"Math is Cool" Masters – 2006-07

Sponsored by: Sylvan Learning Center - Wenatchee

PreAlgebra – January 13, 2007

Individual Contest

Tear this sheet off and fill out top of answer sheet on following page prior to the start of the test.

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INDIVIDUAL TEST - 35 minutes

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PreAlgebra – January 13, 2007

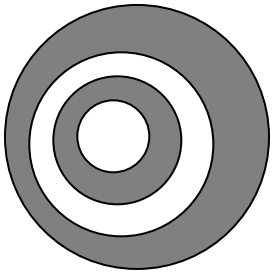
Individual Contest

1	What is the area, in square inches, of a circle with a diameter of 2 inches?
2	Evaluate: $\frac{3}{5} \div \frac{7}{8}$
3	What is the next number in the sequence: $2, -\frac{4}{3}, \frac{8}{9}, -\frac{16}{27}, \ldots$?
4	Francine can type 48 words per minute. How long, to the nearest minute, will it take her to type a paper with 505 words?
5	What is the probability that a randomly chosen card from a standard deck will be either red or an ace?
6	Evaluate: $\frac{5}{8} + 4\frac{1}{3}$ and express your answer as a common fraction.
7	What is the units digit of the product of the consecutive integers from 11 through 19 inclusive?
8	A farm has sheep and turkeys. If there are 44 heads and 124 legs among the animals, how many sheep are there?
9	A bowl contains a large number of white beans. Marcy selects 75 beans and marks each of them with her favorite neon green gel pen. She then mixes the marked beans back into the bowl with the other beans. Next, she randomly selects 80 beans from the bowl and observes that three of them have the neon green mark. If this ratio exactly reflects the ratio in the bowl, how many beans were originally in the bowl?
10	Find the sum of the mean of the numbers in the set {7, 2, 5, 11, 3} and the median of the numbers in the set {216, 1, 27, 125, 64, 8}, and express your answer as a decimal.
11	Simplify the following expression: $3(x - 5) - 4x + 8$
12	Solve for m: $6m - 12 = m + 33$
13	What is the slope of a line containing the following points? (4, -2) and (5, 0)
14	What is the volume, in cubic inches, of a cone with radius 6 inches and height 4 inches?
15	If 42 machines can fill 78 identical cylindrical cans with paint per minute, how many cylindrical cans the same height but half the diameter could 7 machines fill in one hour? (Assume that all machines work at the same constant rate.)
16	If the area of a certain parallelogram is $(18x + 27)$ feet^2 and the length of the base is $(2x + 3)$ feet, then what is the height in feet?

17	What is the surface area, in square cm, of a cylinder with radius 8 cm and height 5 cm?
18	Evaluate: $5^3 \cdot 2^6 \div 4^2$
19	A rectangular tile floor consists of five rows of seven square tiles. If a diagonal line is drawn from one corner to the opposite corner, how many tiles will contain a portion of the line?
20	Evaluate: 73! ÷ 71!
21	Thirty students are dancing in a moshpit and every person bumps each of the others exactly once. How many total bumps occur?
22	A bag contains 3 white marbles, 3 red marbles and 3 blue marbles. If you pick three marbles with no replacement, what is the probability of picking one of each color?
23	What is the surface area in square yards of a regular tetrahedron with edge length 12 yards?
24	Solve for t: $\frac{8}{t+3} = \frac{20}{t}$
25	Wayne Dwade throws a ball whose initial path is described by the graph of the function $y = \frac{1}{3}x + 5$, where x represents the number of feet the ball's center of gravity has traveled horizontally and y represents the number of feet it has traveled vertically. How many feet high is the ball's center of gravity when it has traveled twelve feet horizontally?
26	Evaluate: $34125_6 + 3204_6$ and give your answer as a base 6 number.
27	By what amount is any given term in the following geometric sequence multiplied to give the term that follows it? $\frac{1}{3}, \frac{-5}{6}, \frac{25}{12}, \ldots$
28	What is the greatest common factor of 6! and 12^3?
29	How many different arrangements are there of the letters in the word 'fescennine' (meaning extremely rude, outrageously coarse)?

Challenge Questions

30	Mary holds the ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen, and king of spades in that order in her hand. All of the cards are face up in one stack with the ace showing and the king at the very bottom. If Mary takes the ace off of the pile and discards it, and then moves the 2 to the bottom, then discards the 3, and then moves the 4 to the bottom, and so on, until she has only one card left, what will that remaining card be?
31	The formula $\left(2^{p-1}\right)\left(2^p - 1\right)$ results in a perfect number for some prime values of p, including $p = 7$. What is the resulting perfect number when $p = 7$?

32	Four overlapping circles have radii of 2 cm, 5 cm, 8 cm and 11 cm as shown. As a reduced common fraction, what is the ratio of the area of the smaller gray region to the area of the larger gray region? 
33	Evaluate for a = 11 and b = 11: $(16a^2 + 40a + 25) - (4b^2 - 12b + 9)$
34	The equation of a line in standard form is $Ax + By = C$, where A is a positive integer and B and C are integers and A, B and C have no common factor greater than one. What is the equation, in standard form, for a line containing the point (2, 5) and slope of 3?
35	What is the length, in inches, of the longest diagonal of a right rectangular prism with dimensions 3 inches by 5 inches by 8 inches?
36	Mark needs someone to do the dishes for him each night for the next 15 nights, because he has to polish his rock collection for the next rock show. He offers his sister a penny the first night, two pennies the second night, four pennies the third night, and so on, doubling the number of pennies each night until 15 nights pass. His sister isn't about to work for such chump change and so Mark has to miss the rock show. How much money, in dollars, did Mark's sister miss out on?
37	Evaluate: $(3^{83} - 3^{80}) \div (9^{41} - 9^{39})$
38	When full, a certain pool takes 45 minutes to drain. When empty, the same pool takes 20 minutes to fill when the drain is plugged. How many minutes would it take to fill the empty pool if someone forgot to plug the drain?
39	The coordinates of the vertices of a triangle are (0,2), (9,2), and (9, 14). The triangle is rotated 90°, 180° and 270° clockwise about the origin. What is the area of the circle that circumscribes these four triangles?
40	In rolling two standard dice, the probability of rolling a sum of x or y is $\frac{1}{4}$. The probability of rolling a sum of x, y, or z is $\frac{5}{12}$. What is the largest possible sum of $x + y + z$?

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Algebra I – January 13, 2007

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6	Evaluate: $\frac{5}{8} + 4\frac{1}{3}$ and express your answer as a common fraction.
7	What is the distance between the points (-2, 7) and (6, -8) on a coordinate plane?
8	What is the units digit of the product of the consecutive integers from 11 through 19 inclusive?
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27	What is the greatest common factor of 6! and 12^3?
28	How many different arrangements are there of the letters in the word 'fescennine' (meaning extremely rude, outrageously coarse)?
29	When one more than my favorite number is multiplied by five, the product is the same as when three less than my favorite number is multiplied by three-fifths. What is my favorite number?

Challenge Questions

30	Mary holds the ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen, and king of spades in that order in her hand. All of the cards are face up in one stack with the ace showing and the king at the very bottom. If Mary takes the ace off of the pile and discards it, and then moves the 2 to the bottom, then discards the 3, and then moves the 4 to the bottom, and so on, until she has only one card left, what will that remaining card be?
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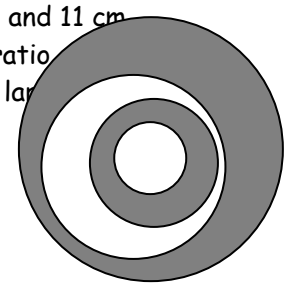
33	Four overlapping circles have radii of 2 cm, 5 cm, 8 cm and 11 cm as shown. As a reduced common fraction, what is the ratio of the area of the smaller gray region to the area of the larger gray region? 

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7th Grade – January 13, 2007

Individual Multiple Choice Contest

Every human institution loses productivity to disease. The Food and Drug Administration is studying how effective certain medications are. They gathered the following data from a certain sample population:

Disease	% exposure	% susceptibility	Mean recovery time (without medication)	Cost of medication ($)
Common cold	10	80	4 days	10
Influenza	8	60	8 days	75
Rubella	0.3	10	85 days	2500
Chicken Pox	2	95	6 days	5
Measles	5	35	12 days	25

Exposure gives probability that a member of the population will be exposed to the given disease over the course of a year. Susceptibility gives the chance that a person will contract the disease if they are exposed. The mean recovery time is the average time it takes a person with the disease to recover from it. The cost of the medication is the cost of enough medicine to treat one person for the entire course of the disease.

1	What is the mean cost of the medications in dollars for one person having each disease? A) $412 B) $487 C) $509 D) $523 E) $602
2	On average, if ten people are exposed to the common cold, what is the sum of the number of days of recovery time expected from all, if they take no medication? A) 4 B) 32 C) 36 D) 40 E) Answer not given
3	Which of the diseases listed will result in an institution losing the most days of productivity due to total recovery time required by people according to the results of the sample population, assuming nobody takes medication? A) Common cold B) Influenza C) Rubella D) Chicken Pox E) Measles
4	If the medication for measles speeds up the recovery time by 25%, what is the new average recovery time? A) 3 days B) 6 day C) 9 day D) 15 days E) Answer not given
5	There are 175 students in a school, and 80% of them are not infected with any disease. If 17 students have the flu and 28 have the common cold, how many have both? A) 6 B) 7 C) 8 D) 9 E) 10

6	Bill Gates' long-lost brother was found living in the remote city of Gothamville, with a population of 100,000. The Gates Foundation sponsors a program by which the entire population of Gothamville is vaccinated against rubella. How much money does the drug company that manufactures the rubella medication lose in sales during the first year of the vaccination program? Assume that everyone who contracts rubella would buy medication, that the vaccine is 100% effective, and that a person can get rubella only once. A) $0 B) $10000 C) $50000 D) $75000 E) Answer not given
7	For a person in this sample population, what are the odds against contracting measles in a given year? A) 393 to 7 B) 7 to 20 C) 400 to 7 D) 13 to 7 E) Answer not given
8	In a 20 foot by 30 foot rectangular room, how many people could fit if a person cannot be within five feet of another person (to minimize transmission of disease)? Assume people have no width or thickness. A) 30 B) 42 C) 35 D) 24 E) Answer not given
9	Bob has calculated that buying the medication for the common cold and not buying the medication have equal cost if the medication speeds up recovery by 25%. What is the value Bob puts on his time, in cents per hour, rounded to the nearest cent? Assume that Bob gives a value of 0 to time spent sick. A) 35 ¢/hr B) 39 ¢/hr C) 42 ¢/hr D) 44 ¢/hr E) Answer not given

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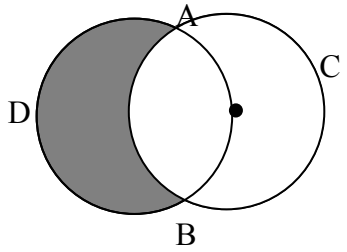
7th Grade – January 13, 2007

Team Contest

1	A cow is tied to an external corner of a triangular barn with sides measuring 10 m, 20 m, and $10\sqrt{3}$ m. If the cow's tether is 12 m long and is tied to the corner between the 10 and 20 m sides, what is the area, in square meters, of the region the cow can graze?
2	Evaluate: $(1+2\cdot 3)^4 - (5\cdot 9 - 6\cdot 8)^7$
3	When the digits of a positive two-digit number are reversed the result is a positive two-digit number 45 less than the original number. What is the smallest possible value of the original number?
4	What is the least common multiple of 168 and 126?
5	The operation € is defined for all non-zero numbers as: a € b = a^2/b Determine the value of [(1 € 2) € 3] – [1 € (2 € 3)]
6	What is the sum of the greatest and least possible perimeters of triangles where two of the three sides are 11 inches and 17 inches and the third side is an integer number of inches?
7	Given that 3^n divides 10! (that is, when 10! is divided by 3^n, there is no remainder), what is the greatest possible integral value of n?
8	Evaluate as a mixed number: $3\frac{1}{4} \div 2\frac{1}{3}$
9	A cockroach begins at A and walks clockwise along the circumference of the white circle past C. When it gets to B, it goes along the circumference of the gray circle past D and back to A. If the radius of each circle is 4 feet, how many feet are in the total distance traveled by the cockroach? [The circumference of the gray circle passes through the center of the white circle.] 
10	The Mariners are ahead 3 to 1 in a best-of-seven series against the Astros. If the probability is 1/2 that either team will win any game, what is the probability that the Mariners will win the series?

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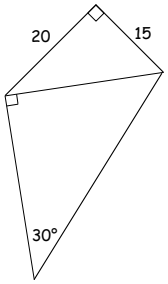
7th Grade – January 13, 2007

Pressure Round Contest

1	Richard and Stephanie each make a list of numbers. Both lists start with 7, include only positive integers, and have no number greater than 100. For his list, Richard takes each number and adds 6 to get the next number. For her list, Stephanie doubles each number and subtracts 5 to get the next number. Find the sum of all numbers (including 7) that are on both Richard's list and Stephanie's list.
2	Find the perimeter of the quadrilateral shown. 
3	If five different numbers are randomly selected from among the first 20 positive integers, find the probability that you choose a group of five numbers such that if listed in numerical order would be consecutive. (For example, 3, 6, 4, 2, 5 would meet this criterion since they could be ordered as 2, 3, 4, 5, 6.)
4	A 14-ounce mixture of sugar and salt is 10% sugar. How many ounces of sugar must be added to produce a mixture that is 60% sugar? Give your answer as a decimal.
5	The calculator I bought on eBay has a weird flaw. When I add two numbers ($x + y$), it reverses the digits of **at least one** of x, y, and the sum. (That is, it may reverse the digits of any one of these numbers, any two of these numbers, or of all three of them. If the digits of one or both addends are reversed, it adds the numbers after reversing the digits.) When I add the same pair of 4-digit positive integers repeatedly, my calculator displays the following different sums: 68911, 2176, 7891, 56131, 11986, 1987, and 13165. What is the correct sum of the two numbers I entered?

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7th Grade – January 13, 2007

Mental Math Contest

PERSON 1		
1.1	What is the circumference, in feet, of a circle with radius pi feet?	$2\pi^2$ [or 2 pi squared][feet]
1.2	How many distinct factors of 28 are prime?	2 [factors]
1.3	Solve for x in the equation: negative fourteen x minus 3 equals two x plus twenty-nine.	-2
1.4	If the smallest angle in a parallelogram is fifteen degrees, then the largest angle is n times fifteen degrees. What is n?	11
PERSON 2		
2.1	What is the sum, in centimeters, of the lengths of the edges of a regular tetrahedron if one edge has length 4 centimeters?	24 [cm]
2.2	How many zeros does the product of the first thirty odd positive integers end in?	0
2.3	What is the remainder when you divide 14,641 by 11?	0
2.4	How many perfect squares less than 150 are odd and have a square root that is a prime number?	4 [perfect squares]
PERSON 3		
3.1	What is the surface area, in square millimeters, of a solid hemisphere with radius 3 millimeters?	27π [mm^2]
3.2	What is the next number in the sequence that starts 1, 16, 81, 256?	625
3.3	In how many different ways can the letters in the word banana, B-A-N-A-N-A, be arranged?	60 [ways]
3.4	What is the greatest common factor of 72 and 84?	12
PERSON 4		
4.1	Add the number of days in one week to the number of days in February, 1989, then multiply that sum by 2.	70 [days]
4.2	The product of two integers is 48 and the quotient of the two integers is 5 and one-third. What is the sum of the two integers?	19
4.3	What is the fifth root of 243?	3
4.4	What is the sum of the numbers in the following sequence: one, two, four, eight, dot, dot, dot, five hundred twelve?	1023

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7th Grade – January 13, 2007

COLLEGE KNOWLEDGE BOWL ROUND #1

#	Problem	Answer
1	Hannah swims across a pool one way at 2 meters per second, then back across at 3 meters per second. What was her average speed in meters per second? Give your answer as a reduced common fraction.	$\frac{12}{5}$ [m per sec]
2	What is 80 percent of 39 times two-thirteenths of 100?	480
3	Wood burns for a length of time directly proportional to its volume. One cubic foot of wood burns for 2 hours. If Jim had 3 cylindrical logs each 1 foot long and with radius 6 inches, for how many minutes will those 3 logs burn?	90 pi [min]
4	In the word "COOL" (spelled C-O-O-L), each different letter stands for a different digit, and the two Os stand for the same digit. If both C and L are even and less than 6, how many different 4-digit integers could COOL represent that are divisible by 22?	0 [integers]
5	Convert 75 gallons per hour to an equivalent number of cups per minute.	20 [cups per min]
6	Austin and Sarah have to seal a large box of envelopes. If Sarah can seal envelopes twice as fast as Austin, and Austin can seal the entire stack in seven hours, how many minutes will it take them working together to do the job?	140 [min]
7	What is the probability of flipping exactly 3 heads on 5 flips of a fair coin?	$\frac{5}{16}$
	Extra Problem – Only if Needed	
8	Find the total surface area, in square centimeters, of a cylinder whose diameter and height are both 30 centimeters.	1350 pi [sq cm]

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7th Grade – January 13, 2007

COLLEGE KNOWLEDGE BOWL ROUND #2

#	Problem	Answer
1	What is the perimeter, in inches, of an equilateral triangle with an area in square inches of 9 times the square root of 3?	18 [inches]
2	How much larger is the positive square root of 1444 than the positive square root of 144?	26
3	If the probability that Robin gets an e-mail on any given day is one-third, what is the probability that she gets an e-mail at least once in a 5-day work-week?	$\frac{211}{243}$
4	Jerry is counting by ninety-threes. He starts like "ninety-three, one-hundred eighty-six" and so on. What is the smallest number he says that is more than one thousand?	1023
5	A tree grows one foot per year. If one inch equals two point five six centimeters, how many centimeters does the tree grow every four years? Give answer as a decimal.	122.88 [cm]
6	Two angles are insulting if their sum is 360 degrees. For example, the insult of a 200-degree angle is 160 degrees. If the insult of angle X is eight times angle X, find the degree measure of the supplement of the complement of angle X.	130 [°]
7	Find x if 2 to the x power is equal to the product of 8 to the one-fourth power and 32 to the one-fourth power.	[x =] 2
	Extra Problem – Only if Needed	
8	How many degrees are in each exterior angle of a regular pentagon?	72 [°]

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7th Grade – January 13, 2007

COLLEGE KNOWLEDGE BOWL ROUND #3

#	Problem	Answer
1	What is the 18th term of an arithmetic sequence whose fourth term is 8 and whose seventh term is 15 point 5?	43
2	If I add one to each prime number less than one hundred, and then multiply the resulting sums together, in how many zeros will the product end?	5
3	Katrina needs 35 cents for bus fare. She finds a dime. How many ways can Katrina give exact change for the bus fare if she uses the dime she found?	13 [ways]
4	Simplify: $\frac{1}{2}\sqrt{1260}$ [One-half the square root of one thousand two hundred sixty.]	$3\sqrt{35}$ [3 square root of 35]
5	A 20-ounce package of ground turkey is on sale. If you buy one package for four dollars, you get a second package free. If I get two packages with this deal, what is the price per pound, in dollars, of the turkey I got?	[$] 1.60
6	When the sum of four thousand two-hundred five and seven thousand six-hundred eighty-nine is rounded to the nearest hundred, what is the sum of its digits?	11
7	If half **my** number is 2 times the square of **your** number, what is **my** number if **your** number is the cube of negative 2?	256
	Extra Problem – Only if Needed	
8	How many lines of symmetry does a regular nonagon have?	9 [lines]

"Math is Cool" Masters – 2006-07

PreAlgebra – January 13, 2007

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:
KEY

First Score

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	π [in^2]		
2	24/35		
3	32/81		
4	11 [min]		
5	7/13		
6	119/24		
7	0		
8	18 [sheep]		
9	2000 [beans]		
10	51.1		
11	$-x - 7$ [or $-x + \bar{7}$]		
12	[m =] 9		
13	2		
14	48π [inches^3]		
15	3120 [cans]		
16	9 [feet]		
17	208π [cm^2]		
18	500		
19	11 [tiles]		
20	5256		

	Answer	1 or 0	1 or 0
21	435 [bumps]		
22	9/28		
23	$144\sqrt{3}$ [yds^2]		
24	[t=] -5		
25	9 [ft]		
26	$41333_{[6]}$		
27	-5/2		
28	144		
29	100,800		
30	10 [of spades]		
31	8,128		
32	7/19		
33	2040		
34	$3x - y = 1$		
35	$7\sqrt{2}$ [inches]		
36	[$]327.67		
37	117/40		
38	36 [minutes]		
39	277π [units^2]		
40	24		

"Math is Cool" Masters – 2006-07

Algebra I – January 13, 2007

Final Score:

KEY

First Score

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	π [in^2]		
2	24/35		
3	32/81		
4	11 [min]		
5	7/13		
6	119/24		
7	17 [units]		
8	0		
9	18 [sheep]		
10	2000 [beans]		
11	51.1		
12	[m =] 9		
13	48π [inches^3]		
14	3120 [cans]		
15	9 [feet]		
16	208π [cm^2]		
17	500		
18	11 [tiles]		
19	5256		
20	435 [bumps]		

	Answer	1 or 0	1 or 0
21	9/28		
22	$144\sqrt{3}$ [yds^2]		
23	[t=] -63/13		
24	15 [ft]		
25	$41333_{[6]}$		
26	$-\frac{\sqrt{2}}{2}$		
27	144		
28	100,800		
29	-17/11		
30	10 [of spades]		
31	8,128		
32	[$]327.67		
33	7/19		
34	$7\sqrt{2}$ [inches]		
35	3x + 2y = -4		
36	2040		
37	117/40		
38	36 [minutes]		
39	277π [units^2]		
40	24		

"Math is Cool" Masters – 2006-07

7th Grade – January 13, 2007

First Score
(out of 18)

School Name_____Team #_____

Proctor Name_____Room #_____

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	D		
2	B		
3	B		
4	C		
5	E		
6	D		
7	A		
8	C		
9	C		

"Math is Cool" Masters – 2006-07

7th Grade – January 13, 2007

First Score
(out of 20)

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

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	121π [m^2]		
2	4588		
3	61		
4	504		
5	-2/3		
6	90 [in]		
7	4		
8	$1\frac{11}{28}$		
9	$\frac{32\pi}{3}$ [ft]		
10	7/8		

First Score

"Math is Cool" Masters – 2006-07

7th Grade – January 13, 2007

School Name_____Team #_____

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	57
2	$85 + 25\sqrt{3}$ [units]
3	$\frac{1}{969}$
4	17.5 [ounces]
5	6712