“Math is Cool” Championships -- 2018-19

6th Grade

Mental Math Answers

	Answer
1	2
2	60 [m^3]
3	3
4	21
5	3
6	27 [songs]
7	5 [ducklings]
8	1/4

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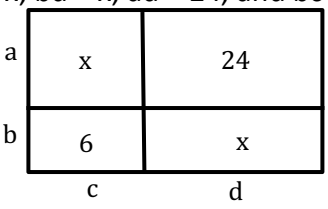
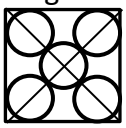
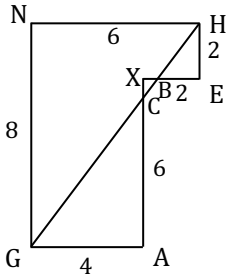
Individual Test Selected Solutions

	Answer	**Solution**
1	285	
2	310	
3	5/14	
4	[x =] -7	
5	216 [tennis balls]	
6	250	
7	40 [inches]	
8	12 [cups]	
9	6/11	
10	44 [legs]	
11	7 [quarters]	
12	37	
13	100	

14	43/60	
15	27 [pears]	
16	0	
17	12 [weeks]	
18	6 [digits]	
19	5	926 = 17, 084 = 12, 17 – 12 = 5
20	50	
21	13 [crackers]	
22	2/3	
23	2000 [minutes]	
24	1575 [seconds]	
25	1/2	11, 19, 41 13, 17, 29, 31, 43, 47
26	20480 [milligrams]	$5 \times 2^{12} = 5 \times 4096 = 20480$
27	320	
28	26 [%]	M mixture 20% of 40 is 8 gallons of acid in the first, 30% of 60 is 18 gallons of acid in the second solution. Total solution is 100 gallons, with 26 gallons of acid.
29	18 [space diagonals]	M/H Geo – 3d space diagonals You can draw three from every vertex, so 3 x 12 = 36, but each one has been counted twice, so divide by 2

30	43 [thieves and dollars]	M/H remainders and division Make a list of multiples of 6: 6, 12, 18, 24, 30, 36, . . . Add 1 to the quotient of these numbers and 6 to get the possible number of thieves. The first one in the list to have a remainder of 1 when divided by 5 and to have a quotient that corresponds to the number of thieves for this multiple of 6 is the correct number of dollars, 36 + 7 thieves = 43
31	57 [jolly ranchers]	M/H counting and prime numbers 43,47,53,57 – Peter's amount does not have to be prime
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	12 [inches]	H Geo – areas of rectangles and perimeter Label left edge with a and b and bottom edge with c and d. Then ac = x, bd = x, ad = 24, and bc = 6.  (bc)(ad) = 144, so (ac)(bd) = 144, so x = 12. Therefore, the area of the whole rectangle is 54. Integer factor pairs of 54 are 1&54, 2&27, 3&18, 6&9. Can't use 1&54 or 2&27 without a, b, c, and d being non-integers. When using 3&18, it works if a = 2, b = 1, c = 6, d = 12, so the perimeter is 42. When using 6&9, it works if a = 4, b = 2, c = 3, d = 6, so the perimeter is 30. The difference is 12.
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	$10\sqrt{2}$ [blocks]	H Coordinate plane, distance on a diagonal 190 = n(n+1)/2, 380 = n(n+1), n = 19. North/south (North is positive): 1-3+5-7+9-11+13-15+17-19 = -10 East/west (East is positive): 2-4+6-8+10-12+14-16+18 = 10 Pythagorean Theorem: $\sqrt{(-10)^2 + 10^2} = 10\sqrt{2}$

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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Multiple Choice Selected Solutions

6	Answer	Solution
1	**B**	
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	**C**	A rectangle formed by two pairs of external vertices of two opposite hexagons 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 C = $6\pi\sqrt{7}$.
8	**C**	
9	**D**	

10	**A**	89 x 30 = 2670 89 x 40 = 3560, so most of the tickets must be adult tickets 86 x 40 = 3440, reduce the number of adult tickets by 1 and see if the difference can be made up with combinations of other tickets, 85 x 40 = 3400, 4 tickets needed to make up $40 – not possible 84 x 40 = 3360, 5 tickets to make up $80 – not possible 83 x 40 = 3320, 6 tickets to make up $120 = 6 children's tickets, so 83 is the answer.

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Team Test Selected Solutions

6	Answer	Solution
1	190	
2	1/720	
3	17280 [times]	
4	44	
5	23	
6	48	
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	$236_{[10]}$	H bases and palindromes $11_4 = 5_{10}$, $22_4 = 10_{10}$, $33_4 = 15_{10}$, $101_4 = 17_{10}$, $111_4 = 21_{10}$, $121_4 = 25_{10}$, $131_4 = 29_{10}$, $202_4 = 34_{10}$, $212_4 = 38_{10}$, $222_4 = 42_{10}$ 5 + 10 + 15 + 17 + 21 + 25 + 29 + 34 + 38 + 42 = 236

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Relay Solutions

6	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	180	90*2=180
2	12	180/15=12
3	28	1+2+3+4+6+12=28
4	44	2^2 x 11^1
	Relay #2	
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.

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College Bowl Round #1 Answers

	Answer
1	100
2	3.25 [hours]
3	9
4	294 [skittles]
5	19
6	1/5525 or "1 over 5525" or "1 out of 5525"
7	50 [in^2]
8	40.5 [in^2]
9	30 [cupcakes]
10	1/20 or "1 over 20" or "1 out of 20"

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College Bowl Round #2 Answers

	Answer
1	123
2	3/8 or “3 over 8” or “3 out of 8”
3	81 [%]
4	31 [people]
5	5 [cm]
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	4
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	7.8
4	11
5	11/36 or "11 over 36" or "11 out of 36"
6	1440 [ways]
7	[x =] 4
8	291 [blue M&Ms]
9	14400
10	4[%]

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College Bowl Round #4 Answers

	Answer
1	160 [mins]
2	20 [crackers]
3	7
4	12 [ostriches]
5	12.72
6	8 [ways]
7	$\sqrt{194}$ [cm] or "radical 194" or "root 194"
8	5/36 or "5 over 36" or "5 out of 36"
9	13
10	27

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College Bowl Round #5 Answers

	Answer
1	98 [writing utensils]
2	162
3	3
4	1
5	37.5 [degrees]
6	50
7	23/50 or “23 over 50” or “23 out of 50”
8	17 [meters]
9	4 [socks]
10	[x =] 9

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College Bowl Round #6 Answers

	Answer
1	30 (stops)
2	179 [months]
3	47.75
4	256
5	[x =] 9
6	5 [terms]
7	518400 [ways]
8	[x =] 13
9	22
10	[$] 140

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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