"Math is Cool" Masters – 2010-11

Sponsored by: EKA Chemicals

December 11, 2010

High School Individual Contest

Algebra 2, PreCalculus, Calculus

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

GENERAL INSTRUCTIONS applying to all tests:

- *Good sportsmanship is expected throughout the competition by <u>all</u> involved. Bad sportsmanship may result in disqualification.*
- *Calculators or any other aids may not be used on any portion of this contest.*
- *Unless stated otherwise:*
  - *For problems dealing with money, a decimal answer should be given.*
  - *Express all rational, non-integer answers as reduced common fractions.*
- *All radicals must be simplified and all denominators must be rationalized.*
- *Units are not necessary unless it is a problem that deals with time and in that case, a.m. or p.m. is needed. 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 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 also be scored as a 0.*

INDIVIDUAL TEST - 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 – 2010-11

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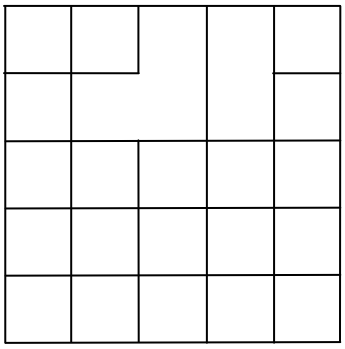
December 11, 2010

High School Individual Contest: Algebra 2, PreCalculus, Calculus

	Questions 1-30: 2 points each
1	Evaluate: $2+3\cdot 4-(5+7)\div 6$
2	What number is 45% of 60?
3	Evaluate: $98.7+654.32$ Express answer as a decimal.
4	Evaluate: $962\div 37$
5	What are the coordinates, in the form (x,y), of the point of reflection of the point $(-1,9)$ across the line $x=4$?
6	If Zavien drives at a speed of 90 kilometers per hour for seven hours, how many kilometers does he travel?
7	What value of *b* satisfies the equation $8b-41=111$?
8	What is the measure, in degrees, of an angle supplementary to an angle of $58°$?
9	How many diagonals can be drawn in a convex octagon?
10	What is the total surface area, in square centimeters, of a cube with edges measuring nine centimeters?
11	What is the length, in meters, of the circumference of a circle with a radius of four meters?
12	Evaluate: $\log_2 32$
13	How many of the numbers below are divisible by six? 9 12 73 188 477 828 2340 3986 6542 9996
14	When I ask the 37 students in my class what pizza topping(s) they like, 14 say pepperoni and 28 say mushrooms. If 11 said both of those toppings, how many said neither?
15	What is the sum of all the positive two-digit numbers less than 50?
16	Express $\sqrt{5000}$ in simplest radical form.
17	Express 234.5 in scientific notation.

18	Two numbers sum to 95 and differ by 37. What is the value of the smaller of the two numbers?
19	I have three positive integers, x, y, and z. If x is greater than 3, y is greater than 6, z is greater than 5, and x + y + z = 75, how many possible combinations of x, y, and z exist?
20	At Suman's Family Farm, Danny the Dog barks every 14 minutes and Daisy the Dog barks every 21 minutes. If Danny and Daisy both bark at 1:00 PM, how many times between noon and midnight that day will they bark together?
21	A rowboat is comprised of 4 starboard-side rowers and 4 port-side rowers. Coach Murphy has 2 starboard rowers, 3 port rowers, and 5 rowers who can row either side. How many different combinations of people can Coach Murphy choose for his rowboat?
22	Miya and Harshini are trying to bake cookies. With any given batch of cookies, there is a 90% chance they will be successful. After how many batches is the probability that all of them have been successful less than $\frac{1}{2}$?
23	Evaluate the area of a triangle with vertices at coordinates (3, 18), (-2, 4), and (0, -16).
24	What is the sum of all integer values of x satisfying $x^2 \equiv 216 \bmod (2x^2 + 3x)$? Assume that only positive integers can be bases for modular arithmetic.
25	In Camelot, a person is either a knight or a knave. Knights always tell the truth and knaves always lie. Albert, Barty, and Cornelius live in Camelot. Between Albert, Barty and Cornelius, how many are knaves if they make the following statements? Albert: "Cornelius is a knight." Barty: "If Albert is a knave, Cornelius is a knight." Cornelius: "Exactly one of Albert and Barty is a knight."
26	I have two urns. Urn A contains 4 blue marbles and 6 red marbles. Urn B contains 4 red marbles and 5 blue marbles. I take one marble from Urn A and place it in Urn B, then take one marble from Urn B and place it in Urn A. What is the probability that Urn A now contains more blue marbles than Urn B, as a fraction?
27	Suzanne, the medium, spends her 10-hour work day helping ghosts and ghouls one at a time without taking a break. When she is helping a ghost, there is a 30% chance it requires a half hour, and a 70% chance it needs a full hour. For ghouls, 40% require a half hour and 60% require a full hour. If 80% of the creatures she meets are ghosts and the other 20% are ghouls, how many creatures can she expect to help each day? Round your answer to the nearest whole number.
28	Mitchell can swim 2 kilometers (km) per hour and Jimmy can swim 3 km per hour. They start swimming toward each other at opposite ends of a 15 km lake. A bird keeps flying from one to the other at a rate of 23 km/hr. How many kilometers does the bird fly before Jimmy and Mitchell meet?
29	Lily is flying home, and has 4 individual flights in her trip. She has an 80% chance of making each flight. If she misses a flight, her travel will take 1 hour more per remaining flight (missing flight #1 adds 4 hours, flight #2 adds 3, etc), but she is guaranteed to make the rest of her flights. How many extra hours should Lily's parents assume her travel will take due to missed flights? Express your answer as a decimal rounded to the nearest tenth of an hour.
30	Evaluate: $(3 + 2i)^5$. Express your answer in a + bi form.

Challenge Questions: 3 pts each

31	In the data set {31, 17, 43, 53, 23, x, y} of integer test scores between 0 and 100 inclusive, there is a single mode which is greater than the median. What is the smallest possible value of the mean?
32	Three distinct circles of radius 6 meters are mutually externally tangent. A fourth circle is drawn tangent to each of the first three circles and containing all of the first three circles. What is the radius, in meters, of the fourth circle?
33	How many positive four-digit integers contain exactly three different digits?
34	Two balls with radii of 24 cm are rolled into a corner of a room so that each touches the floor, a wall, and the other ball. A third ball of the same radius is then stacked on top of the other two so that it touches both lower balls and both walls. How many centimeters is the top of the third ball above the floor?
35	Arrange the following letters in increasing order: $R = 2^{3^4}$, $S = 3^{4^2}$, $T = 3^{24}$, $U = 2^{43}$, $V = 4^{32}$, $W = 4^{2^3}$
36	What is the sum of the 33 smallest positive perfect cubes that are not perfect squares?
37	In how many ways can ten identical pieces of candy be distributed among four children if no child may have more than twice as much candy as any other child?
38	Set P is the set of all two-digit positive integers that can be expressed as the ***product*** of distinct one-digit positive integers. Set S is the set of all two-digit positive integers that can be expressed as the ***sum*** of distinct one-digit positive integers. How many elements are in the set $P \cup S$?
39	The figure shows an array of unit squares with some missing line segments. How many rectangles that are not squares exist in this figure? 
40	A hen lays an egg every two days, and all eggs hatch into hens (ready to lay their first eggs in two days) three days after they are laid. If you have four hens one of which hatched today, yesterday, and each of the two previous days, and you just collected and ate any eggs laid today, how many hens will you have in two weeks? To clarify, one day from today, you'll have four hens and two eggs that will hatch in three days. Two days from today, you'll have four hens and four eggs, pairs of which will hatch in two or three days. Three days from today, you'll have four hens and six eggs, pairs of which will hatch in one, two, or three days. Four days from today, you'll have six hens and six eggs, pairs of which will hatch in one, two, or three days.

"Math is Cool" Masters – 2010-11
PreAlgebra, Algebra & Geometry

December 11, 2010
Individual Contest

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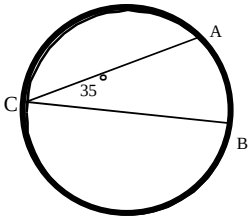
"Math is Cool" Masters – 2010-11

PreAlgebra, Algebra & Geometry

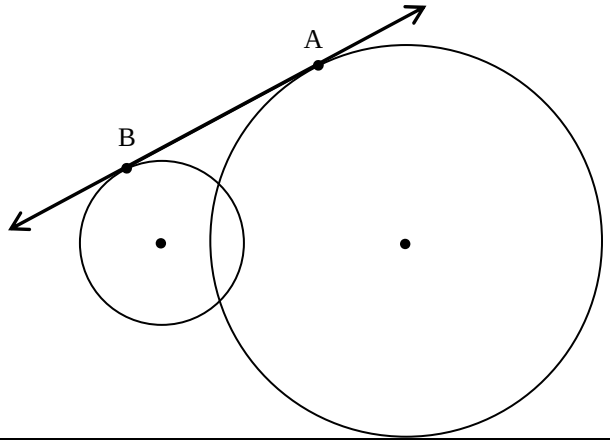
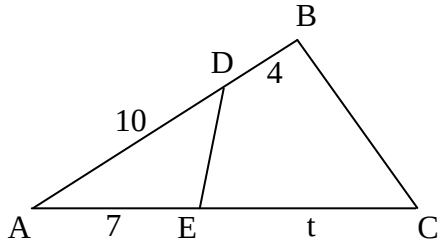
December 11, 2010

Individual Contest

Questions 1-30: 2 points each	
1	Find the following sum: $832 + 721 + 129 + 678$
2	Simplify and evaluate: $5 + 3(2 - 7(5 - 11)) - 2 + 5$
3	Write $\frac{11}{16}$ as a decimal rounded to two decimal places.
4	Find $\frac{6}{7}$ of 48. If your answer is not a whole number, express it as an improper fraction.
5	Evaluate: xy + 2m if x = 2, y = 4 and m = 3.
6	210 is increased by 25%. What is the resulting number? If your answer is not a whole number, express your answer as a decimal.
7	Simplify by adding like terms: $3a^2b^3 - 5aabb^2 + 7a^2bbb$
8	What is the least common multiple of 16, 15 and 21?
9	Evaluate: $a^2 + b^2$ when a = -2 and b = -3
10	Evaluate: $\sqrt[3]{125}$
11	The area of a trapezoid is 48 square units. What is the height of the trapezoid if the two bases are 10 and 22 units in length?
12	What is the slope of the line 3x + 4y = 2?
13	Find the measure, in degrees, of minor arc AB. The measure of angle ACB is 35°. 
14	The length of one leg of a right triangle is 9ft and the length of its hypotenuse is 15 feet. What is the length in feet of the other leg?
15	The length of one diagonal in a rectangle is 11 inches. What is the length in inches of the other diagonal?

16	On a certain UN subcommittee, Ghana has one member, Portugal has two, and Saudi Arabia has three. When they preside over a meeting, they sit in a row, with all members from a country sitting next to each other. In how many ways can they do this?
17	How many positive integer factors of 84 are also factors of 120?
18	Solve for x: $3 - 2(5x - 3) + 2 = 5(7 - 3x) + 1$
19	A quadrilateral with sides measuring 4, 5, 6, and 7 m has an area of 18 m^2 and is similar to a second quadrilateral with two sides measuring 9 and 6 m. What is the area, in square meters, of this second quadrilateral?
20	If $3a + 2b = 7$ and $5a - 3b = -1$ then find the value of $a + b$.
21	Factor: $x^2 + 16x - 17$
22	How many distinguishable arrangements are there for the letters in "LEFFEL"?
23	Find the median of the following data set. {2, 11, 5, 17, 55, 3, 5, 10, 12}
24	Express the positive difference between the base-seven numbers 4213_7 and 1234_7 as a base-seven number.
25	How many cubic inches are in 15 cubic feet?
26	Find the equation in slope-intercept form of the line passing through (-3,2) and (2, 12).
27	A researcher visits a pond and captures and marks 20 fish. On a return visit the next day, the researcher captures 32 fish, and 10 of them are marked from the previous day. Estimate the number of fish in the pond.
28	How many ways can you choose three people, from a group of seven people, to rake leaves?
29	The circumference of a circle is 16π in^2. What is the number of square inches in the area of the circle?
30	Evaluate: $64^{\frac{2}{3}}$

Challenge Questions: 3 pts each

31	What is the third term of a harmonic sequence with a first term of 8 and a second term of 5? A harmonic sequence is one where each term is the reciprocal of the corresponding term of an arithmetic sequence.
32	You are currently at the point (1, 3) in the Cartesian plane, and wish to travel to the point (-2, 7) by making exactly seven one-unit steps, each of which is either horizontal or vertical. How many paths could you follow?
33	A set of twelve nonnegative integers has a median of 8, a mode of 3, and a mean of 9. What is the greatest possible range for the data set?
34	When $(4u-3)^5$ is expanded and like terms are combined, what is the coefficient of the u^2 term?
35	A circle with radius 5 cm overlaps a circle with radius 12 cm so that their centers are 13 cm apart. A line is drawn tangent to both circles as shown. What is the length of segment AB, in centimeters? 
36	In the figure shown, where $m\angle ADE = m\angle ACB$ and all given lengths are in meters, what is the value of t? 
37	In a certain card game, you pay \$3 to draw one card. If it is a spade, you get \$10. If it is any other suit, you get \$1. What is the expected number of dollars you would gain by playing this game? Express your answer as a decimal rounded to the nearest hundredth (cent). If you would expect to lose money, your answer should be negative.
38	How many even factors does the number 2310 have?
39	Evaluate: $\cfrac{4}{5+\cfrac{4}{5+\ldots}}$
40	Donna picks a random weekday (Monday through Friday) in July or August to go to the dentist. As a reduced fraction, what is the greatest probability for any possible year that she will go to the dentist on a Monday?

"Math is Cool" Masters – 2010-11

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9th & 10th 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: $\log_5(64)\cdot\log_2(343)\cdot\log_3(625)\cdot\log_7(243)$ A) 30 B) 341 C) 360 D) 852 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	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

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	What is the sum of the prime numbers less than 30? A) 129 B) 130 C) 133 D) 138 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	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

"Math is Cool" Masters – 2010-11

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9th & 10th Grade – December 11, 2010

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	Electricity-eating bugs are arriving to feast at a 240 volt wall outlet. If the first bug consumes 5 volts, and each succeeding bug consumes twice the number of volts as its predecessor, after how many bugs will the consumption have first exceeded the 240 volt capacity of the outlet?
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 8000?
10	A polyhedron has at least one triangular face and at least two quadrilateral faces. What is the least possible number of faces on this polyhedron?

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9th & 10th Grade – December 11, 2010

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	Evaluate: $\prod_{d=1}^{10} d^{(-1)^d (6-d)}$
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	If $a+2b+3c=42$ and $2a-5b+6c=21$, evaluate $3a+7b+9c$.

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9th & 10th 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	A family is driving twelve-hundred miles to Disneyland at a speed of sixty miles per hour. If they have already driven three-hundred miles, how many more hours must they drive?	15 [hrs]
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	What is the surface area, in square meters, of a right rectangular prism with dimensions of one meter, two meters, and four meters?	28 [m^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 cow is tethered to an external corner of a rectangular barn with a rope. If the barn measures forty meters by sixty meters and the rope is twenty meters long, what is the area, in square meters, that the cow can graze?	300π [m^2]
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 numbers sum to ninety-four and differ by seventy. What is the smaller number?	12

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9th & 10th Grade – December 11, 2010

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 five white iPads to sell. How many ways are there to distribute these iPads amongst three people, given that each person gets at least one iPad?	6 [ways]
9	What is the sum of the infinite geometric sequence with initial term eleven and fourth term the fraction eight over one-hundred twenty-one?	121/9
10	A pair of tetrahedral dice numbered from one to four is rolled and three coins are flipped. What is the probability of rolling a sum of six on the dice and getting two heads and a tail after flipping the coins?	9/128

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9th & 10th Grade – December 11, 2010

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 times does Tarzan slide down before he is able to reach the top?	13 [times]
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 forty, what is the positive difference between the number of red digits and white digits he paints?	2
10	Humphrey the Hippo and Randolph the Rhino both like to go to the watering hole. The probability that Humphrey will show up to the watering hole is two-fifths, and the probability that Randolph will show up is three-fifths. What is the probability that at least one of them will show up to the watering hole?	19/25

"Math is Cool" Masters – 2010-11

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9th & 10th Grade – December 11, 2010

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 two days before the day before yesterday was a Wednesday, what day will it be eight days after tomorrow?	Tuesday
9	The set of digits four, two, eight, D, eight, one, four, where D is some digit, can be arranged in six-hundred thirty ways. Give ALL possible values for D.	1, 2
10	List the roots of the following cubic function in increasing order: X-cubed plus three-X-squared minus X minus three.	-3, -1, 1

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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-two people, seventeen like ninjas, twenty-two like pirates, and five like neither. How many people like both ninjas and pirates?	12 [people]
9	How many integers between one and one-thousand inclusive are multiples of two and three but not seven?	143 [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 travels down the line at a constant speed of twenty-five meters per second and takes five seconds to hit the tree, what is the horizontal distance, in meters, between the tree and the platform?	$125\sqrt{2} / 2$ [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 twelve feet. What is the total area, in feet squared, in which Gertrude can graze?	108 pi [ft^2]
9	Bartholomew the Bouncing Bat falls from a height of thirty-six feet. After each bounce he rebounds to two-thirds of the height of his last fall. Assuming he continues to bounces indefinitely, what is the total distance he will travel in feet?	180 [feet]
10	Laverne the Lilliputian Lumberjack cuts a sixteen-foot long log into two pieces of integer length, one of which is four feet longer than the other. What is the sum of the integer possibilities that exist for the length, in feet, of another log such that the three pieces can form a triangle?	110 [feet]

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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 has legs of lengths eight inches and fifteen inches. What is the sine of the smallest angle of this triangle?	8/17
9	Jay-Z has a number of problems that is directly proportional to the amount of money he has. Last year he had ninety problems and twenty million dollars. If this year he has thirty-two million dollars, how many problems does he have?	144 [problems]
10	What are the coordinates of the point initially at two-COMMA-four after it has been reflected across the line Y-equals-negative-X and then rotated ninety degrees counterclockwise about the origin?	(2,-4)

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

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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	6 [bugs]		
7	729/4 [un^2]		
8	-271/54		
9	20		
10	5 [faces]		

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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	$\frac{189}{12500}$
4	36 [limbs]
5	133