"Math is Cool" Masters – 2010-11

Sponsored by: EKA Chemicals

11th & 12th Grade – December 11, 2010

Individual Multiple Choice Contest

1	Find all roots of $x^3-7x^2+16x-12$. A) -2, 3 B) -2, 2, 3 C) -3, -2, 2 D) 2, 3 E) Answer Not Given
2	In a certain school on Friday nights 50% of people like to hang out with friends, 30% like to see movies, and 25% like to play sports. 15% like movies and hanging out, 10% like hanging out and sports, and 8% like movies and sports. 6% like all three. How many like none? A) 0% B) 22% C) 28% D) 32% E) Answer Not Given
3	Evaluate $\log_2(10!)$ as a decimal rounded to the nearest tenth if $\log_2 3 \approx 1.6$, $\log_3 5 \approx 1.5$, and $\log_5 7 \approx 1.2$. A) 22.1 B) 22.3 C) 22.6 D) 23.0 E) Answer Not Given
4	The vertices of a regular polygon are labeled alphabetically starting with A. If $\overline{EO}$ passes through the center of the polygon, what is the letter label of the vertex opposite vertex I? A) S B) T C) U D) V E) Answer Not Given
5	When you draw two cards from a standard 52-card deck, what is the probability that they are the same color, the same rank, or both? A) 8/17 B) 25/51 C) 26/51 D) 9/17 E) Answer Not Given
6	X people can fix y machines in z days. How many days will it take x-4 people to fix y+11 machines if x >4? A) $\frac{x}{x+4}+\frac{y}{y+11}$ B) $\frac{zx(y+11)}{y(x-4)}$ C) y$\frac{x-4}{x}$ D) $\frac{(x-4)y}{xz(y+11)}$ E)Answer Not Given

7	In the cryptarithm below, each instance of a particular letter represents the same digit (0-9) and no two different letters represent the same digit (E.g. if one A is 1, all A's are 1 and B cannot be 1). How many possible values can C have? ABC +DAE AFFB A) 1 B) 4 C) 6 D) 9 E) Answer Not Given
8	There exists a point P and a circle O of radius 5. There is a tangent line from P which intersects circle O at point A. There is also a secant line from P which intersects the circle at point B and at point C. Minor arc AB = 60 degrees, and arc AC is 180 degrees. A parallelogram is created using $\overline{PA}$ and $\overline{PC}$ as two of the sides. What is the area of the parallelogram? A) $25\sqrt{3}$ B) $\frac{100\sqrt{3}}{6}$ C) 100 D) $\frac{100\sqrt{3}}{3}$ E) Answer Not Given
9	Solve for x: A triangle has integer side lengths of 4, 11, and x, and has an area of $12\sqrt{2}$. A) 6 B) 9 C) 12 D) 14 E) Answer Not Given
10	Vivek, Matt, and Paul are playing a game with a spinner – you win if you spin your color on your turn, then the remaining two people play for second place. The spinner is 30% Viridian (Vivek's Color), 30% Mint (Matt's Color), and 40% Periwinkle (Paul's Color). Assuming the playing order goes Vivek, Matt, Paul, what is the probability Paul wins and Vivek gets second? A) 12/100 B) 98/353 C) 980/6001 D) 147/1064 E) Answer Not Given

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Team Contest

1	Find the sum of the mean, mode, median, and range of the data set {5, 11, 3, 9, 5, 8, 15}.
2	If $a(b) = 2b + 3$ and $c(d) = 4d^2 - 5$, evaluate $c(a(-6))$.
3	What is the area of a triangle whose vertices are at (5,2), (3,7) and (12,5)?
4	What is the sum of the number of days in December, the number of faces on a right hexagonal prism, and the number of diagonals that can be drawn in a convex septagon?
5	Miya and Harshini baked cookies for their class, but somehow miscounted. They baked 38 cookies for 35 people. If they make sure each person gets at least one, in how many ways can they distribute the cookies?
6	*A* is an arithmetic sequence, *G* is a geometric sequence, and the terms of the sequence S are defined as $S_n = A_n + G_n$. If $S_1 = 5743$, $S_2 = 5280$, $S_3 = 5137$, and $S_4 = 5234$, what is the value of S_5?
7	What is the area, in square units, of the triangle with vertices at the vertex and x-intercepts of the parabola with equation $y = 2x^2 - 10x - 28$?
8	In each round of a certain game, two players take turns rolling a standard six-sided die. On the *n*th turn, a player scores $n!$ if the die shows a number less than or equal to *n* on its top face, at which point a new round begins. What is the expected number of points that the first roller in a round will gain relative to the second roller in the round? If the second roller has the advantage, your answer will be negative.
9	What is the smallest positive integer that has the property that the product of all of its positive factors is 21952?
10	A cone with a base radius of 5 cm and a height of 12 cm is inscribed in a sphere. What is the diameter, in centimeters, of the sphere?

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Pressure Round Contest

1	WSU and UW have entered a fundraising competition. When losing, WSU raises $46/day, and otherwise they raise $35/day. UW raises $42/day when losing, and $38/day otherwise. If each school only finds out the new rankings at the end of each day, how many more dollars does the UW have after 8 days? (Being tied is not considered losing).
2	Quinn has made a hot-or-not list ranking 8 of her friends from best to worst with no ties. She is considering editing the list, and is willing to change each person's rank by +/- 1 from the original list but no more than that (still avoiding ties). How many possibilities are there for her final list?
3	How many 8-digit strings of 1s and 0s exist such that any instance of "010" is immediately followed by "01?"
4	King Kong is hungry. Every time the natives feed him, they offer five humans. The probability of King Kong eating any given limb is 30% (assume all humans have 4 limbs). Given that the natives come to sacrifice people six times, what is the expected number of limbs that King Kong will have consumed?
5	Figure P is described by the equation $17x^2+26x+4y^2-28y-369=162+20y+176x-8x^2$. The circle O is the largest circle internally tangent to P at two points and the circle Q is the smallest circle externally tangent to P at two points. What is the area, in units squared, inside O plus the area outside P but inside Q?

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11th & 12th Grade – December 11, 2010

Mental Math Contest

PERSON 1		
1.1	What is the sum of thirty-four and fifty-seven?	91
1.2	What is the volume, in cubic meters, of a right circular cylinder with a base radius of three meters and a height of three meters?	27π [m^3]
1.3	Sixteen people begin a ping-pong tournament. After the first round of eight games, the winner of each game shakes the hand of the loser, who is no longer in the tournament. A new round of four games then occurs, continuing in this manner until there is a single winner of the final game. How many handshakes occur during the tournament?	15 [handshakes]
1.4	If there are three quacks in four chirps, and five chirps in seven tweets, how many quacks are in fifty-six tweets?	30 [quacks]
PERSON 2		
2.1	What is the quotient when one-hundred twenty is divided by five?	24
2.2	When the secret number is doubled and this result is reduced by seven, the final result is twenty-five. What is the secret number?	16
2.3	How many distinct ways are there to arrange the letters in the word FLUFFY, spelled F-L-U-F-F-Y?	120 [ways]
2.4	A right triangle with legs of six and eight inches is inscribed in a circle. What is the area, in square inches, of the circle?	25π [in^2]
PERSON 3		
3.1	What is the difference between ninety-eight and sixty-nine?	29
3.2	If four X plus nine is equal to eighty-five, what is the value of X?	19
3.3	A famous sequence begins with a first term of one and a second term of one, then continues with each subsequent term being the sum of the two previous terms. What is the sum of the first six terms of this sequence?	20
3.4	A cockroach wants to climb from one corner of a cube to the farthest corner. Given that the side length of the cube is five inches, how many inches are in the shortest route it could take?	$5\sqrt{5}$ [in]
PERSON 4		
4.1	What is the product of fourteen and eight?	112
4.2	Hershey is packing for a trip. She can match any shirt with any skirt to make an outfit. She needs to have a total of eighteen different outfits, and each item of clothing is unique. If she plans to take twice as many shirts as skirts, what is the fewest number of articles of clothing she will need to pack?	9
4.3	What is the sum of the infinite geometric series whose first term is twenty-seven and whose fourth term is one?	81/2
4.4	Two sides of a triangle have lengths of three and ten. What is the sum of all possible integer values for the third side?	50

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COLLEGE KNOWLEDGE BOWL ROUND #1 – SET 1

#	Problem	Answer
1	Evaluate the sum of one factorial, two factorial, three factorial, and four factorial.	33
2	What is the slope of the line through the points fifteen COMMA negative nine and ten COMMA eleven?	-4
3	A right triangle has a hypotenuse measuring twelve meters and a leg measuring eight meters. What is the length, in meters, of the other leg?	$4\sqrt{5}$ [m]
4	How many three-digit positive EVEN integers contain only EVEN digits?	100
5	The probability that James gets this problem correct is $\frac{1}{3}$, while the probability that Tom gets this problem correct is $\frac{3}{4}$. What is the probability that exactly one of them gets this problem correct?	7/12
6	In a five-element data set of integer test scores from zero to one-hundred inclusive, the mean is thirty-seven, the unique mode is fourteen, and the median is thirty-one. What is the largest possible value of the range?	80
7	The sum of the digits of Mikey's favorite counting number is half of his favorite number. How many numbers fulfill this criterion?	1 [number]
8	The Apple Store in Seattle has ten white iPads to sell. How many ways are there to distribute these iPads amongst six people, given that each person gets at least one iPad?	126 [ways]
9	What is the fifth term of the geometric sequence with first term four and fourth term one-thousand three-hundred seventy-two?	9604
10	The Brown crew team is racing Harvard. With every stroke, Brown moves eight and one-third meters, and takes thirty strokes every minute. Harvard moves seven and one-half meters every stroke and takes thirty-two strokes every minute. In a two-thousand-meter race, which team wins and by how many seconds?	Brown, 20 [seconds]

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COLLEGE KNOWLEDGE BOWL ROUND #2 - SET 2

#	Problem	Answer
1	Evaluate thirty-four squared minus twenty-six squared.	480
2	What is the smallest root of the quadratic equation three X-squared minus five X minus two equals zero?	[x=] -1/3
3	How many isosceles triangles have sides measuring integer numbers of meters and perimeters equal to nineteen?	5 [triangles]
4	What is the units digit when thirteen is raised to the one-hundred seventy-fifth power?	7
5	When one card is drawn from a standard fifty-two card deck, what is the probability that the card is a club or an eight (or both)?	4/13
6	What is the sixteenth term of an arithmetic sequence with a tenth term of eighty-four and a sixth term of one-hundred?	60
7	A right circular cone and a sphere share the same radius. If the two shapes both have a volume of two-hundred eighty-eight PI cubic feet, what is the height of the cone, in feet?	24 [feet]
8	Tarzan is climbing a forty-two-foot vine. He looks down at Jane, who is on the ground, after every five feet he climbs. Whenever he does this, he slides down two feet. How many total feet has Tarzan climbed when he reaches the top?	68 [feet]
9	Adam paints house numbers during the summer. He paints every ODD digit red and every EVEN digit white. If one day he starts with house number seventeen and paints through every integer house number up to and including one-hundred twenty-one, what is the positive difference between the number of red digits and white digits he paints?	24
10	Humphrey the Hippo and Randolph the Rhino each arrive at the watering hole between TWO PM and THREE PM. If they each pick a random time to show up, stay for ten minutes, then leave, what is the probability they will meet at the watering hole?	11/36

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COLLEGE KNOWLEDGE BOWL ROUND #3 - SET 3

#	Problem	Answer
1	What number is one-hundred thirty-eight less than the product of fifteen and sixteen?	102
2	What is the distance between the points four COMMA negative three [PAUSE] and negative six COMMA negative twenty-seven?	26
3	What is the surface area, in square meters, of a right rectangular prism with edges measuring two, four, and seven meters?	100 [m^2]
4	What is the total amount of interest earned in a year if one-thousand dollars is invested at a rate of twenty percent annual interest compounded quarterly? Answer in dollars rounded to the nearest hundredth (cent).	[$] 215.51
5	What is the sum of the positive ODD integers less than 30?	225
6	When two fair six-sided dice are rolled, what is the probability that the numbers on their upper faces sum to fourteen?	0
7	I paint the faces of a four-by-four-by-four cube with green paint. I then break the cube up into unit cubes. What is the ratio of the number of unit cubes with exactly two faces painted green to unit cubes with exactly three faces painted green? Say answer in the form of a to b.	3 to 1
8	If three days before the day before yesterday is the same day of the week as the day after tomorrow, and twenty-four days before tomorrow was a Tuesday, what day will it be twelve days after yesterday?	Monday
9	The set of digits four, two, eight, D, eight, one, four, two, where D is some digit, can be arranged in one-thousand six-hundred eighty ways. What is the sum of ALL possible values for D?	14
10	How many non-real roots are there to the equation two-X-to-the-fourth-power minus four-X minus seven?	2

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COLLEGE KNOWLEDGE BOWL ROUND #4 - SET 4

#	Problem	Answer
1	Evaluate four-ninths plus five-sixths.	23/18
2	What is the largest possible difference between a positive three-digit number and the positive three-digit number that results when the order of the digits is reversed?	792
3	What is the measure, in degrees, of an interior angle of a regular pentagon?	108 [°]
4	Coolium has a half-life of fifteen minutes. How many grams of an eight-hundred-gram sample will remain after an hour?	50 [g]
5	In a particular recursive sequence, each term is seven less than twice the previous term. If the fifth term is twenty-three, what is the second term?	9
6	How many positive integers are factors of ninety-six?	12 [integers]
7	April and June are each eating a watermelon. They notice that the total number of seeds is a perfect square, and the numbers of seeds in each watermelon are also perfect squares. If a watermelon can have no fewer than ten seeds, and no more than one-hundred, how many total seeds are there?	100 [seeds]
8	In a group of thirty people, eighteen people like ninjas, thirteen like pirates, and twelve like aliens. Five people like both ninjas and pirates, four like both pirates and aliens, and seven like both aliens and ninjas. Assuming all thirty like at least one of the three rivals, how many people like all three rivals?	3 [people]
9	How many integers between two-hundred fifty and one-thousand twenty inclusive are multiples of two or three (or both)?	514 [integers]
10	Mitchell builds a zip line between a platform and a tree, where the angle between the zip line and the tree is forty-five degrees. If Mitchell accelerates towards the tree at five meters per second squared, and hits the tree at a velocity of twenty-five meters per second, what is the horizontal distance, in meters, between the tree and the platform?	$125\sqrt{2} / 4$ [m]

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COLLEGE KNOWLEDGE BOWL ROUND #5 - SET 5

#	Problem	Answer
1	Evaluate negative four times the quantity negative eight minus negative three.	20
2	What is the measure, in degrees, of the acute angle between the hands of a standard twelve-hour clock at four-forty PM?	100 [°]
3	What is the volume, in cubic meters, of a right square pyramid with a height measuring four meters and base edges measuring six meters?	48 [m^3]
4	Evaluate the logarithm in base nine of two-hundred forty-three.	5/2
5	What is the sum of the terms of an infinite geometric sequence with a first term of twenty-four and a common ratio of two-fifths?	40
6	How many elements are in the set of four-digit numbers that do not contain a six?	5832
7	Jimmy and Suman are competing to write the most problems. Jimmy writes a problem every minute and Suman writes three problems every minute. If they need a total of forty questions, how many more problems will Suman have written than Jimmy when they finish?	20 [problems]
8	Gertrude the Grazing Gazelle is tethered by a twelve-foot rope to the corner of a rectangular barn with dimensions of sixteen feet by ten feet. What is the total area, in feet squared, in which Gertrude can graze?	109 pi [ft^2]
9	Bartholomew the Bouncing Bat falls from a height of thirty-six feet. For the first two bounces, he rebounds to two-thirds of the height of his last fall. After that, he rebounds to only half of his previous height. Assuming he continues to bounce indefinitely, what is the total distance he will travel in feet?	148 [feet]
10	Laverne the Lilliputian Lumberjack cuts a sixteen-foot long log into three pieces with her mighty axe. What is the probability that the three pieces can form a triangle?	1/4

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COLLEGE KNOWLEDGE BOWL ROUND #6 - SET 6

#	Problem	Answer
1	What number is the cube root of nine-thousand two-hundred sixty-one?	21
2	If Zelig is ten years older than Yessica, and Yessica will be fifteen in four years, how many years old will Zelig be in nine years?	30 [years]
3	A cow is tied to an external corner of a rectangular barn using a rope that is twenty meters long. If the barn measures thirty meters by forty meters, what is the area, in square meters, that the cow can graze?	300π [m^2]
4	Given that "I" is the square root of negative one, what is the result when the quantity two "I" is squared, the quantity three "I" is cubed, the quantity four "I" is raised to the fourth power, and these results are added to one another?	$252-27i$
5	What is the least common multiple of eight and fifty-two?	104
6	When four fair coins are flipped, what is the probability that exactly three of them show heads?	1/4
7	Sam and Hayley are playing golf, hitting through a bucket of twenty-four balls. Hayley starts and takes thirty seconds per swing, but only hits every third swing. Sam takes forty-five seconds per swing and hits every ball. Assuming they trade off after every swing and one of them is swinging at all times, how many minutes will it take them to finish the bucket? Express your answer as a decimal.	22.5 [min]
8	A right triangle with legs of lengths eight inches and fourteen inches is inscribed in a circle. What is the area of the circle in square inches?	65 pi [in^2]
9	Jay-Z has a number of problems that is directly proportional to the amount of money he has. The amount of money he has is inversely proportional to the number of gardening tools he has. Last year he had ninety-nine problems, thirty-three million dollars, and sixty gardening tools. If this year he has twenty gardening tools, how many problems does he have?	297 [problems]
10	A point at the coordinates one-COMMA-square-root-of-three is reflected across the Y-axis. What is the length of the arc formed by then rotating this new point counterclockwise about the origin to the X-axis? Express your answer in terms of PI.	2pi/3 [un]

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COLLEGE KNOWLEDGE BOWL ROUND - EXTRA

#	Problem	Answer
1	Sisyphus is pushing a rock up an eighty-foot hill. Every time he reaches the top of the hill, the rock rolls back down, taking with it one foot of dirt the first time, one foot the second time, two feet the third time, three feet the fourth time, five feet the fifth time, and so on. How many times does Sisyphus have to push the rock up the hill?	9 [times]
2	Bella is standing on the top left corner of a five by eight grid of squares. How many paths along the gridlines can she take to get to Edward at the bottom right of the grid, given that she can only travel down or to the right?	1287 [paths]
3	In how many ways can a two-unit-by-two-unit rectangle be exactly covered by non-overlapping rectangles with integer side lengths? For example, one way to exactly cover the rectangle would be to put a two-unit-by-one-unit rectangle on the left side and two one-unit-by-one-unit rectangles on the right side.	8 [ways]

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School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score:

KEY

First Score

(out of 20)

INDIVIDUAL MULTIPLE CHOICE - 15 minutes – 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	D		
2	B		
3	A		
4	A		
5	D		
6	B		
7	C		
8	D		
9	B		
10	C		

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Final Score:

KEY

School Name_____Team #_____

Proctor Name_____Room #_____

First Score

(out of 10)

STUDENT NAME_____

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	33		
2	319		
3	41/2		
4	53		
5	7770		
6	5511		
7	729/4 [un^2]		
8	-271/54		
9	28		
10	169/12 [cm]		

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Final Score:

KEY

First Score

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

PRESSURE ROUND - 10 minutes – 15% of team score

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	[$] 3
2	34
3	131
4	36 [limbs]
5	171π [un^2]