"Math is Cool" Masters – 2012-13

December 1, 2012
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 fraction except in case of problems dealing with money. In the case of problems requiring dollar answers, answer as a decimal rounded to the nearest 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 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 – 2012-13

High School – December 1, 2012
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 regular nonagon with sides measuring eight meters each.
2	What is the sum of the first five terms of the Fibonacci Sequence?
3	Evaluate three to the fifth power.
4	Evaluate one-hundred-one-factorial divided by ninety-nine factorial.
5	What number is twenty percent of eighty?
6	Johnny should have added eight to his number but instead he divided by eight. If he got a result of eighteen, what was the correct sum?
7	What is the area, in square centimeters, of a circle with a circumference measuring twenty-six pi centimeters?
8	What is the absolute value, in degrees, of the difference between the smaller angles formed by the hour and minute hands of a clock at four-twenty PM and two-forty AM?

"Math is Cool" Masters – 2012-13

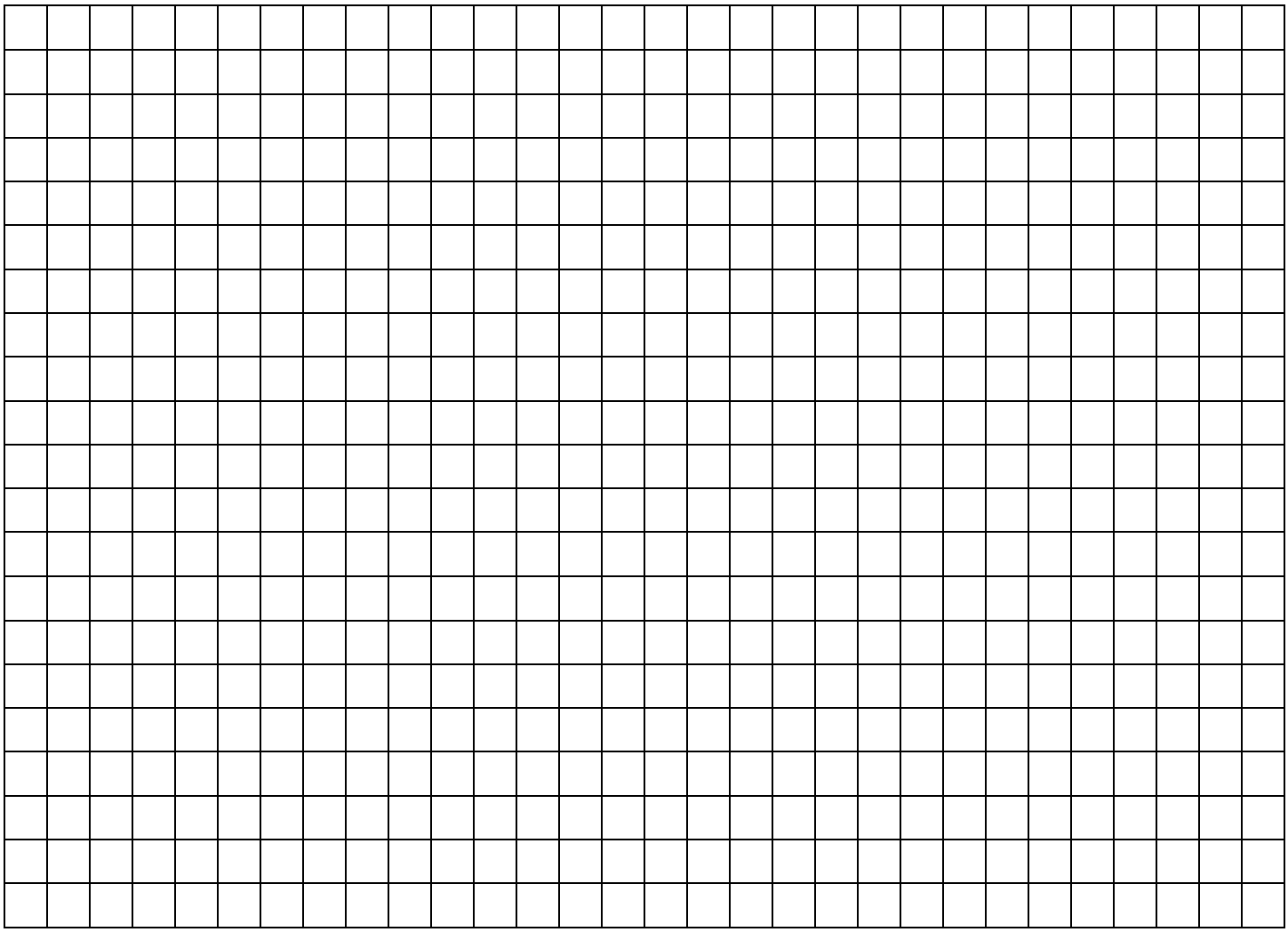
December 1, 2012

Trigonometry 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 – TRIGONOMETRY - 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 – 2012-13

December 1, 2012
TRIGONOMETRY Individual Contest

	Questions 1-30: 2 points each
1	Evaluate: $\frac{2}{3} \div \frac{4}{5}$
2	What is the length of the largest stick that can fit into a box with dimensions of seven feet by twenty-four feet by sixty feet?
3	What area the coordinates, in the form (x, y) of the vertex of the parabola described by $y = x^2 - 4x + 1$?
4	What are the coordinates, in the form (x, y), of the y-intercept(s) of the parabola with equation $y = 4x^2 + 12x + 9$?
5	What is the volume, in cubic centimeters, of a right rectangular prism with edges measuring 8, 11, and 13 cm?
6	A bag contains 3 red and 4 blue marbles. When two marbles are drawn, what is the probability that they are different colors?
7	What is the thirteenth term of an arithmetic sequence with a first term of 14 and a common difference of 15?
8	Express 483.7 in scientific notation rounded to two significant figures.
9	Simplify by combining like terms: $d + 2d^2 - 3d + 4d + 5 - 6d^2 + 7d^2 - 8d + 9$
10	What are the coordinates, in the form (x, y), of the point of intersection of the lines $3x - 5y = 2$ and $2x - 3y = 1$?
11	What is the total surface area, in square centimeters, of a right circular cylinder with a height of 4 cm and a base radius of 11 cm?
12	What is the volume, in cubic centimeters, of a sphere with a diameter measuring 16 cm?
13	A large square is divided into unit squares and the two diagonals of the large square together intersect 21 of the smaller squares. How many unit squares are in the larger square?
14	Evaluate: $\sqrt{25 + \sqrt{25 + \sqrt{25 + \cdots}}}$

15	A right circular cylinder has a base circumference of 1 cm, and a height of 10 cm. A path is drawn from a point on the bottom "edge" of the cylinder to the point on the top "edge" that is directly above the initial point. If the path goes around the cylinder five times, what is the shortest possible length of the path?
16	What is the probability of obtaining 6 heads in 10 tosses of a fair coin?
17	What is the units (ones) digit of $\sum_{n=1}^{10} n!$?
18	For what value(s) of x is $2\lvert x-3\rvert = \lvert x+1\rvert$
19	What is the area, in square centimeters, of an isosceles triangle with sides measuring 10 cm and 25 cm?
20	It takes the five people on the math team of Bakersville High 7 hours to make 9 loaves of garlic bread. How many hours would it take for just 3 people to make 5 loaves? Express as an improper fraction.
21	How many positive integral values of n satisfy the expression: $\sqrt[n]{3} < \sqrt[n]{n} < \sqrt[n]{10}$
22	A goat is tied to an outside corner of a regular hexagonal barn with rope of length 30m, if the length of a side of the barn is 10m what is the total area the goat can graze?
23	A right isosceles triangle with leg of length 1 is constructed. Then upon the first triangle's hypotenuse another isosceles right triangle is constructed. This pattern continues indefinitely. What is the area of the 12^{th} triangle in this pattern?
24	Bertha has 3 pairs of red gloves, 4 pairs of blue gloves, and 5 pairs of black gloves. If Bertha leaves the lights off when she picks gloves, what is the minimum number of gloves must she pick in order to ensure a proper pair?
25	An ant is moving along the circumference of a horizontal circular disk of radius of 8cm at a speed of $\frac{\pi}{2}$ cm/s. At the same times, the disk is rising at a rate of 2 cm/s. What is the distance, in centimeters, between the ant's initial position and its position 8 seconds later?
26	2 liters of 40% ethanol solution are added to x liters of 70% ethanol solution. If the total concentration of ethanol in the solution is 58%, what is the value of x in mL?
27	What is the sum of the positive solutions to the equation: $x^2 + \frac{18}{x^2} = 9$?
28	What is the reflection of the point (1,1) across the line y=x+3?
29	What point, (x,y) on the graph $y = x^2 - 2x + 5$ is closest to the line y=-2?
30	Name the point, in (x,y) notation, on the y-axis with smaller y-coordinate that is five units from the point (2,3).

Challenge Questions: 3 pts each	
31	When a five-card poker hand is dealt at random from a standard 52-card deck, what is the probability it is three of a kind (three of one rank and one each of two other ranks)?
32	Bertha's unicycle has a wheel with radius of $\frac{4}{\pi}$ feet. If she decides to go visit her friend on her unicycle and her friend's house is 552 feet away, then how many revolutions has the wheel made when she arrives at her friend's house?
33	A map turtle sheds its entire topshell over the course of one week, and undergoes a shedding cycle once every 4 months. One shedding cycle produces 9 usable scales, and one can construct an exquisite pseudomap from 231 scales. How many exquisite pseudomaps can be constructed with two years' production from a map turtle farm containing 100 map turtles?
34	What is the fourth term of a harmonic sequence with first term 3 and second term 5?
35	What is the largest possible area, in square centimeters, of a trapezoid inscribed in a semicircle of radius 2 cm?
36	What is the area, in square centimeters, of a square inscribed in a circle with an area of 80π cm^2?
37	What is the greatest number less than 40 that cannot be expressed as the sum of more than one consecutive positive integer?
38	What is $1010_2 + 2020_4 + 3030_8$ in base 16?
39	Evaluate: $\sum_{m=1}^{15} \frac{1}{m^2+3m+2}$
40	Matt's special positive number has the property that the sum of its positive factors is less than twice the positive number itself. If you know that the number is less than 50, then how many possible numbers could Matt's special positive number be?

"Math is Cool" Masters – 2012-13

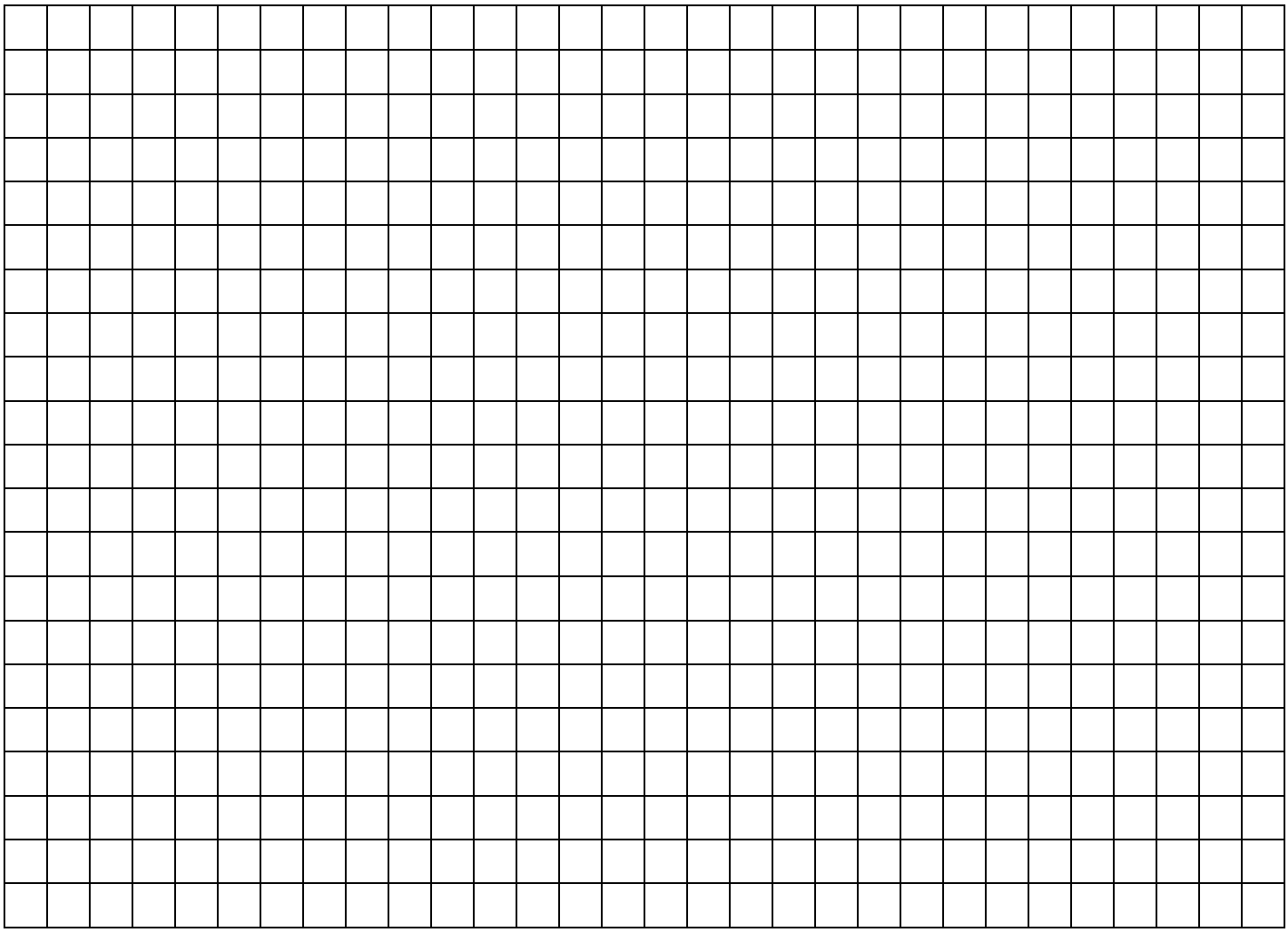
December 1, 2012

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 – 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 – 2012-13

December 1, 2012
CALCULUS Individual Contest

	Questions 1-30: 2 points each
1	Evaluate: $\frac{2}{3} \div \frac{4}{5}$
2	What is the length of the largest stick that can fit into a box with dimensions of seven feet by twenty-four feet by sixty feet?
3	What area the coordinates, in the form (x, y) of the vertex of the parabola described by $y = x^2 - 4x + 1$?
4	What are the coordinates, in the form (x, y), of the y-intercept(s) of the parabola with equation $y = 4x^2 + 12x + 9$?
5	What is the volume, in cubic centimeters, of a right rectangular prism with edges measuring 8, 11, and 13 cm?
6	A bag contains 3 red and 4 blue marbles. When two marbles are drawn, what is the probability that they are different colors?
7	What is the thirteenth term of an arithmetic sequence with a first term of 14 and a common difference of 15?
8	Express 483.7 in scientific notation rounded to two significant figures.
9	Simplify by combining like terms: $d + 2d^2 - 3d + 4d + 5 - 6d^2 + 7d^2 - 8d + 9$
10	What are the coordinates, in the form (x, y), of the point of intersection of the lines $3x - 5y = 2$ and $2x - 3y = 1$?
11	What is the total surface area, in square centimeters, of a right circular cylinder with a height of 4 cm and a base radius of 11 cm?
12	What is the volume, in cubic centimeters, of a sphere with a diameter measuring 16 cm?
13	A large square is divided into unit squares and the two diagonals of the large square together intersect 21 of the smaller squares. How many unit squares are in the larger square?
14	Evaluate: $\sqrt{25 + \sqrt{25 + \sqrt{25 + \cdots}}}$

15	A right circular cylinder has a base circumference of 1 cm, and a height of 10 cm. A path is drawn from a point on the bottom "edge" of the cylinder to the point on the top "edge" that is directly above the initial point. If the path goes around the cylinder five times, what is the shortest possible length of the path?
16	What is the probability of obtaining 6 heads in 10 tosses of a fair coin?
17	What is the units (ones) digit of $\sum_{n=1}^{10} n!$?
18	For what value(s) of x is $2\lvert x-3\rvert = \lvert x+1\rvert$
19	What is the area, in square centimeters, of an isosceles triangle with sides measuring 10 cm and 25 cm?
20	It takes the five people on the math team of Bakersville High 7 hours to make 9 loaves of garlic bread. How many hours would it take for just 3 people to make 5 loaves? Express as an improper fraction.
21	How many positive integral values of n satisfy the expression: $\sqrt[n]{3} < \sqrt[n]{n} < \sqrt[n]{10}$
22	A goat is tied to an outside corner of a regular hexagonal barn with rope of length 30m, if the length of a side of the barn is 10m what is the total area the goat can graze?
23	A right isosceles triangle with leg of length 1 is constructed. Then upon the first triangle's hypotenuse another isosceles right triangle is constructed. This pattern continues indefinitely. What is the area of the 12^{th} triangle in this pattern?
24	Bertha has 3 pairs of red gloves, 4 pairs of blue gloves, and 5 pairs of black gloves. If Bertha leaves the lights off when she picks gloves, what is the minimum number of gloves must she pick in order to ensure a proper pair?
25	An ant is moving along the circumference of a horizontal circular disk of radius of 8cm at a speed of $\frac{\pi}{2}$ cm/s. At the same times, the disk is rising at a rate of 2 cm/s. What is the distance, in centimeters, between the ant's initial position and its position 8 seconds later?
26	2 liters of 40% ethanol solution are added to x liters of 70% ethanol solution. If the total concentration of ethanol in the solution is 58%, what is the value of x in mL?
27	What is the sum of the positive solutions to the equation: $x^2 + \frac{18}{x^2} = 9$?
28	Evaluate: $\sum_{n=2}^{10} (1000_n)$
29	What point, (x,y) on the graph $y = x^2 - 2x + 5$ is closest to the line y=-2?
30	Name the point, in (x,y) notation, on the y-axis with smaller y-coordinate that is five units from the point (2,3).

Challenge Questions: 3 pts each	
31	What is the length, in meters, of the median drawn to the hypotenuse in a right triangle with legs of length 5 m and 12 m?
32	FaceSpace friends Luis and Karina agree to meet at a restaurant for a blind date, but because they're a little nervous about it, they decide that they'll each arrive at a random time between 4 PM and 6 PM, and that they'll each wait 30 minutes for the other, then leave if they haven't met. What is the probability they meet at the restaurant?
33	Let $a_1 + a_2 + \cdots + a_n = 272$ where each term is a positive real number. What is the maximum value of $a_1 \times a_2 \times \ldots \times a_n$? Express your answer as an exponent with a decimal base.
34	What is the fourth term of a harmonic sequence with first term 3 and second term 5?
35	If 8 arachnids are equivalent to 5 beetles or 3 caterpillars and 15 dragonflies are equivalent to 6 earwigs or 2 beetles, how many caterpillars would be equivalent to 100 dragonflies?
36	Evaluate: $\prod_{n=2}^{7}(2n-3)$
37	What is the greatest number less than 40 that cannot be expressed as the sum of more than one consecutive positive integer?
38	What is $1010_2 + 2020_4 + 3030_8$ in base 16?
39	What is the volume of the region in Cartesian space where x, y, and z are positive and $x + y + z < 10$?
40	What is the surface area of a sphere that is circumscribed about a tetrahedron of edge length 2 cm?

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012
Individual Multiple Choice Contest

1	Evaluate: $3! + 2! + 1!$ A) 8 B) 9 C) 12 D) 18 E) Answer not given.
2	How many ways can I make 15 cents using some combination of pennies, nickels, and/or dimes? A) 6 B) 7 C) 8 D) 9 E) 10
3	Stacy and Bertha live at intersections on an infinite grid of streets. Bertha lives 3 streets south and 2 streets west of Stacey's house. Assuming that all streets intersect, how many ways can Bertha take on her unicycle to reach Stacey's house, assuming that she only wants to move towards Stacey's house? A) 6 B) 8 C) 9 D) 10 E) 12
4	What is the area of the ellipse with equation $\frac{(x+1)^2}{4}+\frac{(y-3)^2}{25}=1$? A) 10π B) 16π C) 29π D) 100π E) $10\sqrt{(29)}\pi$
5	A lottery gives money to the first 5 names drawn from a hat. The first person gets twice as much money as the second person; the second get twice as much as the third, etc. If $1240 is to be distributed, how much money does the third person get? A) $155 B) $160 C) $165 D) $170 E) $175
6	Ginger is a man with a crazy beard. His beard grows five inches every morning. Unfortunately, his nemesis, Timbers, cuts off two inches every night while Ginger is sleeping! Timbers uses special scissors that will break when trying to cut beards that are over three feet long. How many days will it take for Timbers' scissors to break and for this madness to stop? A) 11 B) 12 C) 13 D) 14 E) 15

7	The perimeter of a right triangle is 19 and the sum of the squares of the sides is 162. What is the area of the triangle? A) $\frac{21}{5}$ B) $\frac{19}{4}$ C) $\frac{16}{3}$ D) $\frac{11}{2}$ E) 160
8	At the beginning of apple season a farmer can sell his fifteen pounds of apples for ten dollars per pound at the farmer's market. For each week he waits to sell his apples, one pound of apples rots (he can't sell them) but the price of apples increases by one dollar per pound. What is the most money, in dollars rounded to the nearest hundredth (cent), he can make in a single sale? A) 150 B) 154 C) 155 D) 156 E) 160
9	Someone suspiciously knocked over Small's birthday cake! Inspector Butters narrowed it down to three people: Sean, John, and Diddy. One of them always tells the truth, two of them are serial liars, and the culprit always lies. Inspector Butters was able to get one line out of each of the suspects: Sean: John didn't do it. John: Diddy did it. Diddy: Sean didn't do it. Help Inspector Butters out! Who did it? A) Sean B) John C) Diddy D) Sean & John E) None of them
10	Kelsey paints the twelve edge squares of a four-by-four grid of unit squares blue, cuts the squares apart, and randomly reassembles them into a large square again. What is the probability that the resulting large square has twelve blue edge squares? A) $\frac{1}{1820}$ B) $\frac{1}{2160}$ C) $\frac{1}{3844}$ D) $\frac{1}{4680}$ E) $\frac{1}{5760}$

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012
Team Contest

1	What is the value of the discriminant of the quadratic equation $3h^2 + 2h + 5 = 0$?
2	How long will it take a water flow of three cups per second to fill a four gallon container?
3	If I draw a four centimeter line segment, randomly choose a point on it, and then randomly choose a point to the right of the first point, what is the probability that my second point is within one centimeter of the right end of the line segment?
4	In a triangle with sides measuring 3, 5, and 6 cm, how many centimeters long is the median to the 6 cm side?
5	If $f \equiv 3 \bmod 4$ and $f \equiv 5 \bmod 7$, what is the largest possible value of f less than 1000?
6	What is the product of the roots of the equation $3v^3 + 4v^2 + 6v - 7 = 0$?
7	What value(s) of h satisfy $3^{2h} - 90 \cdot 3^h + 729 = 0$?
8	What is the sum of the first five pentagonal numbers?
9	What is the remainder when 314_5 is divided by 1110_4? Express your answer as a number in base 10.
10	A regular octagon is drawn, then three quarters and two dimes are placed on vertices of the octagon (at most one coin per vertex). In how many ways can this be done if rotations and reflections of an arrangement are considered different from one another?

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012
Pressure Round Contest

1	What is the slope of the line perpendicular, at the point where x equals one, to the function y equals the square root of the quantity 2 minus x squared?
2	Trung is counting fruit flies in a lab. In petri dish A, there are two red-eyed fruit flies and one white-eyed fruit fly. In petri dish B, there are four red-eyed fruit flies, two white-eyed fruit flies, and an eyeless fruit fly. Trung randomly takes a fly from dish A and puts it into dish B. He then randomly takes a fly from dish B and puts it back into dish A. After that, he pulls out a fly from dish B. What is the probability it is the eyeless fly?
3	Lore is collected, collated, sorted, and stored in a grand repository within a guarded sanctum. There are three broad categories the lore is sorted into: animal, vegetable, and mineral. However, much of the lore overlaps between these areas, and thus additional sections are set up for every conceivable combination of those sections, in 10% content increments. For example, 20% animal 80% vegetable is different than 30% animal 20% vegetable 50% mineral. Given that no content falls outside the three broad categories, how many total sections are there in total?
4	If $m(n)=2n^2-3n+4$ and $n(p)=2p-5$, what is $m(p)$?
5	In a certain twelve by seven array of LED lights, each LED will turn on one second after an adjacent, not including diagonals, LED is turned on. All LED's start off. If two opposite corner LED's are turned on simultaneously, how many seconds after this will the entire array of lights first be illuminated?

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #1 – SET 1

#	Problem	Answer
1	At a rodeo, an arena contains humans, horses, and cows. If there are a total of one-hundred-fifty feet and forty-seven heads, how many humans are in the arena?	19 [humans]
2	What is the name for a triangle with exactly two congruent sides?	Isosceles
3	Evaluate two [PAUSE] plus three times five [PAUSE] minus eight divided by four.	15
4	What is the sum, in degrees, of the exterior angles of an isosceles trapezoid?	$360[^\circ]$
5	What is the probability of drawing a jack, a red card, and a face card, without replacement, in that order?	$\frac{11}{1326}$
6	Joan and her grandson Gene were both born on the fourth of July. This year and each of the past five years, Joan's age has been a multiple of Gene's age. How old is Joan now, in years?	66 [years]
7	What is the log-base-one-twenty-fifth of one-hundred-twenty-five?	-3/2
8	If B is inversely proportional to Z and B equals 36 when Z equals 24, what is the value of Z when B equals 12?	72
9	What is the cosine of the largest angle in a triangle with sides measuring three, five, and seven meters?	-1/2
10	What is the tens digit of sixteen to the sixteenth power?	1

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #2 – SET 2

#	Problem	Answer
1	What is the sum of the squares of the first four positive odd numbers?	84
2	What is the perimeter, in centimeters, of an equilateral triangle with sides measuring twenty-three centimeters?	69 [cm]
3	What number is twenty-three less than eighty-five?	62
4	What time is just as long after five-forty-three PM as one-seventeen PM is after nine-O-one AM?	9:59 PM
5	What is the area, in square centimeters, of an equilateral triangle with sides measuring twelve centimeters?	$36\sqrt{3}$ [cm^2]
6	What the sum of coefficients when the quantity two-J-minus-three [PAUSE] raised to the fourth power is fully expanded and like terms are combined?	1
7	If three-hundred-twenty-one days before yesterday's tomorrow is a Sunday, then what is the day before two days after tomorrow?	Monday
8	What is the smaller angle, in degrees, formed by the hour and minute hand of an analog clock at four-sixteen AM?	32 [degrees]
9	What is the sum of the twenty smallest positive perfect squares that are not perfect cubes?	3730
10	In how many ways can four identical candy bars be distributed among three kids if fairness is not considered?	15 [ways]

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #3 - SET 3

#	Problem	Answer
1	What is the mean of the data set three [PAUSE] twenty-one [PAUSE] one [PAUSE] negative five [PAUSE] fourteen [PAUSE] eight [PAUSE] and twenty-one?	9
2	Evaluate the negative difference between fifty-three and thirty-seven.	-16
3	What is the area, in square centimeters, of a rectangle with sides measuring twelve by fifteen centimeters?	180 [cm2]
4	Evaluate the sine of seven-pi-over-six.	-1/2
5	What is the sum of the fifth row of Pascal's Triangle, if the first row is the one that consists of a single one?	16
6	What is the volume, in cubic centimeters, of a regular hexagonal pyramid with base edges measuring one centimeter and a height of thirty-three centimeters?	$\frac{33\sqrt{3}}{2}$ [cm^3]
7	A geometric sequence has a third term of three-hundred twenty-four and a common ratio of one-third. What is the tenth term of this sequence?	4/27
8	What is the perimeter, in meters, of a rectangle that has an area of twenty-eight square meters and a diagonal measuring the square-root-of-sixty-five meters?	22 [meters]
9	How many distinguishable three-letter sequences can be formed using the letters in the word BANDANA, spelled B-A-N-D-A-N-A?	43
10	If the log-base-two-of-three is C, express the log-base-nine-of-eighteen in terms of C.	$1+\frac{1}{2C}$ or $\frac{2C+1}{2C}$

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #4 - SET 4

#	Problem	Answer
1	What is the range of the data set three [PAUSE] nineteen [PAUSE] one [PAUSE] negative five [PAUSE] fourteen [PAUSE] eight [PAUSE] fourteen?	24
2	In the Fourth Hotel there are four buildings, each with four suites, each with four pillows, each filled with four-hundred feathers. How many feathers are there?	25600 [feathers]
3	What is the perimeter, in centimeters, of a rectangle with sides measuring thirty-four and eighteen centimeters?	104 [cm]
4	Evaluate seven-hundred-thirty-five times six-hundred-seventy-five.	496125
5	Express pi-over-eight radians in degrees-minutes-seconds form.	22 degrees 30 minutes [0 seconds]
6	What is the product of the harmonic mean and the arithmetic mean of three and four?	12
7	A slushee machine has four different flavors and five different straws. If your slushee experience consists of a straw with any combination of one or more flavors, how many different slushee experiences can you choose?	75
8	What comes next in the sequence beginning one, four, twenty-seven, two-hundred-fifty-six?	3125
9	If an interior angle of a regular polygon is one-hundred-sixty-eight degrees, how many diagonals does the polygon have?	405 [diagonals]
10	What is the largest integer in the range of the function D-of-F-equals-F-minus-the-square-root-of-the-quantity-seventy-nine-minus-F-squared, where the domain and range are both subsets of the real numbers?	8

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #5 - SET 5

#	Problem	Answer
1	If Matt takes two hours to finish a two-hundred-page book, how many **minutes** would it take him to finish a fifty page book at that same rate?	30 [minutes]
2	What is the perimeter, in centimeters, of a square with sides measuring ninety-two cm?	368 [cm]
3	What is the greatest common factor of twelve and twenty-six?	2
4	I draw two balls from a bag of twenty-five red balls and twenty-five green balls. What is the probability they are both green?	12/49
5	In triangle MNP, angle M is thirty degrees, MN is 4, and NP is 6. What is the sine of angle P?	1/3
6	Gertie's age is twelve more than Harold's, but twenty years ago her age was triple his. What is Harold's current age in years?	26 [years]
7	What is the positive difference between the geometric mean and arithmetic mean of eight and fifty?	9
8	April of a certain year has five Saturdays in its thirty days. What day of the week in April of the following year (which is not a leap-year) is guaranteed to occur five times?	Sunday
9	What is the seventh triangular number?	28
10	When the quantity three-minus-two-T is raised to the fourth power and like terms are combined, what is the coefficient of the T-cubed term?	-96

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND #6 - SET 6

#	Problem	Answer
1	What number is five less than the sum of nineteen and thirty-four?	48
2	What is the surface area, in square centimeters, of a cube with edges measuring three centimeters?	54 [cm^2]
3	When a single card is drawn at random from a standard fifty-two-card deck, what is the probability that it is an ace or a six?	2/13
4	What is the sum of the fifty smallest positive even numbers?	2550
5	If eighty-four Igloos are equivalent to thirty-six Jacuzzis, how many Igloos would be equivalent to forty-eight Jacuzzis?	112 [Igloos]
6	Clymerium has a half-life of eighteen seconds. How many grams of a six-thousand-one-hundred-forty-four gram sample will remain after three minutes?	6 [grams]
7	How many ways can one arrange two identical armadillos, two identical baboons, and three identical cheetahs at a circular table with seven equally spaced seats if each set of animals must sit together?	2 [ways]
8	If $\frac{\pi}{2} < \theta < \frac{3\pi}{2}$ and $tan\theta = -3$, evaluate $cos\theta$.	$-\frac{\sqrt{10}}{10}$
9	What is the second perfect number?	28
10	What is the area of the region in the Cartesian Plane bounded by the positive X- and Y-axes and the graph of y-equals-the-square-root-of-the-quantity-nine-minus-X-squared?	$\frac{9\pi}{4}$

"Math is Cool" Masters – 2012-13

High School – December 1, 2012

COLLEGE KNOWLEDGE BOWL ROUND – EXTRA

#	Problem	Answer
1	What is the next term of the sequence beginning three, five, nine, seventeen, thirty-three, sixty-five?	129
2	When four fair coins are flipped, what is the probability that exactly three are heads?	1/4
3	What is the least common multiple of forty and fifty-six?	280
4	Evaluate the logarithm in base four of one-thousand-twenty-four.	5
5	When the point four-COMMA-negative-three is reflected across the line Y-equals-two, what are the coordinates of the new point as an ordered pair?	(4,7)

KEY

(Out of 8)

"Math is Cool" Masters -- 2012-13

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	72		
2	12		
3	243		
4	10100		
5	16		
6	152		
7	169 pi [cm^2]		
8	150 [°]		

KEY
First Score

(out of 20

Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

Student Name_____

Proctor Name_____Room #_____

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

KEY

First Score (out of 10)

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

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	-56		
2	64/3		
3	1/4+1/2(ln2) [or] other forms		
4	$2\sqrt{2}$ [cm]		
5	999		
6	7/3		
7	2,4		
8	75		
9	0		
10	560		

First Score

KEY

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

Proctor Name_____Room #_____

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	1
2	1/8
3	66
4	$2p^2-3p+4$
5	8

(Out of 8)

"Math is Cool" Masters -- 2012-13

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			
2			
3			
4			
5			
6			
7			
8			

First Score (out of 20

Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

Student Name_____

Proctor Name_____Room #_____

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			

First Score

(out of 10)

"Math is Cool" Masters – 2012-13

11th & 12th Grade – December 1, 2012

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			
2			
3			
4			
5			
6			
7			
8			
9			
10			