"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Sponsored by:

GENERAL INSTRUCTIONS applying to all tests:

- *Good sportsmanship is expected throughout the competition by <u>all</u> 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:*
  - *All answers are integers, and any non-integer answers will be "coded" as integers.*
  - *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, 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" Masters — 2023-24

11/12th Grade — December 2, 2023

Final Score *(out of 8)*

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

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

All students in the room will concurrently be asked the same eight questions in this individual test. When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. ***You may not change or cross out answers once you have written an answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong.*** *Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his or her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before the next question is read. You may continue to work on a problem (in your head) while the next question is being read. The raw score is 1 point per correct answer.*

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" Masters — 2023-24

11/12th Grade — December 2, 2023

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

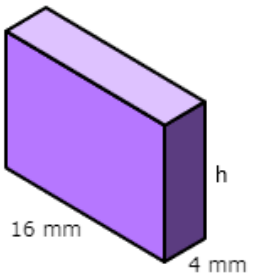
	Answer	
1	789	What is the sum of three hundred sixty-eight and four hundred twenty-one?
2	1,000,000	How many thousands are in one billion?
3	4047 [= a – c]	If 'a' minus 'b' equals two thousand twenty-three, and 'b' minus 'c' equals two thousand twenty-four, what is the value of 'a' minus 'c'?
4	40 [%]	As a percentage, what is the value of five elevenths divided by twenty-five twenty-seconds?
5	25	Yessenia added together some perfect squares, all of which were different. Their sum was fifty-five. What was the largest perfect square that was added?
6	128 [square units]	In square units, what is the maximum area of a rectangle with a diagonal that has a length of sixteen units?
7	58 [terms]	In the sequence of odd integers, beginning with one, three, five and so on, how many terms are there after the term 91, but before the term two hundred nine?
8	50 [%]	When a circuit containing blinking lights A and B is turned on, lights A and B blink together. After that, A blinks once every five seconds and B blinks once every eleven seconds. Asher looks at the lights just in time to see A blink alone. As a percent, what is the probability that the next light to blink will be A blinking alone?

"Math Is Cool" Masters — 2023-24

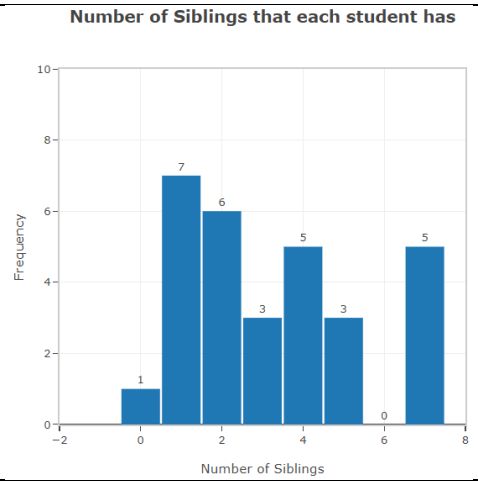
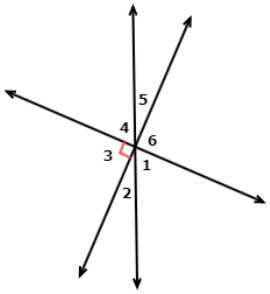
December 2, 2023

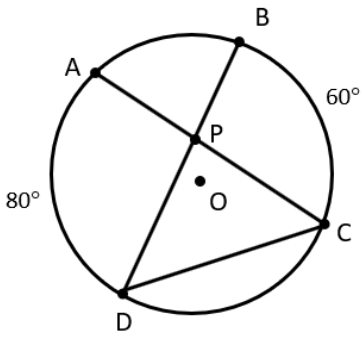
High School Individual Contest

35 minutes, 40 problems, ~92% of individual score.
A 5-minute time warning will be given.

	Questions 1-30: 2 points each
1	Evaluate the expression for x = –1: 8 – 13x
2	Gregg is knitting a scarf at a rate of 1 meter per day. How many centimeters per week is he knitting?
3	The surface area of the following rectangular prism is 608 mm^2. What is the height of the prism, in millimeters? 
4	What is the value of x in the following sequence? -34, x, -20, -13, -6, 1, 8
5	The following table summarizes Mr. Orr's Statistics students at Columbia Basin College by their gender and whether they are from Washington state or some other location. What is the probability in percent that a randomly selected student is Male or from Washington state? <table><tr><td></td><td>From WA</td><td>Not from WA</td></tr><tr><td>Male</td><td>4</td><td>1</td></tr><tr><td>Female</td><td>12</td><td>8</td></tr></table>
6	What is the value of: 1 – 2 + 4 – 8 + 16 – 32
7	How many prime numbers are between 20 and 50?
8	Diego asked his grandmother how old she was. She replied by telling him that she has 6 children, and each was born 4 years apart. Her first child was born when she was 19 years old, and her youngest child is now 19 years old. In years, how old is Diego's grandmother?
9	Find f(4) for the piecewise-defined function f(x): $f(x) = \begin{cases} -3x - 7 \; if \; x < 6 \\ -4x + 3 \; if \; x \geq 6 \end{cases}$
10	Raj and Howard went to the bakery and bought boxes of donuts. Raj bought 40 donuts and Howard bought 24. Each box contains the same number of donuts. What is the largest possible number of donuts in each box?
11	As an integer, evaluate the following product: $(2.4 \times 10^5)(6.0 \times 10^{-3})$
12	Yareli has seven favorite movies. In how many ways can she choose three of them to watch at her upcoming slumber party? The order is not important.

Continued on next page.

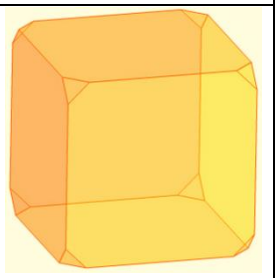
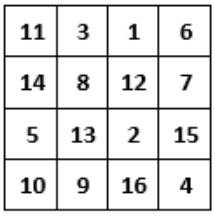
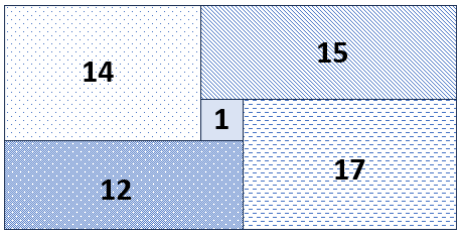
13	The following histogram shows the number of siblings that each student in Ms. Lutrell's class has. What is the mode of this data, in number of siblings? 
14	Which angle is vertical to angle 5? 
15	The solution to the following system of equations is the ordered pair (x, y). What is the value of x + y? $4x + 3y = 10$ $y = -1.5(x - 1)$
16	As an integer, what is the value of the following Roman numeral? MMDXIV
17	Triangle ABC has vertices A (3, -8), B (6, -8) and C (0, -3). After the triangle is rotated 180° counterclockwise around the origin to new vertices A', B' and C', what is the sum of the x-coordinates of A', B' and C'?
18	In a survey, people were asked whether they like red, green, blue, or two or more of the colors. Thirty people were surveyed, all of whom gave one, two, or all three colors as colors they like. At least one respondent gave all three as colors they like, and at least one gave each possible pair of colors (but not the third) as colors they like, and at least one gave only red, green, or blue as a color they like. What is the largest possible number of respondents who could have said they only like red?
19	Grace has a cylindrical glass which is half full of water. The glass has a radius of 3 cm and height of 16 cm. She drinks one-half of the water she has and then pours the remaining water into Lily's cylindrical glass. Lily's glass has a height of 9 cm. What is the radius of Lily's glass in cm if the water fills up a quarter of the glass?
20	A group of 15 students have an average age of 16 years. How many thirty-year olds need to be added to the group to raise the average age to 20 years old?
21	What is the sum of the sine and cosine of an angle measuring $\frac{7\pi}{4}$ radians?
22	Find the sum of the 40 terms in the finite arithmetic sequence which begins as follows: -13, 19, 51, 83, …
	Continued on next page.

23	Aditya and Sahil are sitting opposite each other playing cards. Sahil is holding 4 cards numbered 2, 3, 4, and 5 (not in that order). Sahil wants the cards in ascending order from his perspective, from left to right. Aditya watches Sahil take the leftmost card (from Aditya's perspective) and put it last. He finally watches Sahil take the third card from the right (from Aditya's perspective) and put it last. From Sahil's perspective, what was the original order of the cards, as a 4-digit integer?
24	Twenty schools have each sent a 2-member math team to a competition. For the "fun sum" round, how many different 3-member teams can be formed that do not contain any students from the same school?
25	What is the next number in the sequence that begins: 0, 1, 4, 11, 24, …
26	How many integer solutions does this absolute value inequality have? $\lvert 3x - 2 \rvert < 4$
27	The totient function, $\Phi(m)$, is the number of integers between 1 and m (inclusive) that are relatively prime to m. What is $\Phi(21)$?
28	In circle O shown here, arc BC measures 60°, and arc AD measures 80°. Find the value of ∠APD + ∠BDC, in degrees. 
29	Four integers are added to the set {3, 4, 5, 5, 8}, which increases the mean, median and mode by 1 each. What is the greatest integer in the new set?
30	Let x equal the determinant of the following matrix. If the value of y is reduced by 13, the determinant of the modified matrix is equal to 1 – x. What is y? $\begin{bmatrix} 7 & 4 & -6 \\ 1 & y & 2 \\ 0 & 2 & 3 \end{bmatrix}$

Challenge Questions: 3 points each

31	A geometric sequence has 99 terms, with first term 12 and last term 147. What is the 50th term in the sequence?
32	The year 1978 had an unusual property. When the number is split in half into the two numbers 19 and 78, the sum of the two numbers 19 + 78 equals 97, which are the two digits in the middle of the year 1978. The current year, 2023, does not have this property, because 20 + 23 does not equal 02. What is the next year after 1978 that has this same property?
33	In October 2023, there were 192 high school students that competed in the Tri-Cities Math Is Cool competition. The individual scores for these students are in a bell-shaped or normal distribution. According to the Empirical Rule, how many of the individual scores lie within one standard deviation of the mean? Round to the nearest integer.

Continued on next page.

34	Five cards are randomly dealt from a standard 52-card deck of playing cards. As a reduced common fraction, the probability that the 5-card hand contains at least three Kings is A/B. What is A + B?
35	Light travels at a speed of approximately 3×10^8 meters per second. At this speed, how far will light travel in the year 2024, in millions of kilometers?
36	The eight corners of a cube are cut off, leaving a truncated cube as shown here. The solid has eight triangular faces with a total of 24 vertices. If each of the 24 vertices is connected to every other vertex with a line segment, how many of those line segments will pass through the interior of the truncated cube? 
37	Angie buys three different kinds of candy, which cost 40 cents, 10 cents and 1 cent each. The total cost is 259 cents for 100 pieces of candy. How many pieces of the 1 cent candy did Angie buy?
38	In the following grid, which number is two places away from itself plus 2, one place away from itself plus 5, two places away from itself less 3, and two places away from itself plus 1? One place away indicates adjacent, either horizontally, vertically or diagonally. Two places away indicates two steps in the same direction, either horizontally, vertically or diagonally. 
39	How many ordered triples of positive integers exist, (x, y, z), where x < y < z, whose product is four times their sum?
40	The following figure shows a large rectangle composed of four smaller rectangles and a central square with side length equal to 1. The area of each rectangle and square is given, in square units. What is the value of 10 times the perimeter of the large rectangle, in units? 
IF taking Pre-Calculus or Calculus, continue to Questions 41 - 45	
41	Simplify: $i^2(3 + 4i)(3 - 4i)$ where $i = \sqrt{-1}$
42	What is the minimum number of real solutions that a 6th degree polynomial function can have?
43	De Moivre's Theorem states that if: $z = x + iy = re^{i\theta}$, and n is a natural number, then: $z^n = (x + iy)^n = \left(re^{i\theta}\right)^n = r^n e^{n\theta i}$ Find the value of: $\left(-\sqrt{3} + i\right)^6$
44	Sir Amon Gus is filling his swimming pool with a hose, but he hasn't paid his water bill. The hose starts filling the pool at a rate of 4 liters per second but immediately slows down at a constant rate of 50 mL per second, until it reaches 0 liters per second. What is the volume of the water in the pool, in liters, once Gus's water supply runs dry?
45	For the given function, find the slope of the graph of the function at the point (1, 0). $$f(x) = \frac{2x^2 - 3x + 1}{x}$$

"Math Is Cool" Masters – 2023-24

KEY

High School 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	21
2	700 [cm/week]
3	12 [mm]
4	-27 [=x]
5	68 [%]
6	-21
7	7 [prime numbers]
8	58 [years]
9	-19 [= f(4)]
10	8 [donuts]
11	1440
12	35 [ways]
13	1 [sibling]
14	2 [angle]
15	7 [= x + y]

	Answer
16	2514
17	-9
18	24 [respondents]
19	4 [cm]
20	6 [30-year olds]
21	0
22	24440 [= sum]
23	4253
24	9120 [teams]
25	45
26	2 [integer solutions]
27	12
28	100 [°]
29	11
30	9 [=y]

	Answer
31	42 [= 50th term]
32	2307
33	131 [test scores]
34	10848 [= A + B]
35	9,486,720 [millions of km]
36	120 [line segments]
37	89 [pieces]
38	7
39	5 [triples]
40	318 [units] [= 10 times perimeter]
41	-25
42	0
43	-64
44	160 [liters]
45	1 [= slope]

"Math Is Cool" Masters – 2023-24

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:			

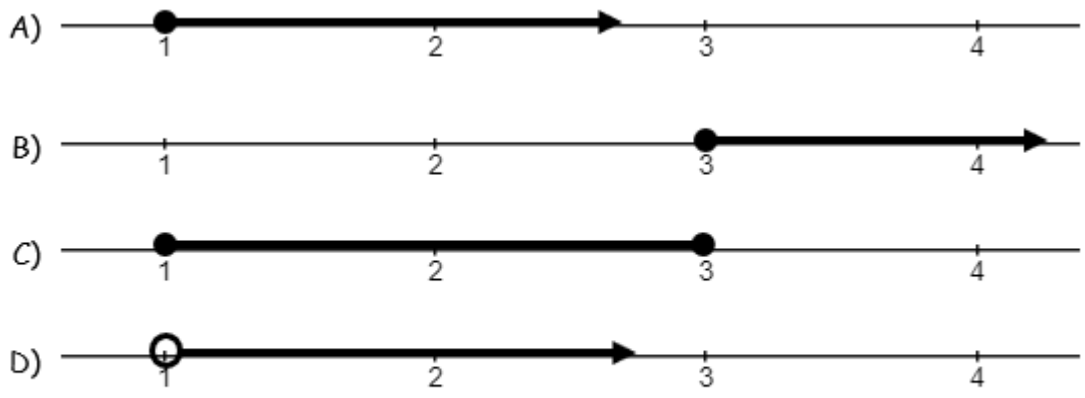
	Answer	1 or 0	1 or 0
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
31-45 TOTAL:			

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Individual Multiple Choice Contest

1	What is the lateral surface area of a cylinder that has a radius of 7 centimeters and a height of 21 centimeters? A) 294π cm^2 B) 392π cm^2 C) 454π cm^2 D) 1029π cm^2 E) Answer not given.
2	Evaluate the expression: $\left(\frac{1}{2}+\frac{1}{4}\div\frac{1}{3}\right)\div\frac{3}{16}$ A) 5/6 B) 5/16 C) 12 D) 20/3 E) Answer not given.
3	Which of the following graphs shows the solution to the following compound inequality: $2x-5\geq -3 \quad and \quad 5x+2\geq 17$  E) Answer not given.
4	In the game of Yahtzee, players roll 5 standard dice and try to get various number combinations. They have a total of 3 opportunities to roll each turn. A Full House consists of 3 dice that are the same plus two dice that are the same, but different from the first three, such as: 3, 3, 3, 2, 2. A Yahtzee consists of 5 dice that are the same, such as 3, 3, 3, 3, 3. After two rolls, a player has 3, 4, 5, 5, 5. Assume they pick up the 3 and 4, and roll them again. What is the probability of getting a Full House that is NOT a Yahtzee? A) 1/6 B) 2/18 C) 5/36 D) 7/36 E) Answer not given.

Continued on next page.

5	Mr. Gardener collects data from his Statistics students at Columbia Basin College, with one data value being their age in years. For the Fall 2023 quarter, his 30 students have reported the following ages, sorted in order: Seven students are younger than 20 years old, 20, 20, 20, 21, 21, 22, 22, 22, 23, 23, 24, 25, 25, 25, 26, 26, 27, 30, five students are older than 30 years old. What is the median age of his students, in years? A) 22 years B) 22.5 years C) 23 years D) Cannot determine. E) Answer not given.
6	Which of the following equations will produce the graph of $y = 4^x$ after being reflected over the y-axis? A) $y = (-4)^x$ B) $y = (0.25)^x$ C) $y = (0.4)^x$ D) $y = 2^{2x}$ E) Answer not given.
7	If $\log_2(10) = a$, what is the value of $\log_{16}(10)$? A) 4a B) a^4 C) $\sqrt[4]{a}$ D) 0.25a E) Answer not given.
8	Express the following base-4 number as a reduced fraction in base-10: 1.32_4 A) 7/8 B) 19/16 C) 15/8 D) 21/8 E) Answer not given.
9	A sequence is defined as follows: $a_n = 1 + a_{n-1} - a_{n-2}\,, for\ n \geq 3$ In other words, starting with the third term, each term is equal to 1 plus the previous term minus the term before that. The first term a_1 equals x, and the second term a_2 equals y. What is the sum of the first 2023 terms in the sequence, as an expression in terms of x and y? A) x + 2022 B) 2023 – y C) x D) x – y + 2023 E) Answer not given.
10	Four standard 6-sided dice are rolled, and the lowest number of the four is discarded. What is the probability that the sum of the remaining three numbers is at least 17? A) 25/432 B) 7/108 C) 61/1296 D) 1/54 E) None of the above.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Final Score *(out of 20)*

Room # **School Name** **Student Name** **Team #**

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

This test is taken individually, but it is part of your team score, which will be calculated by taking the mean of the top 3 scores from your team. This test is the only test where you will be penalized for incorrect responses. You will receive two points for a correct letter response, zero points for leaving it blank, and minus one point for an incorrect response. When you are prompted to begin, tear off the colored answer sheet and begin testing. **ONLY a letter response should be listed as an answer on this answer sheet.**

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

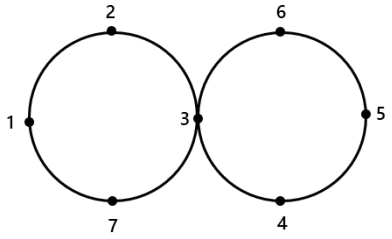
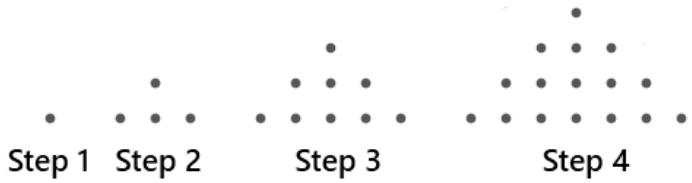
STUDENTS: DO NOT WRITE IN SHADED REGIONS

	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:**		

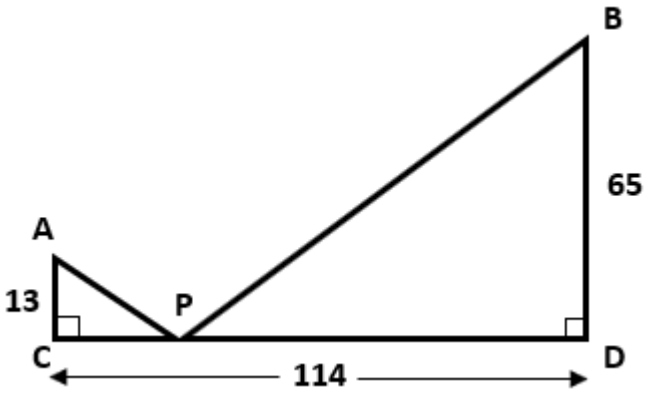
"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Team Contest

1	There are two tangent circles, each with radius 2 cm, with four numbers evenly spaced around the circumferences of each circle. An ant starts at point number 1 and walks a 'figure 8' path along the circumferences, going in order through points: 1, 2, 3, 4, 5, 6, 3, 7, 1 (one full circuit). The ant repeats this pattern until it has walked a distance of 165π, where it stops on a numbered dot. What number is the dot? 
2	The first four steps of a sequence are shown. How many more dots are in Step 15 than are in Step 11? 
3	There are 780 students that have a 1st hour class at Maryam Mirzakhani High School. The number of 1st hour classes is four more than the mean number of students in each 1st hour class. How many 1st hour classes are there?
4	Multiplying the two largest prime numbers that are less than 90 results in a 4-digit integer. What is the largest possible number that can be obtained by rearranging the digits in that 4-digit integer?
5	What is the minimum value in the domain of the following function? $$f(x) = 4 + \sqrt{x-2}$$
6	A 'madness' of unusual marmots have just awoken from their winter hibernation on Mt. Rainier. Some of them have red fur, some have yellow fur, some have green fur, and the rest have blue fur. Some have long tails, and the rest have short tails. Additionally: • Four of them have red fur and long tails. • Eighteen of them have short tails. • Twelve of them have both short tails and either green or blue fur. • Six of them have blue fur and long tails. • Eight of them have both long tails and either yellow or green fur. • Thirty of them have fur that is either yellow, green, or blue. How many of the marmots have both yellow fur and short tails?
7	Two 8-sided dice, with sides numbered from 1 to 8, are rolled. What is the probability in percent that at least one of them shows a prime number?

Continued on next page.

8	Point P is the point on $\overline{CD}$ for which the length $\overline{AP} + \overline{PB}$ is a minimum. Find the length of $\overline{PD}$ in units. All lengths shown on the graph are given in units. 
9	Find the number of integer grid points (x, y), where both x and y are integers, in the region between $y = x^2$ and $y = 100$, including those lying on $y = x^2$ and $y = 100$.
10	The 'digit sum' of a positive integer is found by summing its digits. For example, the digit sum of 274 is 2 + 7 + 4 = 13. The 'digital root' of a positive integer is found by repeatedly calculating the digit sum until a single digit is achieved. For example, the digit root of 274 is 1 + 3 = 4. How many positive 3-digit integers that are less than 500 have a digital root of 5?

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Key

Team Contest – Answer Key

11/12th Grade

	Answer
1	6 [no. of the dot]
2	104 [more dots]
3	30 [1st hour classes]
4	8773
5	2 [=x]
6	4 [marmots]
7	75 [%]
8	95 [units]
9	1351 [points]
10	44 [3-digit integers]

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Final Score *(out of 10)*

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

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

When you are prompted to begin, tear off the colored answer sheet and give a copy of the test to each of your team members and begin testing. Each problem is scored as a 1 or 0. Record all answers on this colored answer sheet.

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" Masters — 2023-24

11/12th Grade — December 2, 2023

Pressure Round Contest

1	A data set consisting of ten distinct positive integers has a mean of 23. The smallest 8 members of the set are: 12, 15, 16, 19, 20, 22, 24, and 27. How many possible pairs of integers could be the 9th and 10th members of the set? The order of the integers in the pairs does not matter.
2	The following expression can be simplified to a binomial in the form ax + b, given that x ≠ -2. What is the value of a + b? $\frac{3x^2+5x-2}{x+2}$
3	Priya has a rope that is 200 cm long. She cuts the rope into four pieces, and uses one piece to form a square, and the remaining three pieces to form three identical equilateral triangles. All rope lengths are used exactly, with no overlap or gaps. All four shapes have integral side lengths in cm. How many different side lengths are possible for the square?
4	Let x be a number such that the following matrix does not have an inverse. What is x? $\begin{bmatrix} 1 & 6 & 4 \\ 2 & 4 & -1 \\ -1 & 2 & x \end{bmatrix}$
5	Find the value of: $\log_2(\log_{16}(\log_5 25))$

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

Pressure Round Contest

1	A data set consisting of ten distinct positive integers has a mean of 23. The smallest 8 members of the set are: 12, 15, 16, 19, 20, 22, 24, and 27. How many possible pairs of integers could be the 9th and 10th members of the set? The order of the integers in the pairs does not matter.
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4	Let x be a number such that the following matrix does not have an inverse. What is x? $\begin{bmatrix} 1 & 6 & 4 \\ 2 & 4 & -1 \\ -1 & 2 & x \end{bmatrix}$
5	Find the value of: $\log_2(\log_{16}(\log_5 25))$

Final Score *(out of 5)*

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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

Pressure Round Score Sheet

Submittal # (order turned in)	1	2	3	4	5
Question #					
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: staple this to the top of the five submittals in order.

Final Score *(out of 5)*

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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

Pressure Round Score Sheet

Submittal # (order turned in)	1	2	3	4	5
Question #					
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: staple this to the top of the five submittals in order.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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.

"Math Is Cool" Masters — 2023-24

11/12th Grade — December 2, 2023

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.

"Math Is Cool" Masters — 2023-24

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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" Masters — 2023-24

11/12th Grade — December 2, 2023

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" Masters — 2023-24

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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" Masters — 2023-24

11/12th Grade — December 2, 2023

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" Masters — 2023-24

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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" Masters — 2023-24

11/12th Grade — December 2, 2023

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" Masters — 2023-24

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Proctor Copy

Mental Math Contest

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

All students in the room will concurrently be asked the same eight questions in this individual test. When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. ***You may not change or cross out answers once you have written an answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong.*** *Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his or her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before the next question is read. You may continue to work on a problem (in your head) while the next question is being read. The raw score is 1 point per correct answer.*

1	What is the sum of three hundred sixty-eight and four hundred twenty-one?	
2	How many thousands are in one billion?	
3	If 'a' minus 'b' equals two thousand twenty-three, and 'b' minus 'c' equals two thousand twenty-four, what is the value of 'a' minus 'c'?	
4	As a percentage, what is the value of five elevenths divided by twenty-five twenty-seconds?	
5	Yessenia added together some perfect squares, all of which were different. Their sum was fifty-five. What was the largest perfect square that was added?	
6	In square units, what is the maximum area of a rectangle with a diagonal that has a length of sixteen units?	
7	In the sequence of odd integers, beginning with one, three, five and so on, how many terms are there after the term 91, but before the term two hundred nine?	
8	When a circuit containing blinking lights A and B is turned on, lights A and B blink together. After that, A blinks once every five seconds and B blinks once every eleven seconds. Asher looks at the lights just in time to see A blink alone. As a percent, what is the probability that the next light to blink will be A blinking alone?	

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11/12th Grade — December 2, 2023

Key

Pressure Round Contest – Answer Key

11/12th Grade

	Answer
1	10 [pairs]
2	2 [= a + b]
3	5 [side lengths]
4	5 [= x]
5	-2

"Math Is Cool" Masters — 2023-24

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Key

COLLEGE BOWL ROUND #1

#	Problem	Answer
1	What is the maximum number of distinct points of intersection that a circle can have with a square?	8 [points]
2	How many composite integers are between thirty and forty, inclusive?	9 [integers]
3	What is the remainder when eight factorial is divided by six?	0
4	Biff and Eho each have the same number of Cheez-its. Biff eats two hundred thirty seven Cheez-its and Eho eats one hundred fifty three Cheez-its and still has four sevenths of his Cheez-its left. How many Cheez-its does Biff have left?	120 [Cheez-its]
5	Yessica randomly picks two cards without replacement from a group of six cards numbered two, three, five, six, seven and ten. The probability that the product of the two numbers on the cards is a multiple of ten is a reduced common fraction A over B. What is A + B?	22 [= A + B]
6	Find the area in square units of the triangle with vertices at the following points: six comma eight (pause) nine comma two (pause) and seventeen comma six.	30 [square units]
7	How many ways are there to choose exactly two pets from a pet rescue facility that currently has five hamsters, seven hedgehogs and eight pygmy goats?	190 [ways]
8	Solve for x: Negative 4x plus fifteen equals negative 9x minus fifteen	-6 [=x]
9	What is the next number in the sequence that begins as follows: Two, two, four, six, ten, sixteen, twenty-six, and so on.	42
10	What is the quotient when one billion is divided by the product of two to the eighth and five to the seventh?	50

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Key

COLLEGE BOWL ROUND #2

#	Problem	Answer
1	A full can of kerosene weighs 8 kg. Half the kerosene is poured out of the can, after which the can weighs 4.5 kg. What is the weight of the empty can, in kilograms?	1 [kg]
2	What is the number of lines of symmetry for an equilateral triangle times the number of edges in a rectangular prism?	36
3	Three consecutive integers sum to eight hundred and thirty-four. What is the sum of the digits of the smallest number?	16 [= sum]
4	How many positive integers less than fifty are not divisible by either three or eleven?	30 [integers]
5	Point A and Point B are points in coordinate space. Point A has coordinates zero, zero, zero and Point B has coordinates two, two, two. How many unique paths are there from Point A to Point B that move from one lattice point to another along the straight lines connecting them in the positive x, y or z direction?	90 [paths]
6	Mario has fifteen dollars in nickels, dimes and quarters. He has twice as many nickels as quarters. He has fifteen more dimes than quarters. How many nickels does Mario have?	60 [nickels]
7	The six digit integer three A six A nine two is divisible by eleven. What is the value of A?	8 [= A]
8	What is the mean of the first ninety-nine counting numbers?	50 [= mean]
9	What is fifty-four divided by two hundred, expressed as a percentage?	27 [%]
10	What is the product of the next two numbers in the arithmetic (proctor – pronounced air-ith-MET-ic) sequence that begins as follows: Forty-eight, thirty-five, twenty-two, and so on.	-36 [= product]

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Key

COLLEGE BOWL ROUND #3

#	Problem	Answer
1	What is nine to the fourth power?	6561
2	If a rhombus with area twenty-six square centimeters has one diagonal of length four centimeters, what is the length in centimeters of the other diagonal?	13 [cm]
3	A standard ten-sided die is numbered on its faces with the integers zero through nine. When the die is rolled, what is the probability as a percent that the number showing is five or less?	60 [%]
4	If I can eat one bagel in four hours and Emily can eat one bagel in eight hours, how many hours would it take for us to eat three bagels together?	8 [hours]
5	Vivek has four pet rats, each of which weighs a whole number of ounces. The median weight of the rats is eleven ounces, and the mean weight of the rats is twelve ounces. What is the greatest possible difference between the weight of the heaviest and lightest rat, in ounces?	24 [ounces]
6	When the positive integer divisors of three hundred eighty-five are arranged from least to greatest, what is the sum of the fourth, fifth and sixth divisors?	101 [= sum]
7	How many ways can the digits one, two, three and four be arranged in a line, such that no adjacent digits differ by more than two?	12 [ways]
8	What is thirty-nine sevenths divided by thirteen twenty-eighths?	12
9	What is the area in square units of triangle ABC with vertices at point A two comma three, point B seventeen comma eleven and point C seventeen comma three?	60 [sq. units]
10	Simply the expression: thirty-two raised to the seven-fifths	128

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Key

COLLEGE BOWL ROUND #4

#	Problem	Answer
1	How many seconds are in three hours and twenty-one minutes?	12060 [seconds]
2	What is the largest prime factor of two thousand forty?	17
3	Twenty-seven unit cubes are arranged to form a larger three by three by three cube. The center unit cube from each face is then removed. In square units, what is the surface area of the resulting solid?	78 [sq units]
4	The sum of four consecutive odd integers is 128. What is the largest of the four integers?	35
5	A line segment has endpoints at A with coordinates zero comma zero and B with coordinates negative three comma four. Point C is the image of point B translated down four units and left three units. What is the perimeter of triangle ABC, in units?	16 [units]
6	If all test scores are integers from zero to one hundred inclusive, what is the least possible median of five test scores that add up to two hundred four?	2 [= median]
7	In order, the first three terms of an arithmetic sequence are x, six, and 2x minus three. What is the fifth term of the sequence?	9 [= 5th term]
8	What is the sum of the entries in the sixth row of Pascal's triangle, where the first row consists of a single one?	32
9	What is the greater of the two solutions to the following equation: negative five x-squared plus two x plus three equals zero.	1 [=x]
10	How many of the following represent whole numbers? Twelve, four-tenths, negative sixty-four, pi, zero divided by ten, five minus eight	2 [whole numbers]

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Key

COLLEGE BOWL ROUND #5

#	Problem	Answer
1	What is the sum of eleven, one hundred one, one thousand one, and ten thousand one?	11114
2	What is the measure in degrees of one exterior angle of a regular hexagon?	60 [°]
3	If two Bleps equals fifteen Drips and five Drips equals twenty-eight Zoops, how many Zoops equal one Blep?	42 [Zoops]
4	What is the value of 'b' in the following geometric sequence: nine, a, b, c, eighty-one	27 [=b]
5	Josie can solve 30 problems in 4 hours when she works alone. Tessa can solve 33 problems in 6 hours when she works alone. If they both work together the entire time, how many hours will it take them to solve 78 problems?	6 [hours]
6	Find the value of x if log base ten of x equals four.	10000 [= x]
7	A yogurt stand offers 6 different kinds of toppings: sprinkles, m&ms, cookie crumbs, whipped cream, licorice bites and sweet pickles. You can put as many different toppings on as you want, from 0 to 6. How many different ways can a frozen yogurt be made by picking from these toppings?	64
8	How many divisors of sixty-four are perfect squares?	4 [divisors]
9	Seventy-five percent of a number is eighty-eight. What is three-eighths of the number?	44
10	If one order of fries and five burgers costs twice as much as three orders of fries and two burgers, how many times as much does a burger cost compared to one order of fries?	5 [times]

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Key

COLLEGE BOWL ROUND #6

#	Problem	Answer
1	What is the sum of the first six positive perfect squares?	91
2	What is the y-coordinate of the vertex of the parabola given by f of x equals quantity x minus four times quantity x plus six?	-25 [= y coordinate]
3	There are two hundred students at this competition. Twenty-two are in Geometry class, fifty-six are in Algebra two, sixty are in Pre-Calc and sixty-two are in Calculus. If one student is randomly selected for the grand prize, what is the probability in percent that they are either in Pre-Calc or Calculus?	61 [%]
4	How many positive factors does one hundred million have?	81 [factors]
5	Point P with coordinates four comma eight is dilated by a scale factor of three halves around the point two comma two. What is the product of the x and y coordinates of the new dilated point?	55 [product]
6	What is the sum of the terms in the infinite sequence that begins: four plus two plus one plus one-half and so on.	8 [= sum]
7	At the end of a party, everyone present shakes hands one time with every other person. A latecomer arrives and shakes hands only with the people that he knows. Altogether, sixty-eight handshakes occurred. How many people did the latecomer know?	2 [people]
8	What is the mean of the prime numbers between twenty and thirty?	26 [= mean]
9	If x equals negative three, evaluate the following expression: six minus two minus 2x	10
10	The product one hundred twenty eight times two hundred fifty six can be written as two raised to the power of x. What is x?	15 [= x]

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Key

COLLEGE BOWL – EXTRA QUESTIONS

#	Problem	Answer
1	What is the slope of the line that goes through the points seven-halves comma negative one and negative fifteen-halves comma twenty-one?	-2 [= slope]
2	A raffle has two hundred free tickets. One ticket will win a one-hundred seventy dollar prize. The remaining tickets will win nothing. If you have one ticket, what is your expected winnings in cents?	85 [cents]
3	What is the cube root of negative one thousand seven hundred twenty-eight?	-12 [= cube root]
4	Using a value of three to approximate pi, what is the surface area in square centimeters of a sphere with a diameter of eleven centimeters?	363 [cm^2]
5	What is the smallest positive integer value of x for which fifty-four times x is a perfect square?	6 [= x]
6	If the mean of five numbers is twenty-seven, what is the sum of the five numbers?	135 [= the sum]

Proctoring Overview

You will receive a room packet envelope with the schedule and College Bowl rotations on the front. Each room packet includes:

1) the proctor instructions and the general instructions that you will be reading,
2) the proctor question/answers packet (this needs to be carefully controlled), and
3) sets of Mental Math, Individual, Multiple Choice, Team, and Pressure Round tests.

(If not in the room packet, the proctor supervisor will provide blank scratch paper.)

When you receive the room packet, count to ensure that you have the correct number of tests for each event (16 Mental Math & Individual, 4 of each of the team events).

Key Points

- Act professional; focus on what you are doing.
- Your job is to proctor the students; that is, you administer tests, give time warnings, & monitor students for proper test taking behavior to ensure competition integrity and avoid issues like failing to put answers on the answer sheet.
- The proctor packet has Mental Math, Pressure Round, and College Bowl questions/ answers. Keep the packet secure! Avoid opportunities for competitors to see tests or answers.
- Student/school names and team numbers are critical on the answer sheets. Make sure that students fill out such identifying information.
- Keep track of time, and provide appropriate time warnings. Keep to the schedule as close as possible. Wait between events, if needed.
- Read & know the rules—competitors & spectators will, and they will call you on it.
- On questions that you read, read smoothly, enunciate clearly, and don't read too fast.
- If unsure of how to deal with an issue/question/concern, flag down the proctor supervisor and ask.
- Be respectful of your classroom — leave it tidy and arranged exactly as you found it. We don't want any displeased teachers!!
- Use the quick-reference guide on the next page for room setup and key information.

Schedule

Each of the 6 events includes about 5 minutes at the start for reading instructions or rearranging the room.

3:30 - 4:00	Coaches register (Library)	5:55 - 6:10	Pressure Round
4:05 - 4:15	Orientation (Gym)	6:10 - 6:40	Proctors get dinner in proctor room
4:15 - 4:20	Students go to testing rooms	6:45 - 6:55	College Bowl #1
4:20 - 4:35	Mental Math	6:55 - 7:05	College Bowl #2
4:35 - 5:15	Individual Test	7:05 - 7:15	College Bowl #3
5:15 - 5:35	Individual M.C. Test	7:15 - 7:25	College Bowl #4
5:35 - 5:55	Team Test	7:25 - 7:35	College Bowl #5

7:35 - 7:45	College Bowl #6	8:00 - 8:30	Awards Ceremony (Gym)

1. Mental Math

Configuration: Students at individual desks spread out in the classroom. Alternating desks, students not next to teammates.

Scheduled Time: 4:20-4:35 PM (read instructions & test)

Duration: 30 seconds per question maximum (beginning after the 2nd reading)

Give Time warning at: 5 seconds

Number of questions: 8 (all students do the same questions)

Proctor Actions: Read each question twice, reading clearly and not too fast. Start the 30 second clock after the 2nd reading.

Key Points: Start by reading "General Instructions" then Mental Math instructions. Make sure everyone writes their name, school & team number on the answer sheet. No talking allowed. Except for the answer, no is writing allowed. Collect answer sheets and organize by team number, then alphabetically by first name of competitor, & staple sheets for the same team together.

2. Individual Test

Configuration: Students at individual desks; same arrangement as for Mental Math.

Scheduled Time: 4:35 PM (read instructions), 4:40-5:15 (test)

Duration: 35 minutes

Give Time warning at: 5 minutes & 30 seconds

Number of questions: 40

Proctor Actions: Ensure appropriate test-taking behavior. Prep for next event (or read College Bowl questions to yourself).

Key Points: Read "Individual Test" instructions. Make sure everyone writes their name, team number, school, proctor name, & room number down on the answer sheet. Collect answer sheets, organize by team, then alphabetically by first name of competitor, and staple sheets for same team together.

3. Individual Multiple Choice Test

Configuration: Students at individual desks; same arrangement as for the Individ. Test.

Scheduled Time: 5:15 PM (read instructions), 5:20-5:35 PM (test)

Duration: 15 minutes

Give Time warning at: 5 minutes & 30 seconds

Number of questions: 10

Proctor Actions: Ensure appropriate test-taking behavior. Prepare for next event.

Key Points: Read Multiple Choice instructions. This is an individual test.

4. Team Test

Configuration: Groups of 4 desks, with the groups spread out in the classroom.

Scheduled Time: 5:35 PM (read instructions), 5:40-5:55 PM (test)

Duration: 15 minutes

Give Time warning at: 5 minutes & 30 seconds

Number of questions: 10

Proctor Actions: Ensure appropriate test-taking behavior. Prepare for next event.

Key Points: Read Team Test instructions. Need to have school & team number on answer sheet. Students can talk quietly & work together.

5. Pressure Round

Configuration: Groups of 4 desks spread out in the classroom (same as Team Test).

Scheduled Time: 5:55 PM (read instructions), 6:00-6:10 PM (test)

Duration: 10 minutes (2 minutes per question)

Give Time warning at: 5 seconds before end of each 2-minutes

Number of questions: 5 (can submit answers in any order)

Proctor Actions: Ensure appropriate test-taking behavior. Score submittals as you go (without showing any answers to students).

Key Points: Students can talk quietly & work together. Proctor: keep answer sheets in order of submittal; make sure that you score the right question and give the right point value.

6. College Bowl

Configuration: Row of 9 desks (side by side) at the front of the room (CBA device on center desk).

Scheduled Time: 6:45 PM (read instructions), 6:50-7:45 PM (test)

Duration: 45 seconds per question (30 seconds per question if there is only one team, who will be only going against the clock)

Give Time warning at: 5 seconds

Number of questions: 10 per round, 6 rounds total

Proctor Actions: Read each question twice, reading clearly and not too fast. Start 45 (or 30) second clock after the 2nd full reading. Mark tally on white board as questions are answered and transfer the numeric total to the score sheets.

Key Points: Event is collaborative, talking is allowed. For a wrong answer, just say, "That is incorrect." (no verbal/visual clues that could be interpreted by the other team to arrive at an answer).

Summary of MIC Proctoring

(for proctors to read to themselves)

Pass out materials (answer sheet/test packets, scratch paper) for the current event to individuals or teams (as appropriate) so they can fill in the name, school, and team number information (very important!). Tell students to not lift the cover sheet or turn over the paper until you give the signal to start. Read the general instructions as the first item at the beginning of the competition (before Mental Math). Read the event-specific instructions just prior to each event and ask if there are any relevant questions. After reading the instructions, you can signal students to begin. Make sure one proctor is watching the time and giving appropriate time warnings (e.g., "five minutes remaining"). At the end of the event, tell competitors to stop work. Collect, sort, & staple the answer sheets (as appropriate) and keep them secure until handed off to a runner.

For the Mental Math/Individual tests, arrange students scattered throughout the classroom with **no student next to another student from their own school**. For the team tests, students will be in groups of 4 desks. College Bowl will require a line of 9 desks side-by-side across the front of the classroom.

For College Bowl, place the College Bowl apparatus (CBA) on a central desk in the line of desks at the front (4 desks on either side of the central one). One proctor will likely need to hold the CBA in place during the College Bowl rounds. Turn the apparatus on by depressing the button or flipping the dip switch. Students may try out the CBA prior to the 1st question. Note: while one light is blinking, the other light is locked out. There is no need to "reset" the device, just let the light finish blinking and it is ready to go.

Keep Pressure Round answers secure while you score the submittals because answers for all questions are on the same sheet. Do not read the answer for College Bowl when you read the question (they are both on the same page). In College Bowl, if an incorrect answer is given, simply say "That is incorrect" and do not give any other cues about the answer (e.g., don't say "sorry, you were close" or exhibit interpretable body language). If both teams fail to supply a correct answer, announce what the correct answer was.

If there is an irregularity (i.e., lack of honesty, poor sportsmanship), make a note of the circumstances, flag the answer sheet, and report the issue to the proctor supervisor.

At the end of the day, return the desks to their original arrangement, recycle any unwanted test materials & used scratch paper, erase any marks you made on the white-board, and generally make sure the classroom is tidied up. Return the CBA, the room packet envelope, the proctor instructions, the contest rules packet, the proctor packet of questions, extra scratch paper, and unused test material to the proctor supervisor.

Detailed Instructions for Proctors

Grades 9-12

NO CALCULATORS ALLOWED ON ANY TESTS!

1. Check to make sure you have everything in your packet.
   - A. ***Mental Math:***
     1. 16 - colored Mental Math answer sheets
     2. Mental Math questions with answers (in the Proctor Packet)
   - B. ***Individual Test:*** 16 individual tests, with colored answer sheets attached
   - C. ***Individual Multiple Choice Test:*** 16 individual multiple choice packets (stapled), with a colored answer sheet on top
   - D. ***Team Test:*** 4 team test packets (stapled), each containing 4 tests plus one colored answer sheet on top
   - E. ***Pressure Round:***
     1. 4 - blank answer sheet packets (with cover sheet/instructions)
     2. 4 – Pressure Round test sets
     3. Pressure Round Answer Key (in the Proctor Packet)
   - F. **College Bowl:**
     1. 4 - College Bowl score sheets
     2. College Bowl questions – 6 rounds (in the Proctor Packet)
   - G. Scratch paper (to be handed out as needed, but try not to waste it)
   - H. Electronic College Bowl Apparatus (CBA; usually distributed at dinner break)

   ALL *COLORED* ANSWER SHEETS WILL BE COLLECTED BY YOU AND WILL BE TAKEN TO THE SCORING ROOM (by RUNNERS) AS SOON AS THEY ARE FILLED OUT BY COMPETITORS (AND PERHAPS GRADED BY YOU). COMPETITORS CAN KEEP ALL OF THE WHITE SHEETS, IF THEY WOULD LIKE (OTHERWISE COLLECT THEM FOR RECYCLE).

   If you are missing anything, you can go get it before the opening ceremony. After the opening ceremony, contact the proctor supervisor/scoring room.

2. Take a photo of how the classroom is laid out (so that it can be returned to its original configuration following the competition). Then set up the classroom desks for the first event (Mental Math).

Respect the teacher whose room you are using. Do not touch their computer or other items. Do not erase anything on their board. Leave the room tidy & in the exact original layout.

Mental Math

3. Arrange desks in a configuration suitable for individual testing (rows/grid of desks all facing forward, students in separated/alternating desks).

4. Put the Mental Math answer sheets face up on the desks such that students are spread out. Wait for students to arrive. ~~You can fill out the proctor name and room number (and perhaps team numbers) on all blank answer sheets, if you like~~. Read over the questions so you will be prepared to read them out loud.

5. After students sit down, check to make sure that no one from the same team is seated next to each other (i.e., "Team xxx, raise your hands."). Ask them to move, if needed.

6. **Check to make sure that students put their full name, school name, team number, and room number on their answer sheet and that the information is legible**.

7. Read the "GENERAL INSTRUCTIONS" (in the Proctor Packet) to the students. Then, read the "MENTAL MATH" instructions (in the Proctor Packet) to the students.

8. Begin the testing. Read each of the eight Mental Math questions to all of the students in the room, per the instructions.

9. At the conclusion of Mental Math, collect the answer sheets. Organize the answer sheets by team number, then alphabetically by first name of competitor. Staple each team's set of four answer sheets together. Promptly hand the packets of answer sheets to your runner for conveyance to the scoring room.

Individual Test

10. The seating configuration will remain unchanged (no swapping seats).

11. Hand out Individual Test packets with the colored blank answer sheet facing up. **Check to make sure that students put their full name, school name, team number, and room number on their answer sheet and that the information is legible**.

12. Read the "INDIVIDUAL TEST" instructions (in the Proctor Packet) to the students and begin the testing at the appointed time.

13. While students are taking the Individual Test, monitor the students for proper test-taking behavior and watch the time to provide 5-minute and 30-second warnings. Make sure students are writing answers on the answer sheet (not the test question pages). During this time you can also get the Individual Multiple Choice tests ready, read through the rules of subsequent events, and (carefully/secretively) look ahead to review the College Bowl questions (i.e., to avoid stumbling over the wording when it comes time to read the questions aloud). You will have observers in the room watching the College Bowl rounds, so make sure you understand the rules, how timing works, etc.

14. At the conclusion of Individual Test, collect the answer sheets. Organize the answer sheets by team number, then alphabetically by first name of competitor. Staple each team's set of four answer sheets together. Promptly hand the packets of answer sheets to your runner for conveyance to the scoring room. Students may keep or recycle their test question packets.

Individual Multiple Choice

15. Keep the room in the same configuration as for the Individual Test.
16. Hand out the tests and have students fill out the top portion of the answer sheet. **Check answer sheets to make sure they are filled out correctly (school, team #, etc.).**
17. Read the "INDIVIDUAL MULTIPLE CHOICE" instructions (in the Proctor Packet) to the students and begin the testing at the appointed time.
18. Monitor the students for proper test-taking behavior (no talking permitted), watch the time, and provide 5-minute and 30-second warnings. While students are taking the Individual Multiple Choice test, get the Team Tests ready.
19. At the conclusion of the test, collect the answer sheets. Organize the answer sheets by team number, then alphabetically by first name of competitor, with the set of team answer sheets stapled together. Hand the answer sheets off to the runner.

Team Test

20. Change the room set-up to groups of 4 desks together so students can work as a team. Hand out the Team Test packets and have teams fill out the information at the top of the colored answer sheet. **Check the answer sheets to make sure they are filled out correctly (school, team #, etc.).**
21. Read the "TEAM TEST" instructions (in the Proctor Packet) to the students and begin the testing at the appointed time.
22. Monitor the students for proper test-taking behavior (talking is allowed), watch the time, and provide 5-minute and 30-second warnings. While students are taking the Team Test, get the Pressure Round tests ready.
23. At the conclusion of the test, collect the answer sheets & hand them off to the runner.

Pressure Round

24. Leave the desks in the same arrangement as the team test. Make sure that all teams can quickly and easily hand you their answer sheet every two minutes.
25. Hand out the colored half-sheet packets to each team so they can fill out their school name and team number on each sheet before testing begins.
26. Have each team tear off the first sheet and give it to you to keep score.

27. YOU WILL BE TIMING THIS EVENT FOR YOURSELF. GIVE THEM A VERBAL 5 SECOND WARNING AND TELL THEM TO HOLD THEIR ANSWER SHEETS UP IN THE AIR EVERY TWO MINUTES. Tell them when the time is up for each two-minute round and, if an answer sheet isn't up in the air all the way at this time, then collect, but score as a zero and just write "time" on the score sheet for that particular question.

28. While they are working on the next round, you need to grade the answer sheets that you just collected and score it on the score sheet. Stack each team's half-sheets in **the order that they were turned in**, keeping the score sheet on top. Remember, you are still timing while you are doing all this!

29. Read the "PRESSURE ROUND" instructions (in the Proctor Packet) to the students and begin the testing at the appointed time.

30. At the conclusion of the fifth round, staple each team's half-sheets together, with the score sheet on top. Wait for the runner to come pick up the four packets before leaving for break.

Dinner Break

31. AT BREAK — Eat dinner in the proctor room. Pick up your College Bowl apparatus (CBA) at this time. If you haven't already, you may want to read over the College Bowl questions to make sure you will be able to pronounce everything properly. Return to your room in time to place the CBA in position.

College Bowl Rounds

32. Place the CBA on the middle desk of the line at the front of the room (you may want to moisten the suction cups with a film of water). One proctor may need to hold the device down (and do timing). Do not press the button to "reset" the CBA (it's an on/off switch).

33. You will have the same teams that were previously in the room for the duration of all College Bowl rounds — if you have an extra/different team, they are in the wrong room and can be disqualified if they hear the questions! Help get them to the correct room.

34. Fill out the score sheets for each team in your room with their school name and team number. Call up the first 2 teams according to the sequence on the room envelope.

35. You will be reading Round #1 questions to two teams while the other two teams (and any spectators) wait in the back of the room out of line of sight of the competitors. Refer to the College Bowl schedule (on your room envelope) to see which two teams compete in each round. If a round only has one team, they will be competing against the clock and thus will have 30 seconds to answer, not 45 seconds. Record the final scores for each team on their score sheets (which you hold on to) after each round. Rounds 2-6 work the same way. Refer to the schedule to make sure the correct

teams are competing at the correct time. Don't get ahead of schedule (or behind, for that matter!). If you finish a round early, please wait until the appointed time to start the next round. If you have any problems (including anyone questioning the rules or a decision made by a proctor) contact the proctor supervisor.

36. Who is keeping score? Who is keeping track of the time? YOU ARE !!!
37. Read the "COLLEGE BOWL" instructions (in the Proctor Packet) to all the students (just one time), then begin the testing for each round at the appointed times.
38. If you mis-read a question, replace it with one of the extra questions.
39. If a parent/coach/student protests an answer, make a note of the situation (the test, the problem number, who answered, what their answer was, etc.) and kindly state that the coach should bring up the issue with the contest director. Proceed as normal, scoring the question based on the answer key.
40. At the conclusion of all College Bowl rounds, get the score sheets promptly to the scoring room (either yourself or via a runner).
41. Release your group to the awards ceremony no earlier than 7:45 PM to avoid causing a disruption to other rooms. Have students help re-set the room.
42. At the end of the day, return the desks to their original arrangement, collect all scratch paper, erase any marks you made on the whiteboard, and generally make sure the classroom is tidied up. Return the College Bowl apparatus, proctoring envelope, and residual material to the proctor supervisor.

General Instructions

- 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:
  - All answers will be an integer, with the exception of the Multiple Choice test.
  - ~~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 fifth 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.

Mental Math Instructions

All students in the room will concurrently be asked the same eight questions in this individual test. When it is time to begin, the proctor will read the first question twice. You may not do any writing or talking while arriving at a solution. Once you have a solution, record it on the sheet in front of you. **You may not change or cross out answers once you have written an**

answer down. If there are eraser marks, write-overs, or crossed-out answers, they will be marked wrong. Once all students have laid their pencils on the desk, another question will be asked. If a student doesn't lay his or her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before the next question is read. You may continue to work on a problem (in your head) while the next question is being read. The raw score is 1 point per correct answer.

Individual Test Instructions

You will have 35 minutes to work on the Individual test, which consists of 40 questions. 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 first 30 questions are worth two points each and questions 31-40 are worth 3 points each. Record your answers on the score sheet. No talking during the test. You will be given a 5 minute warning.

Individual Multiple Choice Instructions

You will have 15 minutes to answer 10 multiple choice questions. This test is taken individually, but it is part of your team score, which will be calculated by taking the mean of the top 3 scores from your team. This test is the only test where you will be penalized for incorrect responses. You will receive two points for a correct letter response, zero points for leaving it blank, and minus one point for an incorrect response. When you are prompted to begin, tear off the colored answer sheet and begin testing. **ONLY a letter response should be listed as an answer on this answer sheet.**

Team Test Instructions

You will have 15 minutes to answer 10 questions as a team. When you are prompted to begin, tear off the colored answer sheet and give a copy of the test to each of your team members and begin testing. Each problem is scored as a 1 or 0. Record all answers on this colored answer sheet.

Pressure Round Instructions

When it is time to begin, you will be handed a packet of five problems. There is a copy of the problems for each team member. Two minutes after the start of the test you are expected to submit an answer for one of the problems. The problems need not be submitted in order; you can submit an answer for any of the problems, and your answer can be a guess, if you like. The maximum value of this first submitted answer is 1 point.

In another two minutes, you are expected to submit another answer to any one of the four remaining problems (you cannot submit a new answer for a previously submitted problem). The maximum value is two points for this second submittal.

This process will continue until all of the problems are answered. Each consecutive submitted answer increases in score value by one point.

You must submit your answers on the colored sheets given to you. If you do not have an answer at the end of a two-minute period, you must still submit an answer sheet with an identified problem number on it. Failure to do so will result in loss of points.

This event is timed, and you will be given a verbal 5 second warning prior to the end of each two-minute period. You will be told to hold your answer sheet up in the air for the proctor to collect. You may keep working as the answer sheets are collected. If a team answers the same question more than once, only the first answer will be scored and the other attempts will be ignored.

College Bowl Instructions

Read these to the competitors before the first round:

To maintain the integrity of the competition, spectators must stay in this room during a round of College Bowl questions. Once all readings for a round have been completed, you may leave.

All competitors must be facing the front of the room in one row. Teams not competing in the current round need to be behind the front row and in front of the spectators. All spectators need to be behind the competitors at the back of the room.

A maximum of ten questions per round will be scored. It is OK for both teams to score the same number of points! The proctor will record the points earned on each team's score sheet, which is retained by the proctor.

You may use scratch paper and pencil. You may talk with your team members while arriving at a solution.

An Electronic College Bowl Apparatus (CBA) will be used to identify the team who is first to have an answer.

During these rounds, each question will be read twice and a maximum time of 45 seconds after the second reading of the question is completed will be allowed for a team to answer. If a team buzzes in after the second reading and gives an incorrect response, the other team has the remainder of the 45 seconds to respond. A team is allowed only one attempt at buzzing in and answering per question. You may interrupt (buzz in) while a question is being read, however, if you do, the proctor will stop reading, and an immediate response is needed. If the correct response is given, the proctor will proceed to the next question. Otherwise, the question will be re-read for the other team, making sure it has two full readings. If an immediate response is not given after a team buzzes in, their lack of an answer in a timely manner is considered incorrect. In the event that only one team is competing in a round (i.e., one team is absent), the team competing will have a maximum of 30 seconds after the completion of the second reading in which to buzz in. The proctor will give a 5-second time warning.

Wait to be acknowledged by the proctor before giving an answer. This avoids the situation of blurting out an answer when the other team buzzed in first.

If two students from the same team answer at the same time with different answers, the answer will be considered incorrect.

If a problem arises with one of the questions, an extra question will be asked to replace that question.

If the round finishes early, you need to stay in the room for the remaining time.

Mental Math Questions

Pressure Round Answers

College Bowl Questions/Answers