"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Sponsored by: Columbia Basin College

GENERAL INSTRUCTIONS applying to all tests:

- *Good sportsmanship is expected throughout the competition by all involved (competitors and observers). Display of poor sportsmanship will result in disqualification.*
- *Competitors may not use calculators or any other aids on any portion of this contest.*
- *Unless stated otherwise:*
  - *Express all rational, non-integer answers as common fractions, except in problems dealing with money, where you should give the answer as a decimal rounded to the nearest cent.*
  - *For 5th grade and up, all fractions and ratios must be reduced to simplest form, all radicals must be simplified, and all denominators must be rationalized.*
  - *Do not round or approximate answers. Leave answers in terms of π or other irrational quantities (e.g., √2), where applicable.*
- *Units are not necessary as part of your answer, unless it is a problem that deals with time, in which case, AM or PM is required. However, if you choose to use units, they must be correct.*
- *Record all answers on the colored cover sheets in the answer column only.*
- ***Be sure that the student name, school, team number, etc. has been filled out at the top of each answer sheet.***
- *Tests will be scored as a 0 if answers are not recorded correctly on the answer sheets.*
- *Blank answer sheets and answer sheets with no name will be scored as a 0.*

FINAL SCORES AND AWARDS

Individual awards are determined by both the Mental Math and Individual Test scores. Individual ties are broken based on the following, in this order: total scaled individual points, total number of correct answers on the Individual Test, Mental Math raw score, number of correct answers from Individual Test #31-40, number of correct answers from Individual Test #16-30, highest numbered question answered correctly on the Individual Test working backwards from #40.

Team (School) awards are based on the highest score from amongst each of the school's "teams of 4 students" in each event and is calculated as 2·(Sum of highest 3 Mental Math scores) + 2·(Avg. of Top 3 Ind. Multiple Choice) + 6·(Team) + 2·(Pressure) + 1·(College Bowl), for approximate weights of 25%, 20%, 30%, 15% and 10% respectively. Team ties are broken based on highest event score in order of the events, starting with Mental Math.

MENTAL MATH TEST - 30 sec./quest., 8 problems, ~8%/25% of individ./team scores

The proctor will read each question twice. You may not do any writing or talking while arriving at a solution. Record only your answer on your answer sheet. You may not change, cross out, erase, or write over an answer once you have written it down. The maximum wait time is 30 seconds after completion of the second reading of the question. Correct answers receive 1 point.

INDIVIDUAL TEST - 35 minutes, 40 problems, ~92% of individual score

When you are prompted to begin, tear off the colored answer sheet and begin testing. No talking during this individual test. You will be given a 5 minute time warning. Correct answers receive 2 points for problems 1-30 and 3 points for 31-40 (in the scaled score).

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Sponsored by: Columbia Basin College

Final Score *(out of 8)*

Room #	School Name	Student Name	Team #

Mental Math – ~25% of team score & ~8% of individual score

Error! Reference source not found.

STUDENT: DO NOT WRITE IN SHADED REGIONS (or anywhere else, other than the answer box)

	Answer	Scorer 2 0 or 1	Scorer 1 0 or 1
1			
2			
3			
4			
5			
6			
7			
8			
11/12th Grade	**TOTAL:**		

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Sponsored by: Columbia Basin College

Key

Mental Math Contest – Answer Key

30 seconds per question – ~25% of team score & ~8% of individual score

SCORERS — Write-overs, Cross-outs, and Erasures Must be Marked Incorrect (0)
Bracketed items […] in the answer key are optional.

11/12th Grade

	Answer	
1	66	What is the product of three-elevenths and two hundred forty-two?
2	3	What is the slope of the line connecting the point four comma five and the point one comma negative four?
3	81 [units squared]	What is the area of a square with perimeter of thirty-six units?
4	6	When two standard six-sided dice are rolled, the probability that the sum of the numbers in the top faces is less than 5 is equal to x. What is the reciprocal of x?
5	55	What is the tenth term in the Fibonacci sequence? Assume the first two Fibonacci numbers are both equal to 1.
6	119	If 289 over x equals x over 49, what is the largest possible value of x?
7	512	What is the area of the triangle bounded by the lines x = 0, y = 0, and x plus 4 y equals 64?
8	49	When written in base ten, how many zeroes are at the end of two-hundred-factorial?

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Sponsored by: Columbia Basin College

Individual Contest

Record all answers on the colored cover sheet. 35 minutes, 40 problems, ~92% of individual score.
No talking during this individual test. A 5-minute time warning will be given.

	Questions 1-30: 2 points each
1	Evaluate: $-2 + 8/4 + 3 * (17 + 9 * 5)$
2	Two whole numbers have a sum of 11 and product of 24. What is the positive difference between the numbers?
3	Evaluate: $25^2 + 35^2 + 45^2$
4	If there are 6 apples in a bin, 4 bins in a bundle, and 2 bundles in a crate, how many apples does 10 crates contain?
5	What is the area, in square meters, of a rectangle having width of 32 meters and height of 128 meters?
6	Find the tens digit of 5^{2020}.
7	If 108 is 90% of x, find the value of x.
8	Find the slope of a line perpendicular to $x + 2y = 8$.
9	How many positive multiples of 9 have three digits, all of which are the same?
10	How many minutes are in 37 days?
11	Richard has 9 coins consisting only of pennies and nickels. If the total value of the coins is \$0.29, how many pennies does Richard have?
12	Find the sum of the infinite geometric series: $10 + 6 + 3.6 + \cdots$
13	A car traveled 281 miles in 4 hours and 41 minutes. What was the speed of the car in miles per hour?
14	Angles A and B are supplementary. If $m\angle A = 56°$, find $m\angle B$, in degrees.
15	The midpoint of the line segment connecting $(2, 7)$ and $(-8, 13)$ is (a, b). Find the value of $a^2 + b^2$.
16	Find the remainder when $x^{2020} + 2x + 3$ is divided by $x - 1$.
17	What is the median of the first six smallest positive prime numbers?
18	Find the smallest solution to the equation $x^2 + 12x = 45$.
19	If $x \blacksquare y = x + 3y - 1$ for all integers x and y, evaluate: $(1 \blacksquare 2) \blacksquare 3$
20	What is the greatest common factor of 45, 60, and 75?

21	Exactly three of the interior angles of a convex polygon are obtuse. What is the largest number of sides this polygon can have?
22	The first four terms of an arithmetic sequence are $x+1$, $2y$, $3x+y$, and 12. What is the sum of the first 24 terms of this sequence?
23	The arithmetic mean of the following set $$S = \{1, 2, 4, 8, 9, 10, 14, 16, 17\}$$ is x. If a single element is removed from S, the arithmetic mean of the resulting set is $x-1$. Which number was removed?
24	Find the area of a triangle with vertices at $(1, 3)$, $(7, -8)$, and $(1, -5)$.
25	For which positive integer n is $5^{50} = n^n$ true?
26	For how many integer values of x is $\sqrt{12-\sqrt{x}}$ also an integer?
27	The interior angles of a hexagon are in the ratio $3:4:4:4:4:5$. How many degrees are in the measure of the smallest exterior angle?
28	How many even integers between 1 and one million have digits that are all primes?
29	A right circular cylinder is 3 feet tall and has a base 16 feet in diameter. Adding x feet to either the cylinder's radius or height (while keeping the other dimension constant) increases the volume of the cylinder by the same nonzero amount. Find the largest integer less than $100x$.
30	If $r = \sqrt{\frac{1}{25}+\frac{1}{144}}$, find the smallest integer greater than $1000r$.

Continued on Next Page

Challenge Questions: 3 points each	
31	Stacey chooses four distinct numbers at random, without replacement, from the set of integers 1 to 10, inclusive. The probability the product of these four numbers is divisible by 10 is equal to a/b, where a and b are positive integers with no common factors. Find $a + b$.
32	If x, y, and z are positive integers such that $1/x + 1/y + 1/z = 6/7$, evaluate: $x^2 + y^2 + z^2$
33	Let $\sqrt{10!} = a!\sqrt{b}$, where a and b are integers and b is prime. Find $a + b$.
34	Find the product of the *real* roots of the equation: $$x^4 - 12x^3 + 60x^2 - 164x + 195 = 0$$
35	Suppose f is a function such that $f(xy) = f(x)/y$ for all positive reals x and y. If $f(50) = 300$, find the value of $f(60)$.
36	If the letters of the word ELEMENT are randomly arranged, the probability the three Es are consecutive is equal to p. Find the largest integer less than $p \times 10^6$.
37	What is the area of a triangle with side lengths 17, 28, and 39?
38	Zozo is a city where three-fifths of the residents will always lie, while the rest always tells the truth. Locke asked three randomly selected people from Zozo if it rained yesterday and all of them said yes. The probability that it truly rained yesterday is equal to p. Find the value of $700p$.
39	The least common multiple of the consecutive integers from 20 to k, inclusive, is greater than 10^6. If $k > 20$, what is the smallest possible value of k?
40	An ellipse in the xy-plane has foci at $(3, 4)$ and $(10, 20)$. Moreover, the ellipse is tangent to the x-axis. Find the length of the major axis of the ellipse.
IF taking Pre-Calculus or Calculus, continue to questions 41 - 45	
41	How many digits does $4^{16}5^{25}$ have when multiplied out expressed in base 10?
42	How many positive integers satisfy all three properties? • Has three digits • All digits are distinct • The digits are in increasing order or decreasing order. For example, 458 or 931.
43	A line bisecting the larger acute angle in a triangle with sides of length 66 cm, 88 cm, and 110 cm divides the opposite side into two segments. The length of the longer segment of that side is L centimeters. Find the value of L^2.
44	If S is the sum of the solutions to$\lvert y + 3\rvert = 7 - \lvert 2 - 5y\rvert$, find the value of $6S$.
45	Tracy starts a trip sometime between 8 A.M. and 9 A.M., when the hour and minute hands of her watch are together. She arrives at her destination the same day sometime between 2 P.M. and 3 P.M., when the hour and minute hands of her watch are $180°$ apart. How many minutes was her trip?

"Math Is Cool" Championships – 2020-21

KEY

Individual Contest – Answer Key

SCORERS: Bracketed […] items in answer key are optional. Just mark the score as 0 or 1 and add up those values to reflect total correct. First Scorer – use the right-hand columns so 2nd scorer can do a blind scoring.

	Answer
1	186
2	5
3	3875
4	480 [apples]
5	4096 [m^2]
6	2
7	120
8	2
9	3
10	53280 [minutes]
11	4 [pennies]
12	25
13	60 [mph]
14	124 [degrees]
15	109

	Answer
16	6
17	6
18	-15
19	14
20	15
21	6 [sides]
22	900
23	17
24	24
25	25
26	4
27	30 [degrees]
28	1365
29	533
30	217

	Answer
31	173
32	1777
33	13
34	15
35	250
36	142857
37	210 [sq. units]
38	160
39	25
40	25
41	28 [digits]
42	204
43	3025
44	3
45	360 [minutes]

"Math Is Cool" Championships – 2020-21

Total Correct (all columns)

Room # _____ SCHOOL NAME _____ STUDENT NAME _____ Team # _____

Individual Contest – Score Sheet

STUDENTS: 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:			

11/12th Grade

Dec. 2, 2020

Scorers: Just score as 0 or 1 and add up those values (i.e., just work with number correct).

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

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Individual Multiple Choice Contest

1	Find the perimeter of a rectangle 6 meters wide and area of 24 square meters.				
	A) 25 meters	B) 20 meters	C) 15 meters	D) 10 meters	E) Answer Not Given
2	Find the least common multiple of $24x^6y^2z$ and $28x^4y^3$.				
	A) $4x^4y^2$	B) $672x^{24}y^6$	C) $52x^{10}y^5z$	D) $168x^6y^3z$	E) Answer Not Given
3	If $\frac{x+y}{2x-y}=\frac{3}{2}$, find the value of $\frac{x}{y}$.				
	A) $4/5$	B) $5/4$	C) $6/5$	D) $5/6$	E) Answer Not Given
4	Which of the following numbers is both complex and rational.				
	A) 3.14159	B) e	C) $\sqrt{2}$	D) i	E) Answer Not Given
5	Let $n>1$ be the smallest composite number having no prime factors less than 10. Find the sum of the digits of n^2.				
	A) 12	B) 13	C) 14	D) 15	E) Answer Not Given
6	Suppose x varies directly with y^3, and y^5 varies directly with z. Then x^5 varies directly with z^n. Find n.				
	A) 4	B) 3	C) 2	D) 1	E) Answer Not Given
7	If x, $2x+2$, $3x+3$, … form a geometric sequence, what is the fourth term?				
	A) 27	B) 13.5	C) -13.5	D) -27	E) Answer Not Given
8	Find the positive difference of the roots in the equation $x^2-7x=9$.				
	A) -9	B) 3.5	C) -3.5	D) 9	E) Answer Not Given
9	What is the sum of the positive integral divisors of 792?				
	A) 2350	B) 2340	C) 2330	D) 2320	E) Answer Not Given
10	For real number x, let $M(x)$ equal the minimum value of $x+2$, $-2x+4$, and $4x+1$. Find the largest possible value of $M(x)$.				
	A) $8/3$	B) $5/2$	C) $2/3$	D) $1/2$	E) Answer Not Given

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Key

Individual Multiple Choice Contest – Answer Key

11/12th Grade

Correct responses are worth 2 points, incorrect responses are worth -1 point, and absence of a response is worth 0 points.

	Answer
1	B
2	D
3	B
4	A
5	E
6	B
7	C
8	E
9	B
10	A

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Final Score *(out of 20)*

Room #	School Name	Student Name	Team #

Individ. Multiple Choice Contest – 15 minutes – ~20% of team score

Error! Reference source not found.

Correct responses are worth 2 points, incorrect responses are worth -1 point, and absence of a response is worth 0 points.

STUDENTS: DO NOT WRITE IN SHADED REGIONS

	Answer	Scorer 2 -1, 0, or 2	Scorer 1 -1, 0, or 2
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11/12th Grade	**TOTAL:**		

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Team Contest

1	Train A is set to leave station X heading east at a speed of 4 meters per second. Train B is set to leave station Y heading west at a speed of 6 meters per second. A bird, traveling at 10 meters per second, leaves station X heading east at the same time train A leaves. When the bird reaches train B, train B will depart. The bird also turns around and heads back toward train A. The bird then continuously goes back and forth between the two trains. Given that station X and Y are 10,000 meters apart, how many meters will the bird have traveled when the trains meet?
2	Urn #1 has 167 red and 143 blue balls. Urn #2 has 4 red balls and 4 blue balls. One ball is picked at random from Urn #1 and placed in Urn #2. Then, two balls are picked at random from Urn #2. Let a/b equal the probably that the two balls are different colors, where a and b are relatively prime positive integers. Find a + b.
3	The infinite series $$\sum_{x=1}^{\infty} \frac{9}{(3x-2)(3x+7)}$$ is equal to a/b, where a and b are relatively prime positive integers. Find $a+b$.
4	Let ax + by + cz = D, be an equation of the plane spanned by vectors ‹4, -6, -1› and ‹-6, 0, 5›, where a, b, and c are relatively prime positive integers. Find a + b + c.
5	Lines are drawn from a point, A, outside a circle with center C and radius $\sqrt{3}$ to the two tangent points, B and D, on the circle. Segment AB has length 3. Let T be the area inside triangle ABD but outside of the circle. Find $(T+\pi)^2$.
6	Let c be a value such that the below matrix does *not* have an inverse. Find the value of 11 c. $$\begin{pmatrix} 11 & 0 & 4 \\ 13 & -3 & c \\ -3 & 1 & -5 \end{pmatrix}$$
7	Suppose that $\log_{10} a = \log_4 b = \log_{25}(4a+b)$. Let $\frac{a}{b} = M + \sqrt{N}$, where M and N are positive integers and N is not divisible by a perfect square. Find $M+N$.
8	Betty is attempting to cross a river in a canoe. The river is $16+4\sqrt{2}$ meters across. The current is moving at a speed of 4 meters per second toward a waterfall, which is $16+4\sqrt{2}$ meters downstream. Assuming Betty can row at a speed of 3 meters per second, what is the fastest time she can get across the river while avoiding falling down the waterfall? Express your answer in seconds.

Continued on next page

9	Find the sum of all positive primes p such that $$p^{2020} + p^{2021}$$ is a perfect square.
10	Let Q(x) be the quotient when $$45x^{74} - 74x^{45} + 29$$ is divided by $$x - 1.$$ Compute the sum of the coefficients of Q(x), including the constant coefficient term.

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Key

Team Contest – Answer Key

11/12th Grade

	Answer
1	16000
2	14
3	67
4	40
5	27
6	181
7	7
8	8
9	3
10	0

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Final Score *(out of 10)*

Room # _____ **School Name** _____ **Team #** _____

Team Contest – 15 minutes – ~30% of team score

Error! Reference source not found.

STUDENTS: DO NOT WRITE IN SHADED REGIONS

	Answer	Scorer 2 0 or 1	Scorer 1 0 or 1
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11/12th Grade	**TOTAL:**		

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Sponsored by: Columbia Basin College

Pressure Round Contest

1	Joe can paint a house in 3 hours and Sam can paint the same house in 5 hours. Let a/b be the number of hours it takes for them to paint the house together where a and b are relatively prime positive integers. Compute a + b.
2	Find the sum of the roots of the polynomial: $3x^3 - 9x^2 - x = -3$
3	Evaluate: $\cos^2(18°) + \cos^2(36°) + \cos^2(54°) + \cos^2(72°)$
4	On her vacation, Sarah brought 2 hats, 3 scarves, 4 shirts, 3 pairs of pants, and 2 pairs of shoes. How many unique outfits can she make? Assume a hat and a scarf are optional items.
5	How many ways are there to distribute $55 one-dollar bills to six people such that all six get at least $8?

"

"Math Is Cool" Championships — 2020-21

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Final Score *(out of 5)*

Room # _____ **School Name** _____ **Team #** _____

Pressure Round Score Sheet

Submittal # (order turned in)	1	2	3	4	5
Question #					
Proctor Score (circle value)	0 or 1	0 or 2	0 or 3	0 or 4	0 or 5
Scoring Room (checkmark)					

Team: Fill in the room, school, and Team #, then hand only this sheet to the Proctor.
Proctor: write in question number for each submittal and circle the score. Add up total.

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Final Score *(out of 5)*

Room # _____ **School Name** _____ **Team #** _____

Pressure Round Score Sheet

Submittal # (order turned in)	1	2	3	4	5
Question #					
Proctor Score (circle value)	0 or 1	0 or 2	0 or 3	0 or 4	0 or 5
Scoring Room (checkmark)					

Team: Fill in the room, school, and Team #, then hand only this sheet to the Proctor.
Proctor: write in question number for each submittal and circle the score. Add up total.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
1 (at 2 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
1 (at 2 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
2 (at 4 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
2 (at 4 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
3 (at 6 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
3 (at 6 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
4 (at 8 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
4 (at 8 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

"Math Is Cool" Championships — 2020-21

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
5 (at 10 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

"Math Is Cool" Championships — 2020-21

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Room # _____ **School Name** _____ **Team #** _____

Pressure Round Answer Submittal

Submittal #	for Question #	Answer
5 (at 10 minute mark)		

Team: Fill in the room, school, and Team # before the round starts.
Write the question number being answered and the associated answer (or a blank).
You may answer questions in any order. A question may not be answered more than once.

"Math Is Cool" Championships — 2020-21

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Room #	School Name	Team #

Total Score for Each Round

College Bowl #1 (10 Possible)	College Bowl #2 (10 Possible)	College Bowl #3 (10 Possible)

DO NOT USE TALLY MARKS ON THIS SHEET. WRITE THE TOTAL SCORE FOR EACH ROUND.

"Math Is Cool" Championships — 2020-21

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Room #	School Name	Team #

Total Score for Each Round

College Bowl #1 (10 Possible)	College Bowl #2 (10 Possible)	College Bowl #3 (10 Possible)

DO NOT USE TALLY MARKS ON THIS SHEET. WRITE THE TOTAL SCORE FOR EACH ROUND.

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

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Proctor Copy

Mental Math Contest

MENTAL MATH – 30 seconds per question – ~25% of team score & ~8% of individual score

Error! Reference source not found.

1	What is the product of three-elevenths and two hundred forty-two?	66
2	What is the slope of the line connecting the point four comma five and the point one comma negative four?	3
3	What is the area of a square with perimeter of thirty-six units?	81 [units squared]
4	When two standard six-sided dice are rolled, the probability that the sum of the numbers in the top faces is less than 5 is equal to x. What is the reciprocal of x?	6
5	What is the tenth term in the Fibonacci sequence? Assume the first two Fibonacci numbers are both equal to 1.	55
6	If 289 over x equals x over 49, what is the largest possible value of x?	119
7	What is the area of the triangle bounded by the lines x = 0, y = 0, and x plus 4 y equals 64?	512
8	When written in base ten, how many zeroes are at the end of two-hundred-factorial?	49

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

Key

Pressure Round Contest – Answer Key

11/12th Grade

	Answer
1	23
2	3
3	2
4	288
5	792

"Math Is Cool" Championships — 2020-21

11/12th Grade — Dec. 2, 2020

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Key

COLLEGE BOWL ROUND #1

#	Problem	Answer
1	What is the sum of the largest and smallest positive prime factors of 2020?	103
2	Express as a binary (base 2) number: $6\log_4 2 + \log_4 256$. Only the digits of your answer need to be provided, or in other words, do not include the base.	111[base 2]
3	It costs $1.75 to wash a load of laundry and $1.50 to dry a load of laundry. If you are washing and drying 3 loads of laundry and additionally only washing 7 loads of laundry, how much money did you spend? Express your answer in dollars. Do not include a decimal point and cents.	22
4	How many ways can you rearrange the letters in the word HASHTAGS so that the As are not next to each other?	3,780
5	The area in the xy-plane bounded by the curve $x^2 - 8x + 4y^2 + 8y - 16 = 0$ is $k\pi$. What is k?	18
6	What is the product of the third and seventh digits after the decimal point in the decimal representation of 1/7?	2
7	Evaluate: $\sqrt{2 + \sqrt{2 + \sqrt{2 + \cdots}}}$	2
8	Let i equal the square root of -1. What is the product of $7 + 2i$ and its conjugate?	53
9	What is the measure of the smaller angle between the hour and minute hands of a clock at 3:30? Express your answer in degrees.	75 [degrees]
10	The probability of drawing three consecutive cards with the same suit from a standard deck of 52 cards, without replacement, in its simplest form, is $^n/_d$. What is $d - n$?	403

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COLLEGE BOWL ROUND #2

#	Problem	Answer
1	What is the 2020th term of an arithmetic sequence with first term 57 and common difference negative 7?	-14,076
2	When closing a deal on an apartment rental in NYC, real estate agents receive a commission that is 15% of the annual rent. If the monthly rent is $1,500, the agent receives how many dollars? Do not include a decimal point and cents.	2,700 [$]
3	A solid box is 8 inches by 9 inches by 10 inches and is made of 1-inch cubes. If the outside of the box is painted, how many unit cubes are not painted at all?	336
4	How many positive integer divisors of 6,075 are perfect squares?	6
5	The area of a trapezoid is 144 units squared. B_1 $is \frac{1}{6}$ h and B_2 $is \frac{1}{3} h$. What is B_1?	4 [units]
6	The determinant of matrix A below is equal to d. What is the sum of the positive factors of d (not including d)? $$A = \begin{bmatrix} 9 & 1 \\ 11 & 19 \end{bmatrix}$$	218
7	There are 5 unfair coins, where the probability of flipping heads is 60%. The probability that exactly 2 of them show heads when these 5 coins are flipped is $^{n}/_{d}$, as a reduced fraction. Find the value of $\sqrt{d} - \sqrt{n}$.	13
8	What is twice the sum of the terms in the following infinite geometric series? 729, 243, …	2,187
9	Vegeta wants to know what is the first prime number that is over 9000. What is that number?	9001
10	Calculate the sum of coefficients in the expansion of $(3x - 7)^3$.	-64

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COLLEGE BOWL ROUND #3

#	Problem	Answer
1	What is the date of the 220th day of the year 2020? State as mmdd (ie: January 1 = 0101). Include leading zeroes in your answer.	0807
2	What is the least common multiple of 24 and 63?	504
3	The area of a 60° angle sector of a circle is 6π. The circumference of the circle is $k\pi$. What is k?	12
4	Richard is trying to record a 15 second *TikTok* video. It takes him 3 seconds to "floss," 5 seconds to "do the robot," and 2 seconds to "disco." How many combinations of dance moves can Richard use in his video? (He can repeat dance moves)	7
5	Three tennis balls, with diameter 2 inches each, are stacked perfectly on top of each other in a cylindrical can that has a diameter of 2 inches and 12 inches in height. The volume of the space inside the can but outside the tennis balls is $k\pi$ cubic inches. What is k?	8
6	Given eight points in the plane, find the maximum number of lines that can be drawn by connecting any of the two points.	28
7	The point (x, y) is 2/3 the distance between (18,2) and (-3, -10), and is closer to (-3, -10). What is the absolute value of the sum of the coordinates of (x, y)?	2
8	How many integers between 20 and 50, inclusive, have an odd number of positive integral factors?	3
9	What is the sum of the 5th and 10th terms in the "Fibonacci" sequence? Assume the first two Fibonacci numbers are both equal to 1.	60
10	You see people, some with dogs, on a sunny day. You count 158 legs and 57 heads. 80% of people are wearing sunglasses. How many eyes (individual, not pairs of eyes) do you see? Assume that no dogs are wearing sunglasses.	58

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COLLEGE BOWL — EXTRA Qs

#	Problem	Answer
1	Express 0.375 as a fraction n/d where n and d are relatively prime. What is n + d?	11
2	Find the largest solution to the following equation: x^2-3x-28 = 0	7
3	The line 3x + 4 = y is reflected over the y-axis to the line ax + b = y. What is the sum of a and b?	1
4	Anita rolls 2 similar fair n-sided dice, where n > 5. What is n, if the most probable sum of the numbers obtained is 17?	16
5	There are 50 unpaired socks in a sock drawer. Fifteen are pink, 15 are purple, and the rest are yellow. How many socks do you have to take out of the drawer to have guaranteed that at least one sock of each color was taken out?	36
6	What is the sum of the entries in a 4 by 4 identity matrix?	4