ounces of nuts, three ounces of pretzels, and one ounce of yogurt chips. After the additions, the ounces of nuts she has is one less than twice the ounces of yogurt chips she has. How many ounces of yogurt chips were in the original mixture?
8. Jordan makes a free throw 1/3 of the time and Jorge makes one 1/2 of the time. They shoot 120 times simultaneously at different baskets. What is the expected number of free throws both make at the same time?
9. Dana paints a *1 ft x 1 ft x 1ft* cube red. She cuts it into 1728 *1 in x 1 in x 1 in* cubes. How many tiny cubes have only two faces painted red?
10. The base of a triangular prism is an equilateral triangle with sides of length 7. The height of the prism is 13. Find the exact value of the surface area of this prism.
11. The IMSA class of 2008 has 206 students. 129 are taking Calculus, 59 are taking Differential Equations and 23 students are taking both Calculus and Differential Equations. How many students are not enrolled in either course?
12. Seven people eat dinner at a circular table. How many ways can they seat themselves, if only their relative order around the table matters?
13. I decrease one side of a square by 50% and increase the other by 50%. The new rectangle’s area is what percentage of the area of the original square?
14. Arnold is chasing his platypus. For every three steps the platypus takes, Arnold takes two. However one of the master’s steps is equal to two of the animal’s in length. The platypus takes 10 steps before the master begins chasing. When Arnold finally catches up, how many steps has the animal taken?
15. Three corporate executives are dividing the profit of the company. If the first exec gets 1/2 of the money and the second gets 1/3 of the money, the third gets $7,000,000. How much total profit did the company earn? Express answer in dollars.
16. Dr. Condie walks two miles north, five miles west, two miles northwest, three miles east, and two miles southeast.  How far is he from his starting point in miles?
17. Four factory workers produce three machines every two weeks. Assume that each worker works at the same pace each day. How many days do seven workers take to produce 14 machines? Round to the nearest whole day.
18. Mary has been able to get 89, 90, 85, 86, and 92 on her five math tests. She wants an A (90) for the semester and there’s only one test left. What minimum grade does she need to achieve her wish?
19. Sharon rolls two six-sided fair dice. What is the probability that their sum is less than 10?
20. Dr. Krouse buys two dozen Krispy Kreme™ for her family of four. She eats one on the way home and wants to divide the remaining 23 identical donuts among the four family members. If a family member need not receive any donuts, in how many ways can the 23 donuts be divided among the four different people?

**2009 IMSA Junior High Math Competition**

7th Grade Individual Contest

1. What is the perimeter of a regular pentagon with a side length of 7?
2. The area of a circle is. Find the diameter.
3. In a regular octagon, find the degree measure of an interior angle.
4. What is the greatest number of wedges you can get by cutting an orange exactly 3 times?
5. Find the sum: .
6. Find the product of the greatest common factors of 72 & 45, and 75 & 27.
7. A triangle has side-lengths of. What is its area?
8. A suburban sandwich shop makes gourmet sandwiches. They have 4 different kinds of meat, 5 different kinds of vegetables, 3 different kinds of bread, and 4 different kinds of sauces. If you make a sandwich with one of each, how many different sandwiches can you make?
9. At the beginning of a biking trail, a biker takes off at 1:00PM traveling at 10mph. At the end of the trail, another biker takes off at 1:30PM travelling toward the first rider at 15mph. If the entire biking trail is 40 miles long, then at what time will they pass each other?
10. Given that . Find .
11. A bag of marbles contains 5 blue marbles, 7 red marbles, and 11 green marbles. What is the probability of selecting two red marbles and then one blue marble in that order given that the marbles are not replaced?
12. An author has written a 10-page comic, and is ready to publish it. While walking over to the publisher, she drops all the unlabeled pages on the ground. What is the probability that she will randomly put the pages in order, assuming one sheet contains only one page?
13. If the digits of a two-digit number are switched, the new number is 20 less than twice the original. Find the original number.
14. In how many different ways can you arrange the letters in IMSA?
15. There are 3 zags in every 14 zigs, 7 zigs in every 3 poofs, 42 poofs in every 6 booms, 60 booms in every 7 zooms, and 35 zooms in every 6 kapows. How many zags are there in a kapow?
16. The planet Mars consists of 40 million species. Out of these species, 15% are amphibians, 25% are mammals, 30% are insects, 20% are bacteria, and 10% other. If 10% of the species decline every five years, then how many million species will be left after 15 years?
17. Find the sum of all positive whole number factors of 2037.
18. What is the probability that one will select four aces without replacement consecutively right off the top from a standard deck of cards?
19. Rita, a bank teller, needs to get into the bank safe to count the money. She always seems to have trouble remembering the 5-digit code. She knows the following: (1) the sum of all the digits is 24; (2) the sum of the 1st and 4th is equivalent to the sum of the 2nd and 5th; (3) the product of the outermost digits is 15; (4) the product of all the digits is 0; and (5) no digit is repeated. Which code(s) is (are) possible?
20. A number is called repdigit if there is at least one pair of consecutive digits that are equal. For example, 355 and 2244 are repdigit, while 202 and 1016 are not. Find the number of repdigit numbers *n* with.

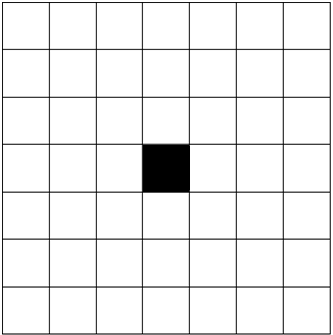
**2010 IMSA Junior High Math Competition**

7th Grade Individual Contest

1. If the average of Jon’s five test scores is 85 and he got 90, 100, 85, and 75 on the first four tests, what was his score on the final exam? (All the test scores are out of 100, and they’re all weighted equally.)
2. Samir needs a matching pair of socks. He has 8 green socks, 16 red socks, 18 purple socks, and 2 pink socks (so he has 4 pairs of green socks, 8 pairs of red, etc.), but the problem is that the lights are off in his room. How many single socks does he need to pull out of his drawer in order to guarantee a matching pair?
3. There are 100 closed doors in a hallway, and they’re all marked, in order from left to right, with the numbers from 1 to 100 (so the leftmost door has a “1” and the rightmost door has “100”). Omotayo runs down the hallway and *opens* all of the doors that are marked with numbers divisible by 1 so that all of them are now open. Then, she runs back and *closes* all doors with numbers divisible by 2, and she continues this process (closing open doors and opening closed doors) for every number up to 100. How many doors are open when she’s done?
4. Sara bought some pieces of chocolate and some pieces of candy for 51 cents and 9 cents apiece respectively. If she spent $2.16 on a total of 10 items, how many pieces of chocolate did she buy?
5. How many different ways can Mrs. O’Leary choose groups of three out of her class of 12 students?
6. If the sum of two numbers is 14 and their product is 48, what is the sum of their squares?
7. Jayanshu needs to find the number with the greatest number of divisors among a list that her math teacher gave her. She correctly identifies 1690 as the answer, but she incorrectly writes “42” down as the number of positive factors 1690 has on her homework. How many factors (also known as divisors) does 1690 actually have?
8. A train moving at 75mph can get from Chicago, Illinois, to St. Louis, Missouri, in 4 hours. How long will it take a train moving at 60mph to get from Chicago to St. Louis?
9. In a community of trolls, there are two clans; members of one always tell the truth, and members of the other always lie. A quartet of trolls, Alina, Bonny, Corinne, and David, sits around a campfire, sharing statements.   
    ALINA: I always tell the truth, but Bonny rarely does.   
    BONNY: I always tell the truth, but Alina rarely does.   
    CORINNE: If Alina is lying, Bonny is also lying.  
    DAVID: Corinne never tells the truth.  
   Knowing that two of the trolls always tell the truth and two of the trolls always lie, is David a liar?
10. Find the last digit of 72009+82010+252011.
11. What is the greatest prime factor of the sum of all the numbers from 1 to 200?
12. The science wing at IMSA needs repainting. If Nolan can paint one-fifth of the wing in an hour and a half, and his friend Webster can paint one-sixth of the wing in an hour, how many hours will it take for the wing to be painted if the two friends work together? Express your answer, in hours, as an improper fraction.
13. The menu at a restaurant consists of four appetizers, two entrées, and seven side dishes. A special deal is offered to the customers who order one appetizer, one entrée, and three side dishes. How many different meals qualify for this deal?
14. In a regular octagon, find the degree measure of an interior angle.
15. Let an *odd date* be a date that is comprised of only odd digits (e.g. 11/13/1933 is an *odd date,* but 03/17/1997 is not an odd date as “0” is an even number). If the last odd date occurred in November 1999 (11/19/1999), how many full years will pass between that date and the next odd date?
16. What is the smallest whole number *n* that makes  a composite number?
17. A gift shop sells keychains in packs of 7 and 13. What’s the largest number of keychains that a person can’t obtain by buying these packs?
18. The distance between any two bases on a baseball diamond (which is a square) is 90 feet. If Ivan takes an entire minute to run from home to first and then from first to second, how long will it take him to run directly from home to second (without touching first)? Record your answer in seconds.
19. Farmer Joe wants to put up a fence around a square plot of land. If one foot of fencing costs $10, how much money will it take him to put up a fence around that plot if one side is 10 feet long? Record your answer in dollars.
20. Paul is thinking of a two-digit number, and he bets that Kevin won’t be able to guess what it is even if three clues are given. He tells Kevin that when he divides his number by 5, he gets a remainder of 2, and when he divides his number by 2, he gets a remainder of 1, and when he divides his number by 9, he gets a remainder of 6. What is Paul’s number?

**2011 IMSA Junior High Math Competition**

1. A cube has surface area of. What is its volume in ?
2. Alexa runs at a rate of 3 mile per hour. Adriana runs at a rate of 4.5 miles per hour. If Adriana starts running an hour after Alexa, how many hours does it take for her to catch up?
3. If 8 cows eat 9 acres of grass in 4 days, how much grass with 2 cows eat in 8 days?
4. Joseph has 30 marbles in an urn: 14 are red, 13 are green, 1 is blue, and the rest are yellow. If Joseph draws a marble at random, replaces it, then draws another marble, what is the probability that he will draw a blue and then a red marble?
5. A triangle has sides of length 3, 4, and 5. What is its area?
6. If 
7. If and , what is ?
8. A box has length 4, width 16, and height 8. How many 2 by 2 by 2 cubes can fit in the box?
9. There are 230 sophomores at IMSA who take Spanish and/or French. If 150 take Spanish and 213 take French, how many students are taking both languages?
10. There is a room full of cats and birds. If there are 18 legs in a room and there are as many cats and birds, how many cat legs are in the room?
11. Anna flips a coin until she gets tails twice in a row and then she stops. If she flipped the coin four times and then stopped, what is the probability that she got heads twice?
12. What is the probability that the sum of two dice rolled is an even number less than 6?
13. Katie’s alarm clock goes off every 10 minutes and her doorbell rings every 13 minutes. If she can only wake up when they both go off at the same time and the alarm clock starts at 8:00 and the doorbell first rings at 8:05, when does Katie wake up?
14. If ϕ what is ϕ(ϕ4))ϕ(3)?
15. A square is placed inside a circle with each corner of the square on the circle. An equilateral triangle is placed inside the square with its base on the base of the square. If the circle has radius of 8, what is the area of the triangle?
16. In how many ways can letters in the word “BIBLIOBULI” be rearranged?
17. How many diagonals are in a 23-sided regular polygon?
18. How many squares that include the black square can be formed from the 7 by 7 grid?



1. What is the greatest prime factor of 21! + 22! (where )?
2. Snickerdoodles come in bags of either 7 or 13. Stanley wants to buy an exact amount of snickerdoodles by buying a combination of 7 and 13 bags. For example, Stanley can buy exactly 47 snickerdoodles by buying 3 bags of 7 and 2 bags of 13; however, there is no way to buy exactly 18 snickerdoodles. What is the greatest number of snickerdoodles that Stanley can’t buy?

2012 IMSA Junior High Mathematics Competition

1. A math store buys calculators for $100 each. After the store marks up the price by 70% and offers a 30% discount on the markup price, how much (in dollars) does the customer pay before paying the 8.2% tax?
2. If half the perimeter of a heptagon is 31.5 cm, what is the perimeter (in centimeters) of a pentagon with sides lengths equal to those of the heptagon?
3. An alien IMSA student calculates that there are 7 scondies to a mogel, 2 mogels to 3 meytons, 4 meytons to a nince, and 12 ninces to 5 vastkos. How many scondies are equal to 13 vatskos? Express your answer in decimal form.
4. A whole number plus that number squared plus that number cubed minus is . What is that number?
5. What is the value of ?
6. There are 27 IMSA students in an IMSA math class. Out of them, 18 students can answer every question on the seventh-grade individual math contest, 13 can answer every question on the eighth-grade individual math contest, and 7 can answer every question on both math contests. How many students in the class cannot answer every question on either contest?
7. If an equilateral triangle has perimeter 6, what is its area?
8. If 6 cats can eat 6 mice in 6 hours, then how many mice can 1 cat eat in 12 hours?
9. A rectangular patch of grass is *x* feet by (*x* + 10) feet. A walkway that is 3 feet wide is placed completely around the pool forming a larger rectangle. The area of the rectangle formed by the patch of grass and walkway is 192 square feet greater than the area of the grass patch alone. What is the area of the grass patch, in square feet?
10. Find the greatest ten-digit positive multiple of 12 using each digit once and only once.
11. What is the last digit (ones) of the product of the positive prime numbers less than 100?
12. How many squares are on a traditionalcheckerboard if squares can only be made using only the edges of the individualsquares?
13. A point is randomly selected within the rectangle defined by the vertices: (0,0), (5,0), (5, 7), and (0,7). What is the probability that the x-coordinate of the point is less than the y-coordinate? Express your answer as a common fraction reduced to lowest terms.
14. Using only the digits 1 through 5, how many even three-digit positive integers less than 500 can be written if each digit can be used more than once?
15. How many numbers belong to the sequence: , where the difference between consecutive numbers is ?
16. Scott was born on a Tuesday. What is the probability that exactly two of his three best friends were also born on Tuesday? Express your answer as a common fraction reduced to lowest terms.
17. A collection of nickels, dimes and pennies has an average value of 7 cents per coin. If a nickel were replaced by five pennies, the average would drop to 6 cents per coin. How many dimes are in the collection?
18. A number is five more than the product of two consecutive positive integers and is also an integral multiple of both 55 and 121. Let the smaller of the two consecutive positive integers be represented by *k*. Find the sum of all distinct values of *k* if *k* < 157.
19. If the letters of “ILLINOIS” are mixed up, selected randomly one at a time without replacement, and written down in the order drawn, find the probability that the three “I’s” are together, in adjacent positions in this random arrangement of letters. Express your answer as a common fraction reduced to lowest terms.
20. How many ways can we choose 4 elements of {1, 2…12} without replacement such that no two chosen numbers are consecutive?