"Math is Cool" Masters – 2015-16

December 5, 2015

Total Correct: KEY

STUDENT NAME: _____ **School Name:** _____

Proctor Name: _____ Team #: _____ Room #: _____

PRE-CALCULUS - Individual Contest – Score Sheet
DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	65		
2	18		
3	288π		
4	$(-2,3)$		
5	123,722		
6	-3, $\frac{5}{2}$ (any order)		
7	$\sqrt{73}$		
8	$\frac{100D}{K}$ or $\left\lceil\frac{100D}{K}\right\rceil$		
9	1260		
10	44 [%]		
11	414		
12	$\frac{\sqrt{15}}{7}$		
13	-11		
14	1925		
15	32		
1-15 TOTAL:			

	Answer	1 or 0	1 or 0
16	49/15		
17	6		
18	$\frac{4\sqrt{14}}{3}$		
19	16		
20	30		
21	1728		
22	812349, 3879 (any order)		
23	9/20		
24	$\left(-\frac{7}{2},2\right)$		
25	9		
26	$1\frac{11}{15}$		
27	62		
28	180		
29	9		
30	$\frac{39\sqrt{2}}{10}$		
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31	$2x + y - 3z = -8$		
32	7/20		
33	8000π		
34	6		
35	37,050		
36	-5,876		
37	8		
38	$(1,-2,0)$		
39	23/5		
40	12-21-2015		
31-40 TOTAL:			

PRE-CALCULUS

Total Correct:

"Math is Cool" Masters – 2015-16

December 5, 2015

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7			
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9			
10			
11			
12			
13			
14			
15			
1-15 TOTAL:			

	Answer	1 or 0	1 or 0
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31			
32			
33			
34			
35			
36			
37			
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39			
40			
31-40 TOTAL:			

PRE-CALCULUS

"Math is Cool" Masters – 2015-16

December 5, 2015

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25	9		
26	$1\frac{11}{15}$		
27	62		
28	180		
29	9		
30	$\frac{39\sqrt{2}}{10}$		
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31	$2x + y - 3z = -8$		
32	7/20		
33	$2\sqrt{89}$		
34	$67\pi\sqrt{6}$		
35	37,050		
36	-5,876		
37	8		
38	$(1,-2,0)$		
39	23/5		
40	12-21-2015		
31-40 TOTAL:			

CALCULUS

Total Correct:

"Math is Cool" Masters – 2015-16

December 5, 2015

STUDENT NAME: _____ **School Name:** _____

Proctor Name: _____ Team #: _____ Room #: _____

CALCULUS - Individual Contest – Score Sheet
DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1			
2			
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4			
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9			
10			
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12			
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14			
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1-15 TOTAL:			

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16			
17			
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19			
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21			
22			
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24			
25			
26			
27			
28			
29			
30			
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31			
32			
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40			
31-40 TOTAL:			

CALCULUS

"Math is Cool" Masters – 2015-16

Sponsored by:

December 5, 2015

High School Mental Math Contest

Follow along as your proctor reads these instructions to you. Your Mental Math score sheet is on the back.

GENERAL INSTRUCTIONS applying to all tests:

- *Good sportsmanship is expected throughout the competition by all involved, both competitors and observers. Display of poor sportsmanship may result in disqualification.*
- *Calculators or any other aids may not be used on any portion of this contest.*
- *Unless stated otherwise, all rational, non-integer answers need to be expressed as reduced common fractions except in case problems dealing with money. In the case of problems requiring dollar answers, answer as a decimal rounded to the neares hundredth (ie, to the nearest cent).*
- *All radicals must be simplified and all denominators must be rationalized.*
- *Units are not necessary as part of your answer unless it is a problem that deals with time and in that case, a.m. or p.m. is required. However, if you choose to use units, they must be correct.*
- *Leave all answers in terms of π where applicable.*
- *Do not round any answers unless stated otherwise.*
- *Record all answers on the colored cover sheets in the answer column only.*
- *Make sure all answer sheets have all the information (name, team number, etc.) at the top of the sheet filled out.*
- *Tests will be scored as a 0 if answers are not recorded on the answer sheets.*
- *Blank answer sheets and answer sheets with no name will be scored as a 0.*

Mental Math – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. ***You may not change or cross out answers once you have written an answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong.*** *Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

"Math is Cool" Masters – 2015-16

Sponsored by:

High School – December 5, 2015

Mental Math Contest

Mental Math – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. ***You may not change or cross out answers once you have written an answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong.*** *Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

#	Problem
1	What is the perimeter, in meters, of a right triangle with an area of twenty-four square meters and a leg measuring eight meters?
2	Express three-thousand four-hundred fifty-seven point two six eight nine in scientific notation rounded to two significant digits.
3	What is the surface area of a right rectangular prism with edges measuring three meters, six meters, and seven meters?
4	What is the units digit of 27^{27}?
5	What is the sum of the terms of an infinite geometric sequence with first term twenty-eight and common ratio one-fourth?
6	Superman is chasing Green Lantern at a speed of five thousand miles per hour, but Green Lantern is flying away at a speed of forty-six hundred miles per hour. If they started one thousand miles apart, how many hours would it take for Superman to catch Green Lantern?
7	What is the maximum possible perimeter, in meters, of a rectangle with an area of one-hundred twenty square meters and sides that are integer numbers of meters?
8	When two cards are drawn from a standard fifty-two-card deck, what is the probability that they are of different ranks?

“Math is Cool” Masters – 2015-16

Sponsored by:

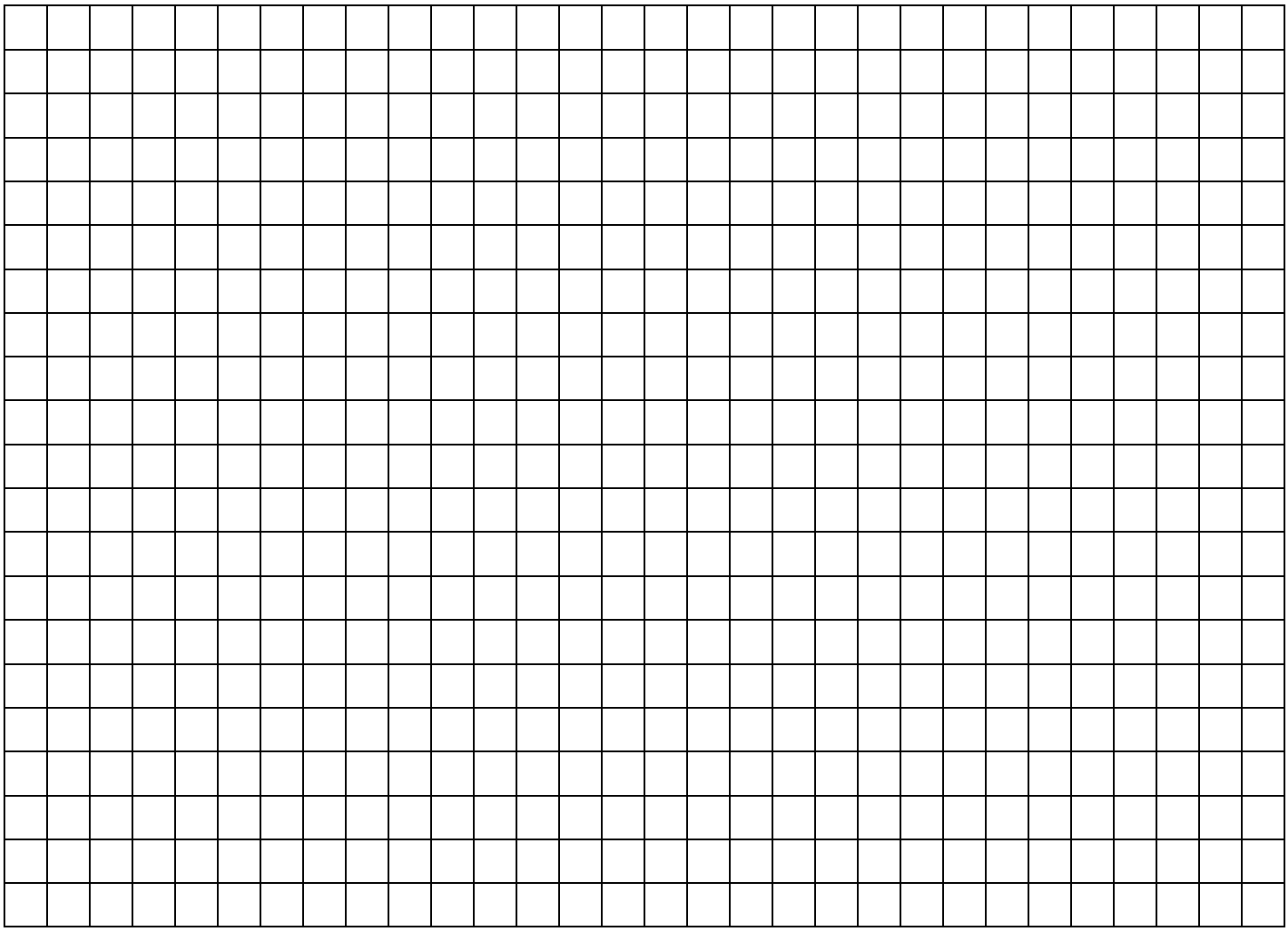
December 5, 2015

PRE-CALCULUS - Individual Contest

Tear this cover sheet and scratch paper off and fill out the top of the colored answer sheet prior to the start of the test. The graph below is for your use, if needed.

INDIVIDUAL TEST – PRE-CALCULUS - 35 minutes

You may NOT be seated next to anyone from your school. If you are MOVE NOW to avoid being disqualified! When you are prompted to begin, tear off the colored sheet and begin testing. Make sure your name and school are recorded on the answer sheet. The raw score will be 2 points for correct answers to problems 1-30 and 3 points for 31-40. Record your answers on the score sheet. No talking during the test. You will be given a 5 minute time warning.



"Math is Cool" Masters – 2015-16

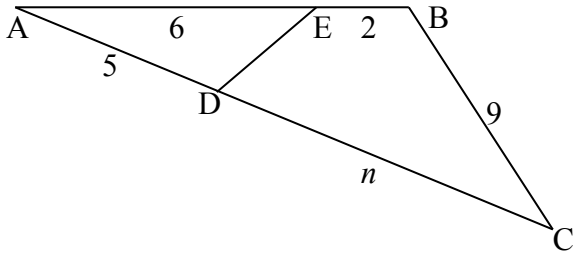
Sponsored by:

December 5, 2015

PRE-CALCULUS - Individual Contest

	Questions 1-30: 2 points each
1	Evaluate: $4 - 5 - (-8)(9) - 6$
2	If $c(b) = b(b+1)(2b-1)$, evaluate $c(2)$.
3	What is the volume, in cubic meters, of a sphere with a diameter of twelve meters?
4	What are the coordinates, in the form (x, y), of the center of the conic section with equation $x^2 - 2y^2 + 4x + 12y = 25$?
5	What is the sum of 89142 and 34580?
6	What value(s) of t satisfy $2t^2 = 15 - t$?
7	In ΔFGH, $f = 8$, $g = 9$, and $m\angle H = 60°$. What is the length of side h?
8	If you can buy K kilograms of dirt for D dollars, how many dollars would 100 kilograms of dirt cost?
9	What is the sum, in degrees, of the interior angles in a nonagon?
10	The average of Eddie's first three test scores is 92%. What is the lowest percentage Eddie can get on his fourth test to make sure his overall percentage doesn't slip below 80%?
11	A recursive sequence is defined with first term $j_1 = 24$ and later terms $j_n = 2(j_{n-1} + 1)$. What is the value of j_5?
12	If j is an angle in the fourth quadrant and $\cos j = \frac{1}{4}$, evaluate $\tan 2j$.
13	What value(s) of g satisfy $\frac{g-3}{2g+4} = \frac{2g+1}{4g+17}$?
14	What is the sum of the three-digit perfect cubes?
15	If A, B, and C are distinct one-digit counting numbers, how many solutions are there to the equation $A + B = C$?
16	What value(s) of w satisfy $2w + 3(w-4) = 5(6-2w) + 7$?
17	How many positive integer factors of 2754 are multiples of 18?
18	A triangle has sides measuring 6 m, 10 m, and 12 m. What is the length, in meters, of the altitude to the longest side?
19	Two circles with radii of 7 m and 19 m have their centers 20 m apart. A line segment is drawn from one circle to the other, tangent to both. What is the length, in meters, of that line segment?
20	How many elements are in the set of positive three-digit palindromes that are divisible by three?
21	I have nine different books I wish to put next to one another on a shelf. Two of the books have red covers, four are orange, and three have yellow covers. If I wish to keep all books of the same color next to one another, in how many ways can I arrange my books?

22	List which of these numbers is divisible by nine: 23678, 7849, 812349, 3879, 34568, 892345.
23	Bag A contains two orange marbles and three red marbles. Bag B contains four orange marbles and three red marbles. A single marble is drawn from Bag A and placed in Bag B, after which a single marble is drawn from Bag B. What is the probability that the last marble drawn is red?
24	Consider the function $s(r) = \log_3(14 - 3r - 2r^2)$ with a domain and range that are subsets of the real numbers. Express the domain in interval notation.
25	A red cubical box with edges measuring 3 inches contains a 2-by-2-by-1 black block and 23 identical white cubes with edges measuring 1 inch. In how many distinguishable ways can the contents of the box be arranged? Note that the box has an open top and a closed bottom, but the sides are indistinguishable.
26	Evaluate **as a mixed number**: $8\frac{9}{20} \div 4\frac{7}{8}$
27	What is the minimum possible perimeter, in square meters, of a rectangle with an area of 240 m^2 and sides that are integer numbers of meters?
28	The complement of angle A is complementary to the supplement of angle B. What is the sum of the measures of angle A and angle B, in degrees?
29	What is the smallest possible number of regions in a figure containing two intersecting circles, at least one pair of perpendicular lines, and at least one pair of parallel lines?
30	What is the shortest distance from the point $(5, -6)$ to the line $y = 7x - 2$?

Challenge Questions: 3 pts each	
31	What is the equation of the plane through the points $(-4,3,1)$, $(3,-20,-2)$, and $(1,-4,2)$? Your answer should have integer coefficients, at least one of which is 1.
32	At Pizza Piazza half of the pizzas have meat, one-third of the pizzas have onions, and two-fifths of the pizzas have mushrooms. In addition, one-fourth of them have both meat and onions, one-fourth of them have both meat and mushrooms, and one-fourth of them have both onions and mushrooms. Finally, one-sixth of the pizzas have meat, onions, and mushrooms. What fraction of the pizzas do not have any of these toppings?
33	A cow is tied to an external corner of a rectangular barn using a 100 m rope. If the barn measures 80 m by 60 m, what is the total area, in square meters, that the cow can graze?
34	What is the greatest common factor of 324 and 678?
35	What is the sum of the first 30 terms of an arithmetic sequence with first term 46 and common difference 82?
36	The terms of a sequence are defined by $h_n = (n-1)! - (n+2)!$. What is the sum of the terms from h_1 to h_5?
37	How many positive integer factors of 72 are also factors of 2568?
38	What is the solution, as an ordered pair in the form (q,p,m), of the system of equations $q+p+m=-1$, $q-p-2m=3$, and $2q+3p-m=-4$?
39	In the figure to the right, $\angle AED \cong \angle DCB$, and all line segments are labeled in meters. What is the value of n? 
40	Bouscalium has a half-life of 1 day. At 12:00:01 AM on 12-5-2015, your sample contains one kilogram of Bouscalium. What is the last date (in the form MM-DD-YYYY) on which you will have more than one centigram of Bouscalium in your sample at some point in the day?

PRE-CALCULUS

“Math is Cool” Masters – 2015-16

Sponsored by:

December 5, 2015

CALCULUS - Individual Contest

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INDIVIDUAL TEST – CALCULUS - 35 minutes

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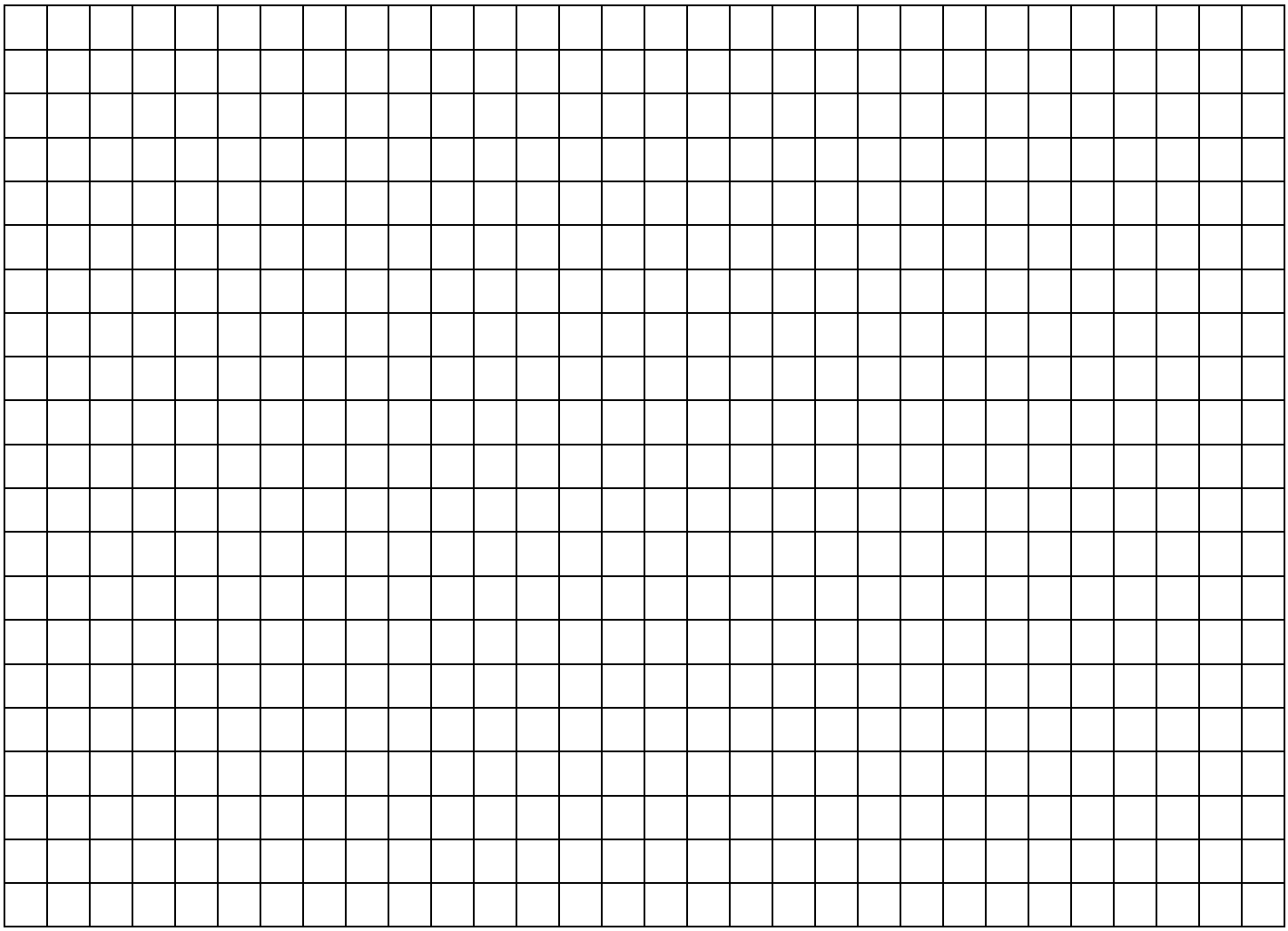

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December 5, 2015

CALCULUS - Individual Contest

	Questions 1-30: 2 points each
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16	What value(s) of w satisfy $2w + 3(w-4) = 5(6-2w) + 7$?
17	If $k(t) = 2t - \frac{3}{t}$, evaluate $k'(1)$.
18	A triangle has sides measuring 6 m, 10 m, and 12 m. What is the length, in meters, of the altitude to the longest side?
19	Two circles with radii of 7 m and 19 m have their centers 20 m apart. A line segment is drawn from one circle to the other, tangent to both. What is the length, in meters, of that line segment?
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23	Bag A contains two orange marbles and three red marbles. Bag B contains four orange marbles and three red marbles. A single marble is drawn from Bag A and placed in Bag B, after which a single marble is drawn from Bag B. What is the probability that the last marble drawn is red?
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33	A cowboy is located at the point $(-2,-5)$ and wants to go to town at the point $(3,-6)$, but he must take his horse to the river (the line $y=-x+8$) for water "on the way". What is the shortest distance he can travel?
34	What is the area of the ellipse with equation $2x^2+3y^2+4x+60y=100$?
35	What is the sum of the first 30 terms of an arithmetic sequence with first term 46 and common difference 82?
36	The terms of a sequence are defined by $h_n=(n-1)!-(n+2)!$. What is the sum of the terms from h_1 to h_5?
37	How many positive integer factors of 72 are also factors of 2568?
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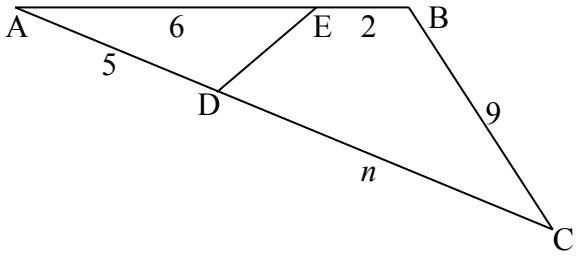
39	In the figure to the right, $\angle AED \cong \angle DCB$, and all line segments are labeled in meters. What is the value of n? 
40	Bouscalium has a half-life of 1 day. At 12:00:01 AM on 12-5-2015, your sample contains one kilogram of Bouscalium. What is the last date (in the form MM-DD-YYYY) on which you will have more than one centigram of Bouscalium in your sample at some point in the day?

CALCULUS

"Math is Cool" Masters – 2015-16

Sponsored by:

11th & 12th Grade – December 5, 2015

Individual Multiple Choice Contest

1	A solid cube of white plastic is painted red on all faces and then cut into sixty-four congruent smaller cubes. How many of the smaller cubes are red on exactly two of their faces? A) 12 B) 24 C) 32 D) 36 E) Answer not given.
2	What is the sum of the squares of the roots of $x^2 + 2x + 3 = 0$? A) -3 B) 3 C) 2 D) -2 E) Answer not given.
3	In ΔBCD, $c = 12$, $m\angle D = 75°$ and $m\angle B = 45°$. What is the length of side b? A) $4\sqrt{6}$ B) $\frac{36}{5}$ C) $5\sqrt{2}$ D) $\frac{26\sqrt{2}}{5}$ E) Answer not given.
4	What is the sum of the positive integer factors of 725? A) 854 B) 899 C) 930 D) 1225 E) Answer not given.
5	Evaluate: $\sqrt{2\sqrt{3\sqrt{2\sqrt{3\cdots}}}}$ A) $\sqrt[4]{24}$ B) $\sqrt{5}$ C) $\sqrt[3]{12}$ D) $3 - \frac{\sqrt{2}}{2}$ E) Answer not given.
6	A geometric sequence has first term 3 and common ratio 2. What is the product of the first 5 terms? A) 128,416 B) 248,832 C) 385,248 D) 642,080 E) Answer not given.
7	All the Pinkney kids save their money and pitch in equally to buy an XCubeDX. If there had been one more kid, each kid would have paid $40 less than they did. If there had been two fewer kids, each kid would have paid $100 more than they did. How many dollars did the XCubeDX cost? A) $8,400 B) $9,000 C) $9,600 D) $10,200 E) Answer not given.
8	What is the lateral surface area, in square meters, of a right square pyramid with a base area of 144 m^2 and a volume of 384 m^3? A) 228 B) 232 C) 236 D) 240 E) Answer not given.
9	On the first leg of his journey, Dierk unicycled 20 miles at a speed of 15 miles per hour, and on the second leg he went 10 miles in 45 minutes. What was his average speed, in miles per hour, over his entire journey? A) 15 B) $\frac{50}{3}$ C) $\frac{72}{5}$ D) 20 E) Answer not given.
10	What is the mean of the median, mode, and range of the data set {5, 67, 8, 90, 6, 71, 67, 86}? A) 50 B) 73 C) 75 D) 80 E) Answer not given.

"Math is Cool" Masters – 2015-16

Sponsored by:

11th & 12th Grade – December 5, 2015

Team Contest

1	At how many points do the graphs of $y = 10\log_{20} x$ and $y = 5\sin \pi x$ intersect?
2	In the data set $\{4, 6, 85, 1, 435, 3, 45, 256, 78, y, z\}$, y and z are integers, and the unique mode is greater than the mean, which is greater than the median. What is the minimum possible value of $y + z$?
3	What is the sum of the three smallest terms of the arithmetic sequence with first term 6 and common difference 5 that are also terms of the geometric sequence with first term 4 and common ratio 3?
4	It is possible to roll two balls into the corner of a rectangular room with vertical walls so that both of them touch the floor, both walls, and the other ball. If one of the balls has a radius of 4 m, what is the largest possible radius, in meters, of the other ball?
5	Quincy and Petra are playing a game in which they take turns rolling a die. The first person to roll a 6 or any number that was already rolled is the winner. What is the probability that the first player eventually wins the game?
6	I have 25 coins in my pocket worth a total of \$4.32. If each coin is either a penny, nickel, dime, or quarter, what is the largest number of nickels I could have?
7	It is currently 10:30 AM on Saturday. What day of the week will it be in one million seconds?
8	Caladrian currency comes in 3 tapple, 5 tapple, and 11 tapple denominations. What is the largest number of tapple that cannot be created using these denominations?
9	If G is the set of all four-digit positive integers with four distinct digits and H is the set of positive multiples of 4 less than 10,000, how many elements are in the set $G \cup H$?
10	Express any solution to the system of equations $r + s + t = 11$, $rst = -72$, and $rs + st + rt = -18$ in the form (r, s, t).

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11th & 12th Grade – December 5, 2015

Pressure Round Contest

1	The point $(4,1)$ is rotated $270°$ clockwise around the point $(-3,-8)$ to point K, which is then reflected across the line $x+y=7$ to point J. What are the coordinates, in the form (x,y), of point J.
2	The Circlotron is a supercollider in the shape of a giant torus. Its cross-sections are circles with radii of 10 m, and the path made by the centers of those circles is a circle with a radius of 10 **km**. Ignoring how they might get it *into* the Circlotron, what is the length, in meters, of the longest rigid pole (assume it has no width) that workers can transport through the Circlotron during a renovation?
3	How many diagonals can be drawn in a convex 20-gon that connect vertices that have at least two other vertices between their endpoints?
4	What is the missing term of the sequence 7, 8, 11, 18, __, 52, 83, 126?
5	What is the tens digit of 27^{27}?

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COLLEGE KNOWLEDGE BOWL ROUND #1 – SET 1

#	Problem	Answer
1	Evaluate the base four logarithm of two-hundred fifty-six.	4
2	Evaluate seven to the fourth power.	2401
3	A right triangle has a hypotenuse measuring seven meters and a leg measuring five meters. What is the length, in meters, of the other leg?	$2\sqrt{6}$
4	Arlo, Bo, and Cindy are in the same very hard math class, and their respective probabilities of passing the class are one-fourth, one-third, and one-half. What is the probability that none of them pass the class?	$\frac{1}{4}$
5	In a right triangle with legs measuring SQUARE-ROOT-FIVE meters and SQUARE-ROOT-ELEVEN meters, what is the sine of the smallest angle?	$\frac{\sqrt{5}}{4}$
6	Evaluate eight-ninths minus three-fourths.	$\frac{5}{36}$
7	When my secret number is increased by 526 and this result is tripled, the final result is 8934. What is my secret number?	2452
8	Express the base three number TWO-ZERO-ONE-TWO-ZERO-ONE as a base ten number.	532
9	What is the surface area, in square meters, of a regular icosahedron with edges measuring six meters?	$180\sqrt{3}$
10	What is the sum of the integers between 8 and 38, inclusive?	713

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COLLEGE KNOWLEDGE BOWL ROUND #2 – SET 2

#	Problem	Answer
1	Convert 200 degrees to radians.	$\frac{10\pi}{9}$
2	72 is 48 percent of what number?	150
3	When a coin is flipped four times, what is the probability that at least one of the first two flips is a head and at least one of the last two flips is a tail?	$\frac{9}{16}$
4	What is the tenth term of a geometric sequence with first term seven and common ratio two?	3584
5	Adam cycles around a half-mile velodrome track at a speed of 20 miles per hour. Tom starts at the same location on the track, but goes the opposite direction at a speed of 10 miles per hour. How many times will they be at the same position as one another in the first 5 minutes of their ride? Do not count the fact that they were together at the start.	5
6	If Q is inversely proportional to the cube of P and P is 12 when Q is 12, what is the value of Q when P is 4?	324
7	If eight liters of a 27 percent acid solution are combined with four liters of a 63 percent acid solution, what percentage of the resulting solution will be acid?	39
8	Express the product of the base five numbers THREE-FOUR and ONE-TWO-ZERO as a base five number.	10130
9	A bag contains three purple marbles and five blue marbles. When two marbles are drawn randomly, what is the probability they are the same color?	$\frac{13}{28}$
10	How many subsets of the one-digit positive integers contain **exactly** one prime number and **at least** two composite numbers?	88

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COLLEGE KNOWLEDGE BOWL ROUND #3 – SET 3

#	Problem	Answer
1	What is the name of a line segment drawn from one vertex of a triangle to the midpoint of the opposite side?	Median
2	If Nancy could paint the room in four hours and Larry could paint the room in six hours, how many **minutes** would it take them to paint the room if they work together?	144
3	When Mr. Pham puts a quadratic of the form X-SQUARED-PLUS-B-X-PLUS-C-EQUALS-ZERO on the board, Tom miscopies the value of C and Cherie miscopies the value of B. If Tom gets roots of 4 and -7 and Cherie gets roots of -2 and 9, what are the roots of Mr. Pham's original equation?	-6, 3 (any order)
4	When the quantity TWO-N-MINUS-THREE raised to the fifth power is expanded and like terms are combined, what is the coefficient of the N-TO-THE-FOURTH-POWER term?	-240
5	Express the base two number ONE ZERO ZERO ONE ONE ONE ZERO ZERO ONE as a base eight number.	471
6	Evaluate **as a decimal**: $67.95 + 2.49 + 84.9$	155.34
7	A bag contains five green marbles and seven yellow marbles. Your friend draws two marbles, looks at them, and tells you that they are the same color. What is the probability that they are both yellow?	$\frac{21}{31}$
8	What is the measure, in degrees, of the smaller angle between the hour and minute hands of a 12-hour analog clock at 8:20 AM?	130
9	What is the measure, in radians, of an angle in the second quadrant has a tangent of SQUARE-ROOT-OF-THREE?	$\frac{2\pi}{3}$
10	What is the missing term (the BLANK) of the sequence 1, 1, 2, 3, 3, 4, BLANK, 5, 6, 27, 7, 8, 81?	9

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COLLEGE KNOWLEDGE BOWL ROUND #4 – SET 4

#	Problem	Answer
1	Evaluate sixty-four raised to the two-thirds power.	16
2	My lucky coin has a $\frac{3}{5}$ probability of showing heads when it is flipped. If I flip it three times, what is the probability it shows heads exactly twice?	$\frac{54}{125}$
3	If the sine of an angle in the third quadrant is negative one-third, what is the cosine of that angle?	$-\frac{2\sqrt{2}}{3}$
4	What is the remainder when 2,498 is divided by 79?	49
5	What is the prime factorization, in exponential form, of 945?	$3^3 \cdot 5 \cdot 7$
6	What is the harmonic mean of 8 and 12?	$\frac{48}{5}$
7	A right circular cylinder with a height of eight meters is inscribed in a sphere with a radius of five meters. What is the volume, in cubic meters, of the cylinder?	72π
8	On average, four chickens can lay six eggs in eight days. On average, how many eggs could six chickens lay in six days?	$\frac{27}{4}$
9	Two numbers sum to 2,835 and differ by 469. What is the value of the larger number?	1652
10	What is the area, in square meters, of an isosceles triangle with sides measuring eight meters and twenty meters?	$32\sqrt{6}$

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COLLEGE KNOWLEDGE BOWL ROUND #5 – SET 5

#	Problem	Answer
1	What is the product of the three complex cube roots of negative eight?	-8
2	How many positive odd four-digit integers are palindromes?	50
3	If each couple must sit next to one another, in how many ways can three couples arrange themselves at a round table?	16
4	What is the sum of the 30 smallest even numbers greater than 40?	2130
5	What is the range of the data set {8, 95, 3, 678, 4, 13, 5, 34, 5, 689, 5, 67}?	686
6	When the digits of a positive two-digit integer are reversed, a new positive two-digit integer is created which is 27 less than the original number. What is the second-smallest possible value of the original number?	52
7	What is the area, in square meters, of a triangle with sides measuring four meters and six meters surrounding a 150-degree angle?	6
8	What is the equation, in slope-intercept (Y-EQUALS-M-X-PLUS-B) form, of the line through the points FOUR-COMMA-NEGATIVE-EIGHT and TWO-COMMA-SIX?	$y = -7x + 20$
9	What is the twentieth term of an arithmetic sequence with a first term of 68 and a common difference of 15?	353
10	What number is 349 less than the product of 83 and 59?	4548

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COLLEGE KNOWLEDGE BOWL ROUND #6 – SET 6

#	Problem	Answer
1	Evaluate three to the negative fourth power.	$\frac{1}{81}$
2	If 2 Hyenas can be exchanged for 9 Giraffes and 8 Frogs can be exchanged for 15 Giraffes, how many Frogs could you get for 300 Hyenas?	720
3	How many deciliters are equivalent to eight kiloliters?	80,000
4	What is the period, in radians, of the function SECANT-OF-EIGHT-X?	$\frac{\pi}{4}$
5	Two polyhedrons are similar. The smaller one has a surface area of 50 m^2 and a volume of 30 m^3. If the larger one has a surface area of 5000 m^2, what is its volume, in cubic meters?	30,000
6	Consider a triangle with sides measuring 6 meters, 10 meters, and 12 meters. When an angle bisector of the largest angle is drawn, what is the length of the shorter segment into which the opposite side is divided?	$\frac{9}{2}$
7	What is the sum of the two-digit perfect squares?	271
8	How many positive integers are factors of 684?	18
9	The student council must consist of two underclasspeople and two upperclasspeople. If four underclasspeople and five upperclasspeople are running for the student council, how many different student councils are possible?	60
10	What is the solution, as an ordered pair in the form S-COMMA-R, of the system of equations TWO-S-PLUS-R-EQUALS-ELEVEN and S-MINUS-THREE-R-EQUALS-NEGATIVE-TWELVE?	$(3,5)$

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High School – December 5, 2015

COLLEGE KNOWLEDGE BOWL ROUND – EXTRA

#	Problem	Answer
1	The vertices of a regular n-gon are labeled from A to V in counter-clockwise order. If a line is drawn through vertex G and the center, what other vertex does it pass through?	R
2	What is the sum of the 20 largest odd numbers less than 50?	600
3	Evaluate seven factorial divided by four factorial.	210

Final Score:

KEY

(Out of 8)

"Math is Cool" Masters -- 2015-16

School: _____ Room # _____ Team # _____

Name: _____ Proctor: _____

High School **Mental Math** – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. ***You may not change or cross out answers once you have written an answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong.*** *Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

	Answer	1 or 0	1 or 0
1	24		
2	3.5×10^3		
3	162		
4	3		
5	$\frac{112}{3}$		
6	$\frac{5}{2}$		
7	242		
8	$\frac{12}{13}$		

Math is Cool" Masters – 2015-16

11th & 12th Grade – December 5, 2015

Final Score:

KEY

Student Name _____

Proctor Name _____ Room # _____

First Score

(out of 20)

SCHOOL NAME _____ **Team #** _____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes – 10 problems – 20% of team score

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	D		
3	A		
4	C		
5	C		
6	B		
7	A		
8	D		
9	C		
10	B		

"Math is Cool" Masters – 2015-16

11th & 12th Grade – December 5, 2015

Final Score: KEY

First Score (out of 10)

SCHOOL NAME _____ **Team #** _____

Proctor Name _____ Room # _____

Team Contest – Score Sheet

TEAM TEST - 15 minutes – 30% of team score

*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 **1 or 0**. Record all answers on the colored answer sheet.*

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	3		
2	-417		
3	239,148		
4	$8 + 4\sqrt{3}$		
5	$\frac{169}{324}$		
6	5		
7	Thursday		
8	7		
9	5915		
10	$(12, 2, -3)$ (any order)		

"Math is Cool" Masters – 2015-16

11th & 12th Grade – December 5, 2015

Final Score: KEY

Proctor Name _____ Room # _____

First Score

SCHOOL NAME _____ **Team #** _____

PRESSURE ROUND - 10 minutes – 5 problems - 5 rounds – 15% of team score

When it is time to begin, you will be handed a packet of five problems. There is a copy of the problems for each team member. Two minutes after the start of the test you are expected to submit an answer for one of the problems (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 problems; its maximum value is two points. This process will continue until all the problems are answered and each consecutive problem'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 problem 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. If a team answers the same question more than once, only the first answer will be scored and the other attempts will be ignored.

Pressure Round Answers

	Answer
1	(8,19)
2	$400\sqrt{10}$
3	150
4	31
5	0

Final Score:

(Out of 8)

"Math is Cool" Masters -- 2015-16

School: _____ Room # _____ Team # _____

Name: _____ Proctor: _____

High School **Mental Math** – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

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

Math is Cool" Masters – 2015-16

11th & 12th Grade – December 5, 2015

Final Score:

Student Name _____

Proctor Name _____ Room # _____

First Score
(out of 20)

SCHOOL NAME _____ **Team #** _____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes – 10 problems – 20% of team score

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			
10			

"Math is Cool" Masters – 2015-16

11th & 12th Grade – December 5, 2015

Final Score:

SCHOOL NAME _____ **Team #** _____

Proctor Name _____ Room # _____

First Score
(out of 10)

Team Contest – Score Sheet

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DO NOT WRITE IN SHADED REGIONS

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