"Math is Cool" Masters – 2007-08

Sponsored by:

8th Grade – January 26, 2008

Individual Multiple Choice Contest

The Duchy of Math has been invaded by a fell army of dragons. To defeat them, Archduke Archimedes rewards his knights on the basis of Dragon Points, which are awarded according to the following table. (For example, slaying an 8-foot blue dragon with 10% of its scales vulnerable earns 32 points. "Vulnerable" means that the scales can be damaged.)

	TYPE	BLUE			BLACK			RED		
% Scales Vulnerable	Length, in feet	0-10	10-40	40+	0-7	7-12	12+	0-18	18-84	84+
	80 – 100 %	1	1	2	1	1	3	-	-	-
	60 – 80 %	2	3	7	2	2	11	39	-	-
	40 – 60 %	16	19	26	19	26	31	44	61	-
	20 – 40 %	29	31	35	32	49	58	52	82	96
	0 – 20 %	32	39	51	47	54	67	73	94	100

1	Sir Johannes has slain a 9-foot black dragon with 72% of its scales vulnerable. How many Dragon Points has he earned? A) 1 B) 2 C) 19 D) 32 E) 49
2	For the defeat of which company of foes will Sir Blaise win the most Dragon Points? A) four blue dragons, between 10 and 40 feet, 50% vulnerable B) 15 blue dragons shorter than 10 feet having 75% scales vulnerable C) an eight-foot black dragon with 25% vulnerable scales and a 44-foot blue dragon with 35% vulnerable scales D) a four-foot red dragon with no vulnerable scales and a 41 foot blue dragon with 63% vulnerable scales E) A twenty-foot red dragon with 32% vulnerable scales
3	Irrational Radical, a fierce red dragon, has only one patch of vulnerable scales, which is on his underside. The patch begins at his throat with a single scale in the first row, then two in the next row, and continuing in this way to his stomach with a row of 10 scales. After this row the patch tapers back down to a single scale at his tail. How many vulnerable scales does Irrational Radical have? A) 41 B) 96 C) 100 D) 105 E) answer not given

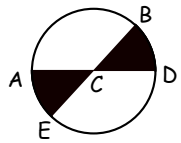
4	It takes the dragon Limiting Discriminant 2 weeks to devour a town alone, but with the help of Irrational Radical they can devour the same-sized town in only 10 days. How many days would it take Irrational Radical alone to devour a town this size? A) 18 B) 21 C) 28 D) 30 E) answer not given
5	Sir Leonhard is worried about fighting a 14-foot black dragon with only one-fourth of its scales vulnerable, and is trying to calculate his probability of success. If Leonhard strikes the dragon on its vulnerable scales with one of his six magic arrows, he will slay it. The magic arrows are guaranteed to strike the dragon, but at a random location on its body. What is the probability that Leonhard will slay the dragon with one of his magic arrows? (Assume all scales are the same size.) A) $\frac{417}{1024}$ B) $\frac{2637}{4096}$ C) $\frac{3367}{4096}$ D) $\frac{393}{512}$ E) answer not given
6	Danger when fighting a red dragon is directly proportional to the length of the dragon and inversely proportional to the percent vulnerable scales. Which of the following red dragons is the most dangerous to fight? A) A 32-foot with 63% vulnerable scales B) A 21-foot with 40% vulnerable scales C) A 5-foot with 10% vulnerable scales D) A 16-foot with 30% vulnerable scales E) A 30-foot with 70% vulnerable scales
7	Sir Isaac's horse is staked to graze 9 meters to his east. Sir Isaac sees the intimidating figure of Irrational Radical 40 meters to his north. Since Irrational Radical wants to eat horse for lunch today, how many meters must the dragon travel to reach Sir Isaac's horse, if the horse does not move? A) 41 B) 42 C) 43 D) 56 E) answer not given
8	Sir Pierre has earned 276 Dragon Points by slaying 12 blue dragons, each from 10 to 40 feet long and with between 20% and 60% vulnerable scales. How many of the dragons slain by Sir Pierre had between 20% and 40% vulnerable scales? A) 0 B) 1 C) 2 D) 3 E) answer not given
9	The feared dragon, Limiting Discriminant, can breathe flames in a perfect cone. If she can breathe 40 cubic feet of flame, how many square feet could she engulf with the base of her conical flame from 10 feet away? A) 12 B) 24 C) 28 D) 40 E) answer not given

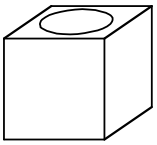
"Math is Cool" Masters – 2007-08

Sponsored by:

8th Grade – January 26, 2008

Team Contest

1	Susan has been saving her allowance for her family's planned trip to Mathland Theme Park. On Tuesday, she set aside 48% of her savings to take on this trip. On Wednesday, she increased the amount she set aside to a total of $50 by taking an additional $11.60 from her savings. In dollars, what was the total amount of her savings before she took any money out for the trip?
2	In the Baseball League of Dreams, the distance from the pitcher's mound to the catcher is 60 feet. In one game, Helix Fernandez pitched for 8 innings and threw pitches that traveled a total distance of exactly one mile. On average, how many pitches per inning did Helix throw in this game, if all his pitches went straight to the catcher?
3	It is given that P + Q = S, where P, Q, and S are all positive integers less than or equal to 100, P and Q are distinct (different) primes, and S is a perfect square. How many different values of S are possible?
4	What is the largest possible value of $\frac{a/b}{c/d}$, where a, b, c, and d are chosen from among the first six natural numbers and no number is used more than once? If your answer is not an integer, give it as a fraction.
5	What is the number of square units in the area of the shaded region if C is the center of the circle shown, AD = 10 units, and angle ACB is 137°? 
6	Put the letters corresponding to the following quantities in order of increasing size, smallest first. Your answer should consist of 5 letters in the correct order. A = the number of days from August 1st through December 31st B = the number of fluid ounces in 1.333... gallons C = the number of centimeters in $\frac{3}{2}$ meters D = the number of square inches in 1 square foot E = the number of seconds in $2\frac{4}{5}$ minutes

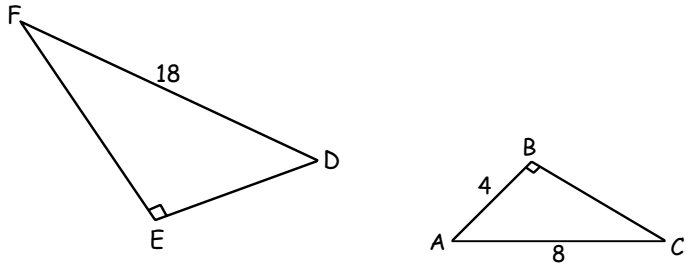
7	From a cube of hard-frozen ice cream of edge length 5 inches, a hemisphere of radius 2 inches is scooped out of the middle of the top of the cube, as shown. What is the surface area of the remaining ice cream, in square inches (assuming no melting)? 
8	Each of Billy Bob's sons has either "Billy" or "Bob" or both in his name. Four sons have "Billy" in their names and five sons have "Bob" in their names. Exactly one son is named Billy Bob and exactly one son is named Bob Billy. The other sons are named just "Billy" or just "Bob." In how many ways could Billy Bob have assigned names to his sons?
9	Let $A = n \cdot n$, $B = n + n$, $C = n \div n$, $D = n - n$, and $E = n^n$. The values of these expressions are written in order from least to greatest for a particular value of n. In case of ties, tied values may be written in any order. For which one or more of the following values of n could the order of the values be written DCEAB? $n = -2,\ n = -1,\ n = 0,\ n = 1,\ n = 2$
10	The range of a set of values is the difference between the highest and lowest values. Find the range of the six values and express your answer as a fraction. $0.\overline{7},\ \frac{5}{7},\ \frac{1}{2},\ 0.\overline{19},\ \frac{1}{5},\ 55\%$ (Note repeat bars over $0.\overline{7}$ and $0.\overline{19}$.)

"Math is Cool" Masters – 2007-08

Sponsored by:

8th Grade – January 26, 2008

Pressure Round Contest

1	A 3-digit perfect-square integer has the form $\underline{abc}$, where the underlined letters stand for different digits. If $\underline{a} < \underline{b} < \underline{c}$, what is the largest value $\underline{abc}$ can have?
2	Triangles ABC and DEF are similar. Find the length of side EF. 
3	How many three-digit positive integers have at least one 2 and at least one 3 among their three digits?
4	Gregg commutes 90 miles one way to work. The first 30 miles takes 45 minutes while the next 60 miles takes 55 minutes. What is his overall average speed, in mph, for the entire trip?
5	If twice A plus B is seven more than half C, and half B plus twice C is 23 more than half A, find A + B + C.

"Math is Cool" Masters – 2007-08

Sponsored by:

8th Grade – January 26, 2008

Mental Math Contest

PERSON 1		
1.1	If three-fourths of the 16 mathletes in this room like math, and one-third of those who like math absolutely love it, how many mathletes in the room absolutely love math?	4 [mathletes]
1.2	Peter flips a coin and rolls a die. What is the probability that he gets tails and an even number?	1/4
1.3	If a circle is inscribed inside a square with a side length of two centimeters, what is the area of the circle, in square_centimeters?	π [cm^2]
1.4	Solve for x: two x plus fourteen equals ten	[x=] -2
PERSON 2		
2.1	How many degrees are in one interior angle of a regular pentagon?	108 [°]
2.2	What is the length in feet of the hypotenuse of a right triangle with leg lengths of five and twelve feet?	13 [feet]
2.3	How many ways can you arrange the letters in the word LETTER (spelled L-E-T-T-E-R)?	180 [ways]
2.4	How many positive integer factors does 72 have?	12 [factors]
PERSON 3		
3.1	A CD player regularly sells for $80. It is on sale for 20% off. What is the sale price, in dollars, of the CD player?	[$] 64
3.2	What is the sum of the five consecutive counting numbers starting with two?	20
3.3	What is the circumference in inches of a circle with an area of 64π square inches?	16π [in]
3.4	Kai guesses on all four questions of a true-false quiz. What is the probability that he will get at least two questions correct?	11/16
PERSON 4		
4.1	My number is 9 more than one-third of Jill's number, and Jill's number is three-hundred-forty-two. What is my number?	123
4.2	What is the sum of the next two numbers in the following sequence? One, two, four, eight, 16 and so on	96
4.3	What is the slope of the line passing through the points (2,3) and (8,15)?	2
4.4	How many times does the curve described by the equation y equals x squared plus five x plus four intersect the x-axis?	2 [times]

"Math is Cool" Masters – 2007-08

Sponsored by:

7th & 8th Grade – January 26, 2008

COLLEGE KNOWLEDGE BOWL ROUND #1

#	Problem	Answer
1	How many square inches are in the total surface area of a right circular cylinder with height 4 inches and volume 36 pi cubic inches?	42 pi [in^2]
2	A ten-pound bag of trail mix is fifty percent peanuts. If five pounds of peanuts are added, what fraction of the new mix is not peanuts?	1/3
3	Destitute David borrows fifty dollars from his friends every two weeks. In 2007, he first borrowed money on January tenth. How many dollars did he owe on December 31st, 2007?	[$] 1300
4	Danielle is going shopping with her dad's credit card. Her first purchase is a pair of jeans for $15. If that purchase represents fifteen percent of her total spending, how many dollars are charged to the credit card after she has finished shopping?	[$] 100
5	A rectangle with sides 4 feet and 9 feet is painted blue. What is the side length, in feet, of the largest square that can be painted with the same amount of paint?	6 [feet]
6	It takes four minutes to cut through an oak cylinder of radius one foot. A 32-foot long cylindrical oak log with radius one foot is to be cut into 4-foot pieces. What is the least number of minutes necessary for this job?	28 [min]
7	Squirrels and robins are sharing a tree. An observer counts 24 heads and 70 feet. How many robins are in the tree?	13 [robins]
	Extra Problem – Only if Needed	
8	Josh has trouble remembering where his money has gone. He lost $20 under a park bench, left $35 in his locker, and put his jeans with half of what was left in the washing machine. If he had $15 at the end of all this, how many dollars did he start with?	[$] 85

"Math is Cool" Masters – 2007-08

Sponsored by:

7th & 8th Grade – January 26, 2008

COLLEGE KNOWLEDGE BOWL ROUND #2

#	Problem	Answer
1	How many miles away is George from his starting point if he has walked 7 miles north and 24 miles west?	25 [miles]
2	Find the least common multiple of 36 and 63.	252
3	At a grocery store, the price of hamburger is $11 for a 5-pound package. If you buy a 25-pound package, the price is 15% less. What is the cost, in dollars, of one pound of hamburger in the 25-pound package?	[$] 1.87
4	A fair cubical die has the numbers 3, 3, 4, 5, 5, and 6 on its faces. What is the probability that the sum of two rolls of this die is even?	5/9
5	Ten pounds of a certain type of cement is composed of 30 percent gravel and 70 percent sand. How many pounds of gravel need to be added to make the mixture half gravel?	4 [pounds]
6	An ant colony has 8 point 2 times 10 to the seventh power workers. If each worker can move 20 grams of dirt in a day, how many grams of dirt can be moved by all the workers in a week? Express your answer in scientific notation.	1.148×10^{10} [grams]
7	A boat travels 12 miles in 2 hours against the current. With the current, the boat travels 30 miles in 3 hours. How many miles can the boat travel in standing water in one hour?	8 [miles]
	Extra Problem – Only if Needed	
8	There are a dozen flowers in a bouquet. How many complete bouquets can be made with 175 flowers?	14 [bouquets]

"Math is Cool" Masters – 2007-08

Sponsored by:

7th & 8th Grade – January 26, 2008

COLLEGE KNOWLEDGE BOWL ROUND #3

#	Problem	Answer
1	Joel spends ten percent of each week on the phone. If he has to pay ten cents per minute on the phone, how much, in dollars, is his phone bill for the month of November?	432 [dollars]
2	Mulan can save an empire in three days. How many empires can she save in 6 weeks?	14 [empires]
3	The metric unit for angle measurements is the grade. The sum of the angles of a quadrilateral is 400 grades. What is the measure in grades of each angle of a regular pentagon?	120 [grades]
4	Dick takes 4 fluid ounces of honey from every beehive. How many beehives must Dick harvest to collect a gallon of honey?	32 [beehives]
5	One triangle has side lengths of twelve, nineteen, and seventeen units. Two sides of a second, similar triangle are twenty-four and thirty-eight units. How many units are in the perimeter of the second triangle?	96 [units]
6	What is the probability of rolling a sum of 11 on two fair six-sided dice?	1/18
7	If fifteen percent of the opposite of x is the opposite of 12, what is one-fifth of x?	16
	Extra Problem – Only if Needed	
8	What simplified fraction is equivalent to point 2 repeating?	2/9

"Math is Cool" Masters – 2007-08

8th Grade – January 26, 2008

Final Score

KEY

School Name_____Team #_____

Proctor Name_____Room #_____

First Score

(out of 18)

STUDENT NAME_____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes

This test is the only test where you will be penalized for incorrect responses. You will receive 2 points for a correct letter response, 0 points for leaving it blank and -1 point for an incorrect response. It is not necessary to write your personal name on the test, but you may put it at the bottom of the test so your coach will be able to give you back the correct test. This test is taken individually, but it is part of your team score, including zeros for missing team members. Your team score will be calculated by taking the mean of your four team members' scores. When you are prompted to begin, tear off the colored sheet and begin testing. ***Since this is a multiple choice test, ONLY a letter response should be indicated as an answer on the answer sheet.*** *No talking during the test.*

DO NOT WRITE IN SHADED REGIONS

Answer		-1, 0 or 2	-1, 0 or 2
1	B		
2	C		
3	C		
4	E (35 days)		
5	C		
6	D		
7	A		
8	E (4)		
9	A		

"Math is Cool" Masters – 2007-08

8th Grade – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score

KEY

First Score

(out of 20)

Team Contest – Score Sheet

TEAM TEST - 15 minutes

When you are prompted to begin, tear off the colored sheet and give a copy of the test to each of your team members and begin testing. Each problem is scored as ***2 or 0****. Record all answers on the colored answer sheet.*

DO NOT WRITE IN SHADED REGIONS

	Answer	2 or 0	2 or 0
1	[$] 80		
2	11 [pitches]		
3	8 [values]		
4	15		
5	$\frac{215\pi}{36}$ [un^2]		
6	DCAEB [in order]		
7	$150 + 4\pi$ [in^2]		
8	420 [ways]		
9	[n =] 1, 2		
10	58/99		

"Math is Cool" Masters – 2007-08

8th Grade – January 26, 2008

Final Score

KEY

School Name_____Team #_____

First Score

Proctor Name_____Room #_____

STUDENT NAME_____

PRESSURE ROUND - 10 minutes

When it is time to begin, you will be handed a packet of questions. There is a copy of the questions for each team member. Two minutes after the start of the test you are expected to submit an answer for one of the questions (it can simply be a guess). The maximum value of this answer is 1 point. In another two minutes you are expected to submit another answer to one of the four remaining questions; its maximum value is two points. This process will continue until all the questions are answered and each consecutive question's worth will go up by one point. You must submit your answers on the colored sheets given to you. If you do not have an answer at the end of a two minute period, you must still submit an answer sheet with an identified question number on it. Failure to do so will result in loss of points. This event is timed, and you will be given a verbal 5 second warning and told to hold your answer sheet up in the air. You may keep working as the sheets are collected.

Pressure Round Answers

	Answer
1	289
2	$9\sqrt{3}$ [units]
3	52
4	54 [mph]
5	20

"Math is Cool" Masters – 2007-08

8th Grade – January 26, 2008

Final Score

School Name_____Team #_____

Proctor Name_____Room #_____

First Score
(out of 18)

STUDENT NAME_____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes

This test is the only test where you will be penalized for incorrect responses. You will receive 2 points for a correct letter response, 0 points for leaving it blank and -1 point for an incorrect response. It is not necessary to write your personal name on the test, but you may put it at the bottom of the test so your coach will be able to give you back the correct test. This test is taken individually, but it is part of your team score, including zeros for missing team members. Your team score will be calculated by taking the mean of your four team members' scores. When you are prompted to begin, tear off the colored sheet and begin testing. ***Since this is a multiple choice test, ONLY a letter response should be indicated as an answer on the answer sheet.*** *No talking during the test.*

DO NOT WRITE IN SHADED REGIONS

	Answer	-1, 0 or 2	-1, 0 or 2
1			
2			
3			
4			
5			
6			
7			
8			
9			

"Math is Cool" Masters – 2007-08

8th Grade – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score

First Score (out of 20)

Team Contest – Score Sheet

TEAM TEST - 15 minutes

When you are prompted to begin, tear off the colored sheet and give a copy of the test to each of your team members and begin testing. Each problem is scored as ***2 or 0****. Record all answers on the colored answer sheet.*

DO NOT WRITE IN SHADED REGIONS

	Answer	2 or 0	2 or 0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			