“Math is Cool” Championships -- 2018-19

7th – 8th Grade

Mental Math Answers

	Answer
1	48
2	8 [cm]
3	3
4	6 [in^2]
5	3
6	[x =] 9
7	5 [ducklings]
8	12 [times]

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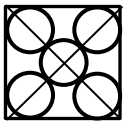
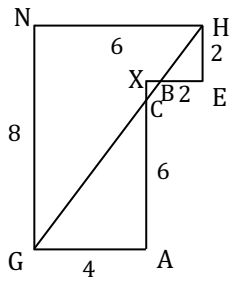
7^{th} – 8^{th} Grade

Individual Test Selected Solutions

	Answer	**Solution**
1	285	
2	310	
3	5/14	
4	[x =] -7	
5	22 [orders]	
6	122	
7	40 [inches]	
8	12 [cups]	
9	2/25	
10	1.1	
11	457 [cents]	
12	37	
13	100	

14	7/9	
15	[$] 585 [.00] [dollars]	
16	190 [in^2]	
17	15 [hours]	
18	6 [digits]	
19	5	926 = 17, 084 = 12, 17 – 12 = 5
20	30 [cubes]	
21	13 [crackers]	
22	120 [ways]	
23	[$] 4[.00] [dollars]	
24	1575 [seconds]	
25	24 [$units^2$]	
26	192000 [microorganisms]	
27	625	
28	$14\sqrt{2}$ [inches]	
29	66π [cm^2]	M/H Area of circles and fractions 36π/6 = 6π = area of each of the small wedges 144π/6 - 36π/6 = 18π = area of each of the six outer sections 3x18π + 2x6π = 66π

30	216	M/H three-digit twin primes 107 + 109
31	7	H units digit 2^2^2000 is the same as 2^4^1000, meaning that 2^(4^1000) will end in the same digit as 2^4, or 6, because 4^1000 will be a multiple of 4 and the pattern in the units digit of the powers of 2 is 2, 4, 8, 6. Since you add 1 to the end of it, it will end in a 7.
32	3070	H number sense, multiples $\frac{100(1+100)}{2} - \left(\frac{33(3+99)}{2} + \frac{9(11+99)}{2} - \frac{3(33+99)}{2}\right)$ The multiples of 21 can be ignored since they are also multiples of 3
33	$[a^2 + b^2 =]$ 128	H Algebra, square of a binomial $(a + b) = 12$ $(a + b)^2 = 144$ $a^2 + 2ab + b^2 = 144$ $ab = 8$ $2ab = 16$ $a^2 + 16 + b^2 = 144$ $a^2 + b^2 = 144 - 16 = 128$
34	1/9	H Probability Of the 6 ways to arrange three items, only two have all three items in different spots, so 1/3 x 1/3
35	23/66	H express repeating decimal as a fraction $100n = 34.84\overline{84}$ $n = .34\overline{84}$ subtract the equations and solve for n
36	$6\sqrt{3}$ [cm]	H 30-60-90 triangles KT is the hypotenuse of a 30-60-90 triangle, so KI, the short leg, is 6. KI is also the hypotenuse of a smaller, different 30-60-90 triangle, so from the intersection of the diagonals to K is 3, and from the intersection of the diagonals to I is $3\sqrt{3}$. So EI is $6\sqrt{3}$.
37	390	H impossible scores If Tom answered all 40 questions correctly, he would get 200 points. If he answered 39, then he could get 195 or 196 points, depending on if he left the last one blank or not. He could not get 197, 198, or 199. If he answers 38 correctly, he could get 190, 191, or 192, but not 193 or 194. If he answers 37, he could get 185-188, but not 189. In summary, Tom cannot get 189,193,194,197,198,199. 193+197 = 390
38	5 [circles]	H diagonal of a square minus diameter of a circle x 3, square root of 2 10 x 1.414 = 14.14 = length of diagonal Diameters of 3 circles tangent to each other aligning with the diagonal add up to 12 cm From edge of circle to corner of square along the diagonal is 2x1.414 – 2 = about 0.8 12 + 2 x 0.8 is less than 14.14 so three circles fit along both diagonals and 5 circles will fit. 

39	6 [integer values]	H palindromes If the last digit of a number is going to change, the first digit must also change. For this to be true, n must be a power of 10. There are 6 powers of 10 between 9 and 9 million.
40	1/12	H Geo – similar triangles, Pythagorean theorem  Determine AX and GA Similar triangles mean $\frac{2}{BE} = \frac{8}{6}$ and $\frac{AC}{4} = \frac{8}{6}$, so AC = $\frac{16}{3}$ and BE = $\frac{3}{2}$. Then BX = $\frac{1}{2}$ and CX= $\frac{2}{3}$. GH = 10 and BC = $\sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{2}{3}\right)^2} = \frac{5}{6}$. Then $\frac{5}{6}$ / 10 = 1/12.

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7^{th} – 8^{th} Grade

Multiple Choice Selected Solutions

7/8	Answer	Solution
1	C	
2	A	
3	B	30 in x 18 in x 10 in = 2.5 ft x 1.5 ft x $\frac{5}{6}$ ft If you consider just cubic footage, there would theoretically be over 15 possible, because 2.5 x 1.5 x $\frac{5}{6}$ = $3\frac{1}{8}$ and 15 x $3\frac{1}{8}$ < 48, which is 2 x 3 x 8. But there are three 2.5s that fit along the side of 8, two 1.5s that fit along the side of 3, and two $\frac{5}{6}$s that fit along the side of 2 and 3 x 2 x 2 = 12. This is one of at least two ways to arrange 12 of the suitcases.
4	E	
5	C	
6	B	
7	D	A rectangle formed by two pairs of opposite exterior vertices would be 3 by $9\sqrt{3}$. The diagonal of this rectangle would also be the diameter of the circle, which is $6\sqrt{7}$. There are at least two other rectangles with this same length of diagonal that can be formed by connecting external vertices of the hexagons. So $(3\sqrt{7})^2\pi = 63\pi$.
8	C	
9	D	

10	**A**	Focus on the numerator: $261.6 \cdot 2^{\frac{1}{6}}\left(1 + 2^{\frac{1}{2}}\right) =$ $261.6 \cdot 2^{\frac{1}{6}} + 261.6 \cdot 2^{\frac{4}{6}} = 261.6 \cdot 2^{\frac{2}{12}} + 261.6 \cdot 2^{\frac{8}{12}}$ = D and G#

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7^{th} – 8^{th} Grade

Team Test Selected Solutions

7/8	Answer	Solution
1	[x =] 8	
2	1/720	
3	17280 [times]	
4	44	
5	27.5 [in]	
6	[x =] 140	
7	2520 [ways]	
8	60	H exponents and fractions $\left(25^{1/2} \cdot \left(\frac{1}{2}\right)^{25}\right)/\left(\left(\frac{1}{4}\right)^{12} \cdot 4^2\right) \cdot \left(\frac{7^{12}}{7^{10}}\right) = (5/2^{25})/(16/4^{12}) \cdot (7^2) =$ $(5/2^{25}) \cdot \left(\frac{4^{12}}{16}\right) \cdot 49 = \frac{5 \cdot 2^{24}}{2^{25} \cdot 16} \cdot 49 =$ $\frac{5 \cdot 49}{32} = \frac{245}{32} = 7\frac{21}{32}$, and 7 + 21 + 32 = 60
9	620 [ice cream cones]	H counting 1 scoop – 4 types of cone x 5 flavors = 20 2 scoops – 4 types of cone x (5 x 5) = 100 3 scoops – 4 types of cone x (5 x 5 x 5) = 500 20 + 100 + 500 = 620
10	$4\sqrt{13}$ [units]	$\frac{1}{3}x^2 + 2 = -\frac{3}{2}x + 23 \Rightarrow 2x^2 + 9x - 126 = 0 \Rightarrow (2x + 21)(x - 6) = 0 \Rightarrow$ x = 6 and y = 14, rule out -21/2 because the intersection is in quadrant 1 $3x - 40 = -\frac{3}{2}x + 23 \Rightarrow -9x = -126 \Rightarrow x = 14$ and y = 2 $\sqrt{(14-6)^2 + (2-14)^2} = \sqrt{208} = 4\sqrt{13}$

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7^{th} – 8^{th} Grade

Relay Solutions

7/8	Answer	Solution
	Practice Relay	
1	32	8+8+8+8=32
2	16	32/2=16
3	4	$\sqrt{16} = 4$
4	28	4+24=28
	Relay #1	
1	36	1+2+3+4+5+6+7+8=36
2	108	36 x 3 = 108
3	4.5	108/24=4.5
4	1 [centimeter]	(2x + 9x)h/2=165 11xh = 330 xh = 30 The smallest integer value of h is 1.
	Relay #2	
1	12	Arithmetic 72/6=12
2	2 [factors]	factors 12 = 2^2 x 3

3	960 [in^2]	Geometry 124/2 = 62, 30 + 32 = 62, 30 x 32 = 960
4	23/960	Probability, number sense 27x35=945, so 27 total multiples. 6x35, 12x35, 18x35, & 24x35 are the 4 that are also multiples of 6, so 27 – 4 = 23, 23/960.

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7^{th} – 8^{th} Grade

College Bowl Round #1 Answers

	Answer
1	100
2	119 [inches]
3	1/64 or "1 over 64" or "1 out of 64"
4	294 [skittles]
5	19
6	1/5525 or "1 over 5525" or "1 out of 5525"
7	2/5 or "2 over 5" or "2 to 5"
8	[$\sqrt{x}$ =] 8
9	30 [cupcakes]
10	1/20 or "1 over 20" or "1 out of 20"

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7th – 8th Grade

College Bowl Round #2 Answers

	Answer
1	3840 [seconds]
2	3/8 or “3 over 8” or “3 out of 8”
3	484
4	31 [people]
5	32.5 [degrees]
6	8/13 or “8 over 13” or “8 out of 13”
7	[$}19.35 or “19 dollars and 35 cents” or “nineteen thirty-five”
8	34 [questions]
9	3600 [min]
10	65

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College Bowl Round #3 Answers

	Answer
1	63
2	2.5π [inches] or 5π/2 or “five-halves pi” or “5 pi over 2”
3	10631
4	11
5	160 [degrees]
6	1440 [ways]
7	$\sqrt{3}$ or “radical 3” or “root 3”
8	291 [blue M&Ms]
9	6π
10	4[%]

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College Bowl Round #4 Answers

	Answer
1	6 [marbles]
2	3 [prime factors]
3	7
4	12 [ostriches]
5	12.72
6	36π [in^2]
7	$\sqrt{194}$ [cm] or "radical 194" or "root 194"
8	5/36 or "5 over 36" or "5 out of 36"
9	7
10	27

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7th – 8th Grade

College Bowl Round #5 Answers

	Answer
1	12 minutes
2	162
3	25 [%]
4	1
5	18 [containers]
6	50
7	23/50 or "23 over 50" or "23 out of 50"
8	17 [meters]
9	70
10	[x =] 9

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College Bowl Round #6 Answers

	Answer
1	30 (stops)
2	[$] 10,000
3	648
4	256
5	[x =] 9
6	$16\sqrt{3}$ [cm^2] or "16 root 3" or "16 radical 3"
7	518400 [ways]
8	36 [mins]
9	22
10	[$] 140

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7th – 8th Grade

College Bowl Round (Extra) Answers

	Answer
1	3
2	5/12 or “5 over 12” or “5 out of 12”
3	4/17 or “4 over 17” or “4 out of 17”
4	800,000
5	28 [in]
6	[x =] 8