"Math is Cool" Masters – 2005-06

Sponsored by: GENIE Industries

7th Grade – November 19, 2005

Individual Contest

Express all answers as reduced fractions unless stated otherwise.
Leave answers in terms of π where applicable.
Do not round any answers unless stated otherwise.
Record all answers on the colored cover sheet.

1	Evaluate: 148 + 927 + 365
2	Reduce completely: 156/84
3	Evaluate: $4 \bullet 3^2 - 6 + 8/2$
4	Evaluate and express as a decimal: 1.8/2.5
5	What is the product of the number of sides on a square and the number of degrees in a triangle?
6	Evaluate: 5^5
7	What is the area of a circle with a circumference of 14π?
8	Evaluate: $\left(4\frac{2}{3}\right)/\left(3\frac{1}{2}\right)$
9	What is the probability of rolling a factor of 30 when rolling a standard six-sided die?
10	What is the remainder when 149 is divided by 7?
11	How many degrees are in each interior angle of a regular nonagon?
12	What is the midpoint of the line segment connecting the points (3, -8) and (6, 2)?
13	A cube has a surface area of 384 cm^2. What is its volume, in cm^3?
14	What value of *G* satisfies this equation: 3G + 2 = 14 ?
15	What is the area, in square centimeters, of a right triangle with a hypotenuse measuring 17 cm and a leg measuring 15 cm?
16	How many positive integers are factors of 24?
17	Express $.\overline{36}$ as a fraction.

18	Evaluate: $\sqrt{2601}$
19	What quadrant does the line 7x+4y=15 not pass through?
20	What is the number of days in a leap year minus the number of edges on a cube minus the number of centimeters in a meter minus the number of eggs in a dozen?
21	My coin collection has only dimes & quarters, and is worth $4.05. If I have twice as many dimes as quarters, how many coins do I have?
22	Evaluate: $126^2 - 124^2$
23	How many squares of any size appear in a 3x5 grid of unit squares?
24	How many different six-digit numbers can be written using one 1, two 2's, and three 3's?
25	A ball is dropped from a height of two meters and on each bounce rises $\frac{3}{4}$ of its previous height. What is the total (up and down) distance it will travel, in meters?
26	What is the sum of the digits in $(111111111)^2$?
27	A sun is cut from construction paper by first cutting a regular octagon, then cutting eight equilateral triangles from the octagon, each of which has a side which is also a side of the octagon. What is the measure, in degrees, of each of the angles at the tips of the sun's rays?
28	If $m(q) = 3q - \frac{4q}{(q+2)(q-3)}$, evaluate m(2).
29	A car travels at 35 mph going from point A to point B, then at 45 mph from point B to point C. It takes 1 hr 40 min to complete the trip from A to C, and point B is exactly midway between A and C. What is the distance from A to C? Give your answer as a decimal number of miles.

Challenge Questions

30	An arithmetic sequence has a first term of 19 and a common difference of 13. What is the twelfth term?
31	When my age is doubled, the result is subtracted from 147, and that result is doubled, the final result is 166. What is my age?
32	What value(s) of c satisfy $3c^2 - 11c + 6 = 0$?
33	My number is greater than 2000 but less than 5000. Its unit's digit is 9, and it has exactly 3 factors. Find the sum of all the numbers that could be my number.
34	Express the base 15 number 987_{15} as a base ten number.
35	What is the coefficient of the x^2 term in the expansion of $(2x-3)^3$?
36	What is the prime factorization of 252?
37	Let n be a positive integer such that n is the cube of a square number. When n is divided by 250, it has the quotient q and no remainder. Find the least positive integer value for q.
38	When six coins are flipped, what is the probability that at least five of them are tails?
39	What is the area of a parallelogram with sides measuring 4 cm and 14 cm and an interior angle measuring 120 degrees, in cm^2?
40	What is the sum of all multiples of seven between 110 and 230?

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Individual Multiple Choice Contest

Einstein, Tycho, Fermi, and Descartes are competing in the Math Computation and Reasoning Championships, known as MathCAR. The competition is based around presenting solutions to a group of problems and being judged by a group of bipartisan judges who award a grade of +, √, or – on each problem presented. Each problem has a maximum score associated with it, as seen in the table below.

Problem	Max Score
A	10
B	12
C	20
D	6
E	18
F	14
G	8
H	16

A score of + yields the maximum score on a problem, a score of √ yields half the maximum score, and a score of – yields a score of zero on the problem.

A MathCAR "presentation" is a combination of problems whose total maximum score is 100 points. There are no restrictions on the number of problems. Problems may be repeated as long as the solutions are different.

Here are the score cards for each competitor from the last competition. Note: Not all information is provided.

Einstein		
Problem	Score	Points
A	+	
C	+	
D	-	
F	√	
F	+	
H	+	
C	+	
	Total Score:	

Tycho		
Problem	Score	Points
G		
D		
H		
C		
B		
F		
H		
G		
	Total Score:	70

Fermi		
Problem	Score	Points
	+	
E	-	
G	+	
H	+	
B	+	
	-	
F	√	
D	+	
	Total Score:	55

Descartes		
Problem	Score	Points
A	+	
B	+	
C	-	
E	+	
C	+	
C	+	
	Total Score:	

Record only a letter as your answer on the colored sheet.

1	In order, what were Fermi's first and sixth problems? A) C,D B) D,C C) H,E D) E,H E) Answer not given
2	Who scored the greatest number of points out of 100? A) Einstein B) Fermi C) Descartes D) Tycho E)Tie
3	Descartes feels he is at a disadvantage having a presentation with so few problems and decides to try and reconfigure his presentation. What is the maximum number of problems he could have in his presentation? A) 11 B) 12 C) 13 D) 14 E) Answer not given
4	The competitors want to add a new problem (problem I) which would allow them to be able to give a presentation with maximum score 100 without repeating any figure. What is the smallest maximum score problem I could have? A) 0 B) 1 C) 2 D) 3 E) 4
5	Considering only scores from Einstein, Fermi, and Descartes, which problem generated the fewest points per attempt, on average? A) D B) E C) F D) G E) Answer not given
6	A "team" score is calculated by multiplying the final score of two competitors and dividing by the total number of problems they presented (whether distinct or repeated). What "team" generated the best "team" score? A) Einstein and Fermi B) Enstein and Tycho C) Descartes and Tycho D) Descartes and Einstein E) answer not given
7	Descartes decides not to change the problems he does in his presentation, but he decides to rearrange their order. To find an order he likes, he decides to randomly choose the order of problems. What is the probability he does two (or more) problem C's in a row at some point in his presentation. A)3/5 B)7/10 C)4/5 D)9/10 E)Answer not given
8	On any given performance Descartes has one of two outcomes. 25% of the time he receives "+"s on every problem he presents. The other 75% of the time he gets 5 "+"s and one "-". In those cases, the "-" is equally likely to be given for any of his six questions. Remarkably, Einstein always gets the same score of 87. What is the probability that Descartes scores higher than Einstein on his next presentation? A) 1/4 B)3/8 C)7/16 D)1/2 E)Answer not given
9	The judges lost Tycho's original score sheet. They know for certain he scored 70 points and that he answered the 8 questions listed. They remember that he received five "+" grades and three "-" grades. With this knowledge, what is the value of the highest point question that Tycho could have missed? A) 12 B) 14 C) 16 D) 20 E)Answer not given

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7th Grade – November 19, 2005

Team Contest

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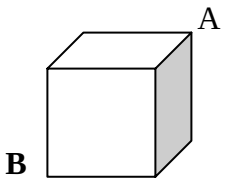
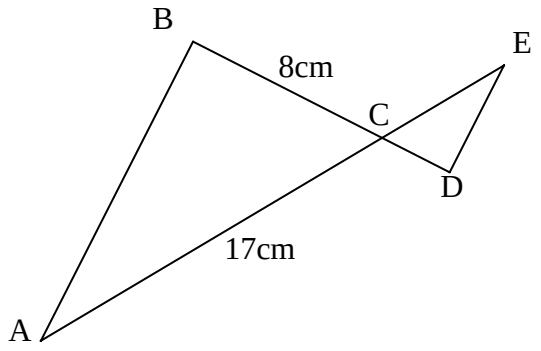
1	The height of an equilateral triangle is $2\sqrt{3}$ cm. How many centimeters are in the perimeter of the triangle?
2	A fly is standing in the corner of a room, seen in the drawing as point A. If the room is in the shape of a cube with edges of length 9 feet, what is the difference, in feet, between walking the shortest distance (on the walls) and flying the shortest distance (through the air) between vertex A and vertex B? 
3	What is the probability that a randomly chosen three-digit number is a multiple of 3 or a multiple of 7?
4	Bauncy Chillups is standing in a hole that is 60 inches deep. He will dig the hole 32 inches deeper so that the top of his head will be the same distance below ground level as it is now above ground level. What is Bauncy's height, in inches?
5	How many three-digit numbers exist such that two of the digits are prime and one is composite?
6	The sum of three integers is 149, the largest is 27 more than the smallest, and one of them is three-fourths of another. What is the smallest of the three integers?
7	Let *A* be the largest possible product of two distinct positive two-digit integers and *B* be the smallest possible product of two distinct positive two-digit integers. What is the value of *A - B*?

8	How many two-digit prime numbers are there such that if the digits are reversed, the resulting number is also a prime number?
9	Solve for x: $5 \cdot 5^{3x} = \frac{1}{3125}$
10	In the given figure BC = 8cm and AC = 17cm. $\overline{AB}$ and $\overline{ED}$ are both perpendicular to $\overline{BD}$. If BD = 12 cm, what is the area of ΔCDE in square centimeters? 

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7^{th} Grade – November 19, 2005

Pressure Round Contest

1	Subtract, and give your answer as a reduced common fraction: $0.4\overline{1} - 0.\overline{23}$
2	If 90 diagonals can be drawn in a certain regular polygon, what is the degree measure of each interior angle of the polygon?
3	From the Pythagorean Theorem, you know that $3^2 + 4^2 = 5^2$. Is there any other case where 3 consecutive integers (given $a < b < c$) have the relationship $a^2 + b^2 = c^2$? If not, answer "no". If so, give the largest of the 3 integers.
4	Susie's kitchen clock gains one minute an hour, while her bedroom clock loses two minutes an hour. She set them both to the correct time on Tuesday. On Wednesday morning, she noticed that the kitchen clock showed 7 AM, while the bedroom clock showed 6 AM. At what time on Tuesday did she set the two clocks correctly?
5	It is given that x, y, and z are distinct natural numbers such that x and y are relatively prime, and y and z are relatively prime. Jim makes 4 statements about x, y, and z. Give the letters of all Jim's statements that must necessarily (always) be true. (A) At least one of x, y, and z is prime. (B) x and z are relatively prime. (C) The product xyz has at least 8 factors. (D) LCM (y,z) = yz

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7th & 8th Grade – November 19, 2005

Mental Math Contest

Express all answers as reduced fractions in terms of radicals and π where applicable, unless stated otherwise.

PERSON 1		
1.1	What is the radius of a circle with circumference 96π?	48 [un]
1.2	Evaluate 5 factorial times 3 factorial.	720
1.3	What is the sum of the first seven prime numbers?	58
1.4	List the prime factors of 32.	2
PERSON 2		
2.1	5000 meters plus 4 kilometers is equal to how many meters?	9,000 [meters]
2.2	What is the sixth smallest prime number?	13
2.3	What is the volume of a pyramid with base area 6 and height one-half?	1 [un^3]
2.4	What is the least common multiple of 16 and 24?	48
PERSON 3		
3.1	Evaluate 16 to the power of three-fourths?	8
3.2	What is the ones digit of the product of the first 8 primes?	0
3.3	What is the area of a circle with diameter 22?	121π [un^2]
3.4	The sum of two numbers is 32 and the difference is 8. What is the smaller of the two numbers?	12
PERSON 4		
4.1	One of the angles in a parallelogram measures 75 degrees. What is the largest measure of any angle in the parallelogram, in degrees?	105 [°]
4.2	Identify the slope of the line given by the equation 3y equals 2x minus 17.	2/3
4.3	What is the perimeter of a regular octagon with side length 12?	96 [un]
4.4	What is the length of the smaller diagonal of a rhombus with one angle equal to 60 degrees and side length 8?	8 [un]

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7^{th} & 8^{th} Grade – November 19, 2005

COLLEGE KNOWLEDGE BOWL ROUND #1

#	Problem	Answer
1	What is the sum of the number four-hundred eighty-six and the number two-hundred nineteen?	705
2	What value of g satisfies the equation three g minus twelve equals sixty-three?	25
3	What is the area of a circle with a circumference of twenty-four pi?	144π [un^2]
4	What is the greatest common factor of 48 and 104?	8
5	Six fair coins are flipped. What is the probability that exactly two of them are heads?	$\frac{15}{64}$
6	Terminal zeros are zeros at the rightmost end of an integer, such as the 0 in 180, but not the zero in 108. The number n factorial has 12 terminal zeros when multiplied out. What is the largest possible integer value for n?	54
7	What is the x-coordinate of the point where the line x plus two y equals negative one intersects the line two x plus y equals seven?	5
	Extra Problem – Only if Needed	
8	A rectangle has an area of one-thousand sixty-six square centimeters. If a similar rectangle has sides which are twice as long as the first rectangle, what is the area of the larger rectangle, in square centimeters?	4264 [cm^2]

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COLLEGE KNOWLEDGE BOWL ROUND #2

#	Problem	Answer
1	What is the product of the number two-hundred forty-seven, and the number thirty-one?	7657
2	What is the x-value of the x-intercept of the line three x plus eight y equals forty-two?	14
3	What is the total surface area, in square centimeters, of a right rectangular prism with edges measuring three centimeters, four centimeters, and five centimeters?	94 [cm^2]
4	What is the least common multiple of 35 and 77?	385
5	When two standard six-sided dice are rolled, what is the probability that the sum of the numbers shown is four?	$\frac{1}{12}$
6	What is the sum of the perfect powers of two, from two to the first power to two to the tenth power?	2046
7	What is the largest integer h that satisfies the inequality four h plus thirty-five is less than twenty-two?	[h=] -4
	Extra Problem – Only if Needed	
8	What is the volume, in cubic centimeters, of a right rectangular pyramid with a height measuring nine centimeters and a base measuring four centimeters by seventeen centimeters?	204 [cm^3]

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COLLEGE KNOWLEDGE BOWL ROUND #3

#	Problem	Answer
1	What is four and three eighths minus one and three fourths expressed as a mixed number?	$2\frac{5}{8}$
2	What is the final result when thirty-two is increased by eighteen, that result is divided by two, and that result is increased by eighteen?	43
3	What is the volume, in cubic centimeters, of a right circular cone with a base diameter measuring twelve centimeters and a height measuring five centimeters?	60π [cm^3]
4	What is the third smallest positive integer that leaves a remainder of 11 when divided by 1234?	2479
5	When three cards are drawn from a standard 52-card deck, what is the probability they are all the same rank? For example, that all three are kings.	$\frac{1}{425}$
6	Two sides of a triangle measure eight centimeters and three centimeters. If the length of the third side is j centimeters, how many possible integer values are there for j?	5
7	Twice my favorite number is one-hundred-two less than five times my favorite number. What is my favorite number?	34
	Extra Problem – Only if Needed	
8	What is the distance between the point 5 comma 3 and the point 9 comma 0?	5

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Final Score:

KEY

First Score

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	1440		
2	13/7		
3	34		
4	.72		
5	720		
6	3125		
7	49π [un^2]		
8	4/3		
9	5/6		
10	2		
11	140 [°]		
12	(9/2, -3)		
13	512 [cm^3]		
14	4		
15	60 [cm^2]		
16	8 [integers]		
17	4/11		
18	51		
19	III or 3 or third		
20	242		

	Answer	1 or 0	1 or 0
21	27 [coins]		
22	500		
23	26 [squares]		
24	60 [numbers]		
25	14 [meters]		
26	81		
27	15 [°]		
28	8		
29	65.625 [miles]		
30	162		
31	32		
32	2/3, 3		
33	9507		
34	2152_{10} or 2152		
35	-36		
36	$2^2 \cdot 3^2 \cdot 7$		
37	4000		
38	7/64		
39	$28\sqrt{3}$ [cm^2]		
40	2856		

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7th Grade – November 19, 2005

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:
KEY

First Score

(out of 18)

STUDENT NAME_____

Individual Multiple Choice Contest – Score Sheet

Correct responses are worth 2 points, incorrect responses are worth -1 point and no response is 0 points.

DO NOT WRITE IN SHADED REGIONS

	Answer	-1, 0 or 2	-1, 0 or 2
1	B		
2	A		
3	E (16)		
4	C		
5	A		
6	D		
7	C		
8	D		
9	C		

"Math is Cool" Masters – 2005-06

7th Grade – November 19, 2005

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score:
KEY

First Score

(out of 20)

Team Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	2 or 0	2 or 0
1	12 [cm]		
2	$9\sqrt{5} - 9\sqrt{3}$ [feet]		
3	$\frac{77}{180}$		
4	76 [inches]		
5	192 [numbers]		
6	37		
7	9592		
8	9 [numbers]		
9	-2		
10	15 [cm^2]		

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7th Grade – November 19, 2005

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score:

KEY

First Score

Pressure Round Answers

	Answer
1	59/330
2	156 [°]
3	1
4	10:40 AM
5	D