"Math is Cool" Championships – 2014-15

October 22, 2014

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

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

High School Individual Contest – Score Sheet
DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
1-15 TOTAL:			

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

	Answer	1 or 0	1 or 0
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
31-40 TOTAL:			

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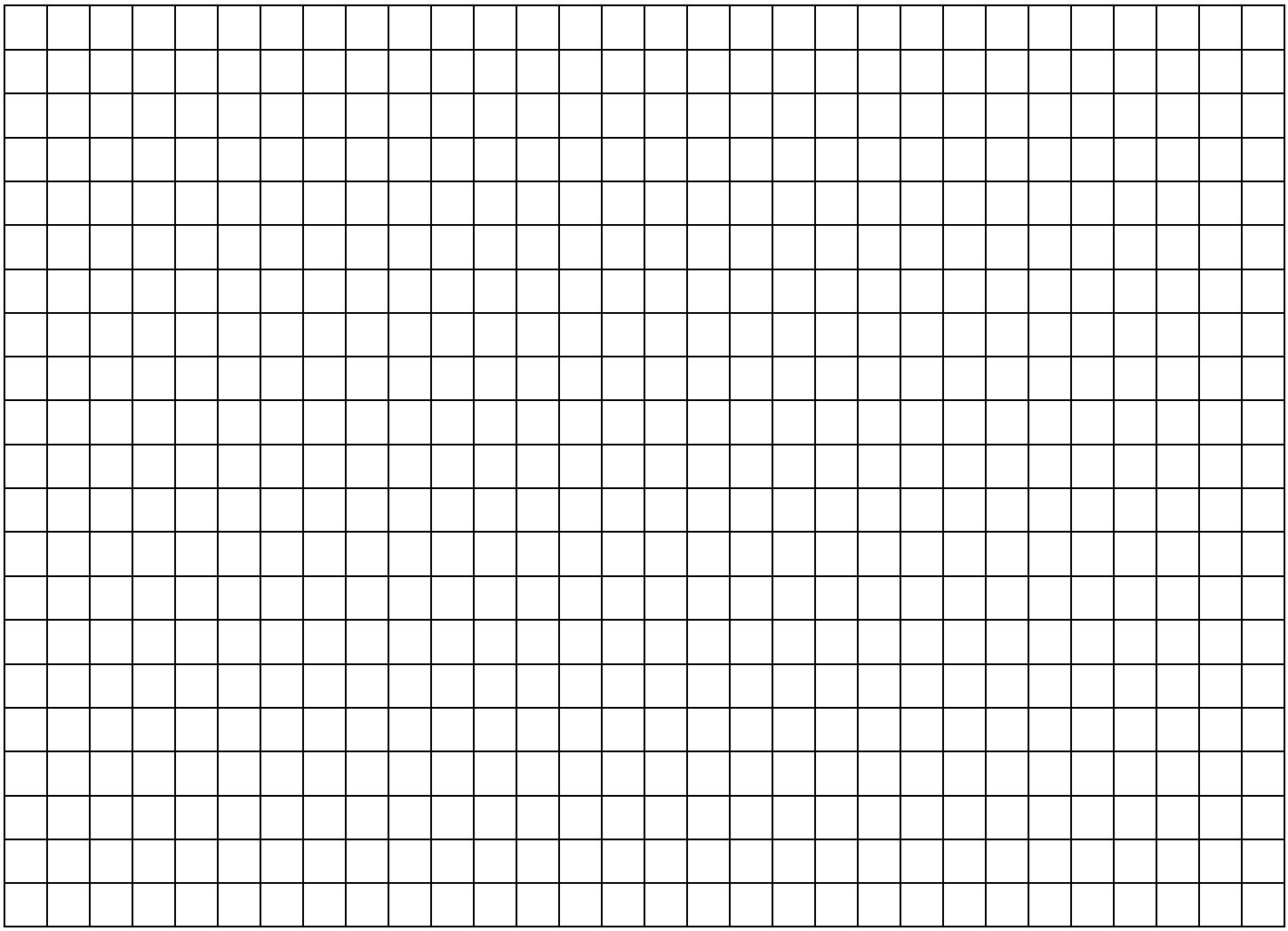
High School Individual Contest

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 – High School - 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.



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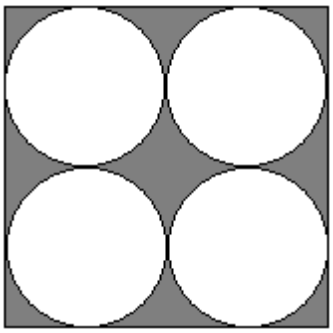
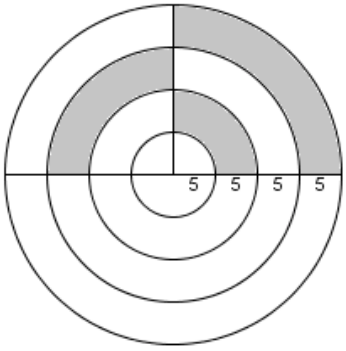
High School Individual Contest

	Questions 1-30: 2 points each
1	Evaluate: $4 - (2^3 - 4^2)/4$.
2	Solve for *x*: $(x + 1) + (x + 2) + (x + 3) + (x + 4) = 30$
3	Two of the sides of a right triangle are 7 and 25, what is the third side, if you know it is an integer?
4	Nine students in the class had an average test score of 85. If we add 1 to the first score, 2 to the second, and so on until adding 9 to the last score; what is the new average?
5	If $h(x) = \frac{x^2+1}{x-1}$. What is $h(-1)$?
6	The two diagonals are drawn from a vertex in a regular pentagon. What is the measure, in degrees, of the angle formed by these diagonals?
7	What is the equation of the line, in y = mx + b form, going through the point (1, 1) and parallel to the line $3x + 2y = 4$?
8	Simplify and write as a reduced fraction: $\frac{2^8 + 2^8 + 2^8 + 2^8}{8^4}$.
9	Crayons are 20 cents each while an empty case that can hold up to 8 crayons costs 50 cents. How many crayons can I buy with $10.00 if I have to buy enough cases to hold the crayons?
10	How many ways are there to rearrange the letters in "RAINIER" if each word must start and end with 'R'?
11	What is the area of a circle with circumference 20 cm?
12	What is the length, in centimeters, of the longest diagonal that can be drawn in a regular hexagon with side length 2 centimeters?
13	Solve for *x*: $x^3 + 3x^2 = 10x$.
14	The two diagonals of a rhombus have lengths of 10 and 14 inches. What is the area of the rhombus in square inches?
15	Calculate: $54^2 - 46^2$.
16	What is the average of the first 10 positive perfect cubes? Express as a decimal.
17	What is the product of the missing numbers in the geometric sequence: 4, ____, 5____?
18	Simplify ($i = \sqrt{-1}$): $(1 + 2i)(3 - i)$.
19	For how many integers, *k*, is $\|k - 7\| < 12$
20	How many isosceles triangles can be formed by connecting 3 vertices of a regular hexagon?

21	What is $2 + \frac{2}{3} + \frac{2}{9} + \cdots$?
22	 The square contains 4 congruent circles tangent to each other and the square, each with a radius of 2. Find the area of the shaded region.
23	Solve for a: $\begin{bmatrix} 3 & 4a \\ 6 & 1 \end{bmatrix} + \begin{bmatrix} -1 & 3 \\ -4 & 7 \end{bmatrix} = \begin{bmatrix} 2 & 8 \\ 2 & 8 \end{bmatrix}$.
24	Find the sum of the squares of all real solutions x to the equation $\lvert 4 - 2x \rvert + 6 = 12$.
25	Solve for x: $\log \frac{1}{x} = \log \frac{2}{3} + \log \frac{3}{4} + \log \frac{4}{5} + \cdots + \log \frac{2013}{2014}$.
26	Let A be the point (0, 4), and let B be its reflection over the line $y = -x$. Let C be the reflection of B over the line $x = 2$. Then let D be the reflection of C over the line $y = -3$. What are the coordinates of D?
27	Bob, Gary and Tom share a total of \$279. Bob gives \$20 to Gary who then gives \$40 to Tom. Finally, Tom gives \$80 to Bob. If they each now have the same amount of money, how much money did Gary start with, in dollars?
28	Find the determinant of the matrix. $\begin{bmatrix} 2 & -2 & 1 \\ 0 & 3 & -1 \\ 2 & 1 & 3 \end{bmatrix}$
29	Consider the parametric equations for $0 \leq t \leq 1$. What is the length of the curve described? $x = 2^{t+2} - 2$ $y = 2^t + 1$
30	Find the ratio of the volume of a cone with radius 3 and height 6 to the surface area of a cylinder with the same radius and height. Express your answer as a common fraction.

Challenge Questions: 3 pts each

31	What is the sum of the number of edges and the number of faces of an icosahedron?
32	Find the area of the shaded region. 
33	What is the radius of the circle given by the equation? $$x^2 + y^2 - 6x + 10y - 11 = 0$$
34	List the vertical asymptote(s) (if any) of the graph: $$y = \frac{x^2 + 3x + 2}{x^2 - 1}$$
35	What is the area of the shape determined by the polar graph of: $r = \sin\theta + \cos\theta$?
36	Equilateral triangle ABC has vertex A at the origin and vertices B and C are on the line $x + y = 4$. What is the side length of the triangle?
37	Let N equal the sum 9 + 99 + 999 + … + 99….9, where the kth term of the series has k nines. If the last term of the series has 99 nines, find the sum of the digits of N.
38	The even integers from 2 to 40 inclusive are written continuously to form a large number: $$N = 246810121416 \ldots 3840.$$ What is the remainder when *N* is divided by 36?
39	Find the sum of the squares of the real solutions to the following equation: $$x^2 + x - 2 = 2\sqrt{x^2 + x + 13}\,.$$
40	Find the largest possible perimeter of an isosceles triangle with area of 120 and whose side lengths are integers.