Use global search and replace to change the following variables.

--- Done by Test Writer ---

Year: 2019-20 → 2019-20

Grade: 11-12 → 9th-10th

Check to make sure it has the proper grade or 'High School' as appropriate

Champs: Championships → Championships or Masters

For the individual test, delete the test and answer sheet not being used.

--- Done by Site Coordinator ---

Date: #date → October 20, 2019

"Official" date may be done by Test Writer

Sponsor: #sponsor → Sponsor SoSoBank or to blank

"Math is Cool" Championships – 2019-20

#sponsor

#date

High School Mental Math Contest

Follow along as your proctor reads these instructions to you. Your Mental Math score sheet is on the back.

GENERAL INSTRUCTIONS applying to all tests:

Good sportsmanship is expected throughout the competition by <u>all</u> involved, both competitors and observers. Display of poor sportsmanship may result in disqualification.

Calculators or any other aids may not be used on any portion of this contest.

Unless stated otherwise, all rational, non-integer answers need to be expressed as reduced common fractions except in case of problems dealing with money. In the case of problems requiring dollar answers, answer as a decimal rounded to the nearest hundredth (ie, to the nearest cent).

All radicals must be simplified and all denominators must be rationalized.

Units are not necessary as part of your answer unless it is a problem that deals with time and in that case, a.m. or p.m. is required. However, if you choose to use units, they must be correct.

Leave all answers in terms of π where applicable.

Do not round any answers unless stated otherwise.

Record all answers on the colored cover sheets in the answer column only.

Make sure all answer sheets have all the information (name, team number, etc.) at the top of the sheet filled out.

Tests will be scored as a 0 if answers are not recorded on the answer sheets.

Blank answer sheets and answer sheets with no name will be scored as a 0.

<u>Mental Math</u> – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

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/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

Final Score:

(Out of 8)

"Math is Cool" Championships -- 2019-20

School:_____Room # _____ Team #_____

Name: _____Proctor: _____

High School **Mental Math** – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

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/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

	Answer	1 or 0	1 or 0
1			
2			
3			
4			
5			
6			
7			
8			

“Math is Cool” Championships – 2019-20

#sponsor

High School – #date

Mental Math Contest

Mental Math – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

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/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

#	Problem
1	What is the perimeter of a square with an area of twenty-five square centimeters?
2	What is the slope of the line connecting the point three comma five and the point one comma negative one?
3	What is the cubed root of twenty-seven squared?
4	If the sides of an equilateral triangle measure eight centimeters, what is the height of the triangle?
5	What is two raised to the eighth power?
6	What is the square of fifty-five minus the square of forty-five?
7	In how many ways could you rearrange the letters in the word D-I-V-I-D-E?
8	What is the minimum of the parabola y equals x squared minus eight x minus two as a coordinate point?

Final Score:

KEY

(Out of 8)

"Math is Cool" Championships -- 2019-20

School:_____ Room # _____ Team #_____

Name: _____ Proctor: _____

High School <u>Mental Math</u> – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score

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/her pencil down, the maximum wait time is 30 seconds after completion of the second reading of the question before another question is asked. You may continue to work on a problem while the next question is being read. The value of each question is a one or zero. Each student will be asked the same eight questions. Individual scores used to determine individual placing will be determined by the sum of the Mental Math score and the Individual Test score for each individual. In addition, the top three Mental Math scores from one team will be totaled and doubled and will contribute to 25% of the team score.*

	Answer
1	20 [cm]
2	3
3	9
4	$4\sqrt{3}$ [cm]
5	256
6	1000
7	180
8	(4, -18)

“Math is Cool” Championships – 2019-20

#date

Total # Correct:

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

Circle Math: **Geometry** **Algebra 2** **Pre-Calculus** **Calculus** Team #: _____ Room #: _____

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

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

	Answer	1 or 0	1 or 0
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
16 – 30 Total			

	Answer	1 or 0	1 or 0
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
31 – 40 Total			

“Math is Cool” Championships – 2019-20

#sponsor

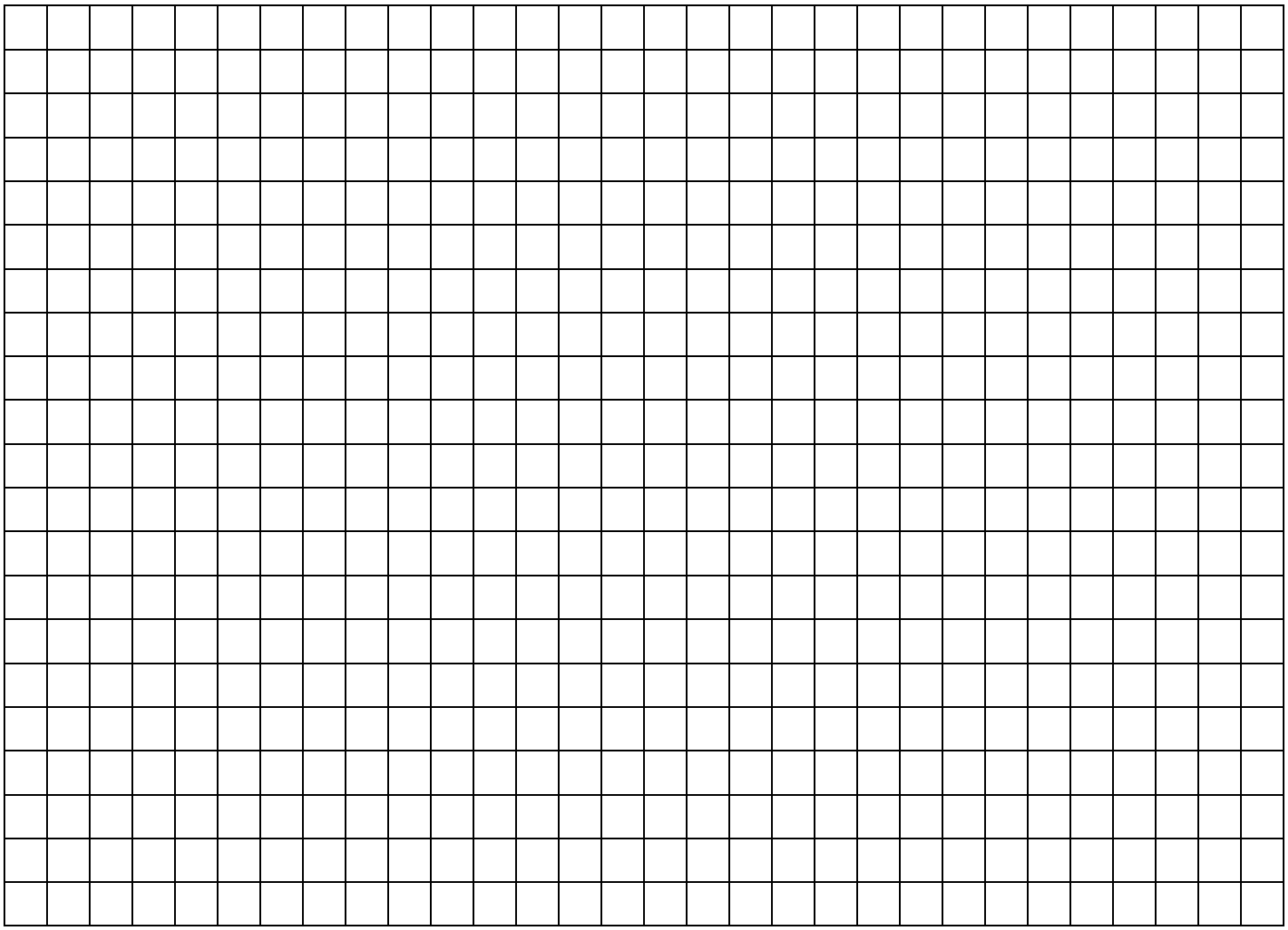
#date

High School Individual Contest

Tear this cover sheet and scratch paper off and fill out the top of the colored answer sheet prior to the start of the test. The graph below is for your use, if needed.

INDIVIDUAL TEST – High School - 35 minutes

You may NOT be seated next to anyone from your school. If you are MOVE NOW to avoid being disqualified! When you are prompted to begin, tear off the colored sheet and begin testing. Make sure your name and school are recorded on the answer sheet. The raw score will be 2 points for correct answers to problems 1-30 and 3 points for 31-40. Record your answers on the score sheet. No talking during the test. You will be given a 5 minute time warning.



"Math is Cool" Championships – 2019-20

#sponsor

#date

High School Individual Contest

	Questions 1-30: 2 points each
1	The central table at the secret Math is Cool test concoction lair has 10 chairs. If 19 people are writing problems and the central table is full, what is the probability that a particular test writer is not at the central table?
2	Evaluate: 324-169
3	Simplify $2\sqrt{192}$
4	What is the area of a semicircle with diameter 16?
5	If one double stitch is made with 3.5 in. of yarn, how many double stitches can be made with 210 yards of yarn?
6	What is the coefficient of x^4 in the expansion of $(x-3)(x^4-6x^3+4x^2+x-7)$ with like-terms combined?
7	The sum of three consecutive integers is 2019. What is the smallest of the three integers?
8	A drawer contains cans of angry water. 7 are unflavored, 4 are strawberry flavored, 3 are mango flavored, and 7 are orange flavored. A saboteur removes all of the labels and rearranges the cans randomly. If I then retrieve one of the cans of angry water, what is the probability it is strawberry?
9	Let $7 = 3x - y$, and $5x = 2y + 8$. What is $x + y$?
10	Evaluate: 43^2.
11	At what point do the lines 5x – 7y = 0 and -2x+y=9 intersect?
12	Given the following equations, solve for x. $3x - a = 6$ $3a - x = 18 + a - x$
13	A bag of marbles contains 4 red, 6 white and 8 blue marbles. If two marbles are drawn without replacement, what is the probability that both are red?
14	The exchange rate for 1 US dollar is 1.30 in Canadian dollars and cents. How much Canadian money will I receive from 25 US dollars, before fees?
15	The height of a triangle is doubled. By what factor has its area increased?

16	Google maps is processing a route to determine its estimated travel time. Accounting for traffic, the route is 20 miles at 60 mph, and 10 miles at 25 mph. Assuming there are no stops, how long will this route take to drive, as a fraction of hours?
17	What is the product of the solutions of the following equation? $0 = 12x^2 - 2x - 14$
18	A red blood cell has a 20% chance to donate its carried oxygen molecule to each organ it passes through between visits to a lung. If a particular red blood cell passes through 4 organs, what is the probability it still has its oxygen molecule afterward?
19	Diagonals are drawn in a hexagon such that each vertex connects exactly 2 diagonals and there are exactly 2 axes of symmetry in the resulting figure. How many nonoverlapping interior polygons does this create?
20	Find the eighth term of the Fibonacci-like sequence that starts with -3, 1, …
21	Two children mow a lawn. By themselves, Kelly can mow the entire lawn in 4 hours, while Leslie can mow the entire lawn in 5 hours. How long, in hours, will it take if both children mow the lawn together?
22	Let 7 be the sum of the digits of the positive integer A. If A*B=215, what is B?
23	The numbers 2, 8, 32, x, y, and z are the first six terms of a geometric sequence. The sum of the six terms is 21, and their correct order is uncertain. If x > y > z, what is z?
24	What is the radius of the circle described by the equation below? $x^2 + y^2 + 12x = 28$
25	Simplify this expression: [y(x + 5)-x(y + 5) - 5(1 -x)] - [8(x - 5) - x(8 + 5) - 5(1 - x)]
26	What is the sum of all positive two-digit multiples of 4?
27	A pizza restaurant sells “tall”, “grande” and “venti” circular pizzas. The tall pizza costs $10 for a 6-inch diameter, a grande pizza costs $15 for 8 in. diameter, and a venti pizza cost $25 for 10 in. diameter. Which of the tall, grande, or venti has the lowest cost per square inch?
28	Gregg travels into the future and glimpses at some of the results of the "Math is Cool 2070" team multiple choice exam. The scores he saw were: 0, 10, 9, 4, 20, -1, 11, 9, 13, 5. What is the product of the mean, mode, median and range of this data?
29	If the factors of a positive integer form a geometric sequence, what is the maximum number of distinct prime factors that the number can have?
30	The chef is cooking up pancakes to feed the math team. According to the recipe, one serving requires 8 fluid ounces of water. If the chef makes 64 servings, how many quarts of water is needed for the recipe?

Challenge Questions: 3 pts each	
31	Outflow pump A, working at a constant rate, will drain its reservoir in 10 days, assuming no inflow in that time. Outflow pumps A and B, when operating together, drain the reservoir in 7 days, while A and C drain it in 4 days. How many days would it take for pumps B and C, but not A, to drain the reservoir?
32	What is the 25^{th} pentagonal number?
33	Solve for x: $$\log_2 x \log_4 x \log_6 x = \log_2 x \log_4 x + \log_2 x \log_6 x + \log_4 x \log_6 x$$
34	An unreliable carbonation chamber injects 1 mL of carbon dioxide into a liter of water every minute with probability $\frac{1}{2}$, and does nothing otherwise. The water must contain at least 7 mL of carbon dioxide to become angry. A container of pure water is placed in the chamber and removed after 10 minutes. What is the probability that it is angry?
35	When three numbers are added two at a time, the sums are sixteen, seventeen, and nine. What is the positive difference between the largest and smallest of the three numbers?
36	A trusted friend flips three fair coins, looks at them, and tells you that there were more tails than heads. What is the probability that they all showed tails?
37	How many positive integer factors of three-hundred are also multiples of fifteen?
38	James is rolling fair dice to generate random coefficients for a parabola. So far, the parabola's equation is $y = 3x^2 - 8x + c$, and the roll of a twelve-sided die will determine the value of c. What is the probability that this parabola has real roots?
39	Find the sum of the infinite sequence: $$\frac{1}{1} + \frac{2}{2} + \frac{4}{4} + \frac{2}{8} + \frac{1}{16} + \frac{1}{32} + \frac{2}{64} + \frac{4}{128} + \frac{2}{256} + \frac{1}{512} + \cdots$$
40	A 8-foot-long flat bar rests on top of a thin post at its center. A 3-pound hammer is placed on one end on the bar. The hammer exerts a rotational force of 12 foot-pounds on the bar known as torque, which is calculated as the product of weight and distance from the point of rotation. To balance the bar, a 1-pound box of nails is placed at the opposite end, and further boxes of nails are placed in 8 inch increments towards the center. How many boxes of nails are required to create the same amount of torque as the hammer?

“Math is Cool” Championships – 2019-20

#date

Total # Correct:

KEY

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

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

High School Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answers
1	9/19
2	155
3	$16\sqrt{3}$
4	32π [units^2]
5	2160 [double stitches]
6	-9
7	672
8	4/21
9	17
10	1849
11	(-7, -5)
12	5
13	2/51
14	[$] 32.50
15	2

	Answers
16	11/15 [hours]
17	-7/6
18	256/625
19	14 [polygons]
20	-11
21	20/9 [hours]
22	5
23	-16
24	8 [units]
25	5y + 40
26	1188
27	Grande [pizza]
28	13,608
29	1 [factors]
30	16 [quarts]

	Answers
31	140/27 [days]
32	925
33	48
34	11/64
35	8
36	1/4
37	6 [factors]
38	5/12
39	106/31
40	4 [boxes]
41	n/a
42	n/a
43	n/a
44	n/a
45	n/a

Math is Cool" Championships – 2019-20

11-12 Grade – #date

Final Score:

First Score
(out of 20)

Student Name _____

Proctor Name _____Room # _____

SCHOOL NAME _____Team #_____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes – 10 problems – 20% of team score

This test is the only test where you will be penalized for incorrect responses. You will receive 2 points for a correct letter response, 0 points for leaving it blank and -1 point for an incorrect response. It is not necessary to write your personal name on the test, but you may put it at the bottom of the test so your coach will be able to give you back the correct test. This test is taken individually, but it is part of your team score, including zeros for missing team members. Your team score will be calculated by taking the mean of your four team members' scores. When you are prompted to begin, tear off the colored sheet and begin testing. ***Since this is a multiple choice test, ONLY a letter response should be indicated as an answer on the answer sheet.*** *No talking during the test.*

DO NOT WRITE IN SHADED REGIONS

	Answer	-1, 0 or 2	-1, 0 or 2
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

"Math is Cool" Championships – 2019-20

#sponsor

11-12 Grade – #date

Individual Multiple-Choice Contest

1	What is the units digit of 7^{247}? A) 7 B) 9 C) 3 D) 1 E) Answer not given.
2	Find the value of x: $3^{2x+5} = 27^{10x-2}$ A) 12/53 B) 9/8 C) 7/8 D) 11/28 E) Answer not given.
3	Evaluate: $\frac{2^5 - 6!}{10^{-2}}$ A) -68800 B) 68800 C) -6880 D) -6.88 E) Answer not given.
4	A triangle has sides 21 and 27. What is the sum of the smallest and largest integer lengths that the third side could be? A) 49 B) 48 C) 52 D) 54 E) Answer not given.
5	Find the slope-intercept form of the line that connects the points (2, -12) and (5, 6). A) $y + 12 = 6(x - 2)$ B) $y = 6x - 24$ C) $y = \frac{1}{6}x - 12\frac{1}{3}$ D) $y + 12 = \frac{1}{6}(x - 2)$ E) Answer not given.
6	In how many ways can 8 different-colored beads be arranged on a loop of string? A) 2520 B) 5040 C) 20160 D) 40320 E) Answer not given.

7	What is the area of a regular hexagon with an apothem of 9? A)$324\sqrt{3}$ B) $162\sqrt{3}$ C) $81\sqrt{3}$ D)$72\sqrt{3}$ E) Answer not given.
8	Find the sum of the following arithmetic sequence: -2, 21, 44, …, 642. A) 8960 B) 18560 C) 9280 D) 640 E) Answer not given.
9	Find the determinant of the following matrix: $\begin{bmatrix} 2 & 1 & -7 \\ 9 & 0 & 5 \\ -2 & 8 & 6 \end{bmatrix}$ A) -586 B) -648 C) 451 D) 685 E) Answer not given.
10	Pam can clean 6 hotel rooms in 1 hour and 10 minutes, while Angela can clean the same number of rooms in 55 minutes. If they work together, how many minutes would it take them to clean 6 rooms? A) 45.2 B) 50.1 C) 30.8 D) 26.8 E) Answer not given.

Math is Cool" Championships – 2019-20

11-12 Grade – #date

Final Score:

KEY

Student Name _____

Proctor Name _____Room # _____

SCHOOL NAME _____Team #_____

INDIVIDUAL MULTIPLE CHOICE - 15 minutes – 10 problems – 20% of team score

This test is the only test where you will be penalized for incorrect responses. You will receive 2 points for a correct letter response, 0 points for leaving it blank and -1 point for an incorrect response. It is not necessary to write your personal name on the test, but you may put it at the bottom of the test so your coach will be able to give you back the correct test. This test is taken individually, but it is part of your team score, including zeros for missing team members. Your team score will be calculated by taking the mean of your four team members' scores. When you are prompted to begin, tear off the colored sheet and begin testing. ***Since this is a multiple choice test, ONLY a letter response should be indicated as an answer on the answer sheet.*** *No talking during the test.*

DO NOT WRITE IN SHADED REGIONS

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

"Math is Cool" Championships – 2019-20

11-12 Grade – #date

Final Score:

First Score
(out of 10)

SCHOOL NAME _____ **Team #** _____

Proctor Name _____ Room # _____

Team Contest – Score Sheet

TEAM TEST - 15 minutes – 30% of team score

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

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

"Math is Cool" Championships – 2019-20

#sponsor

11-12 Grade – #date

Team Contest

1	If $1\frac{4}{5} + 3\frac{x}{3} = 5\frac{2}{15}$, what is x?
2	Evaluate: $\log_{16} 8$
3	Mic rode his scooter from home to the beach and returned along the same path. He traveled at a constant rate of 60 mph to the beach. Mic's average speed for the whole trip was 24 mph. How fast did he travel on the way back?
4	What is the area of a rhombus whose diagonals both measure 12 cm?
5	What is the probability of rolling a composite number on a fair 20-sided die?
6	Let f(x)=x^2/(1-x) and let g(x) = -x^2. What is f(g(-5))?
7	If $(2a + b)^2 = 40$ and $2ab = 8$, what is $(2a)^2 + b^2$?
8	What is the smallest sum of positive integer solutions to the equation 7x + 18y = 201?
9	A wave is described by the equation $A = \sin(2t) - \cos(2t)$. If t is considered to start at zero and increase over time, then at what t-value will A be zero for the third time?
10	Solve for S: $$S = \frac{1}{2} + \frac{4}{4} + \frac{9}{8} + \frac{16}{16} + \frac{25}{32} + \frac{36}{64} + \cdots$$

"Math is Cool" Championships – 2019-20

11-12 Grade – #date

Final Score: KEY

SCHOOL NAME _____ **Team #** _____

Proctor Name _____ Room # _____

Team Contest – Score Sheet

TEAM TEST - 15 minutes – 30% of team score

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

DO NOT WRITE IN SHADED REGIONS

	Answer
1	1
2	3/4
3	15 [mph]
4	72 [cm^2]
5	11/20
6	625/26
7	24
8	13
9	$9\pi/8$
10	6

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round

Order Turned In	1	2	3	4	5	
Question Number						Total
Score	1 or 0	2 or 0	3 or 0	4 or 0	5 or 0	

After filling out the top of each of these half sheets, tear off the top sheet and give to your proctor so he/she can keep score.

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round

Order Turned In	1	2	3	4	5	
Question Number						Total
Score	1 or 0	2 or 0	3 or 0	4 or 0	5 or 0	

After filling out the top of each of these half sheets, tear off the top sheet and give to your proctor so he/she can keep score.

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #1

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #1

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #2

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #2

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #3

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #3

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #4

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #4

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #5

Answer for Question # _____ Answer: _____

“Math is Cool” Championships -- 2019-20

11-12 Grade

School: _____ Team #_____

Proctor: _____ Room #_____

Pressure Round #5

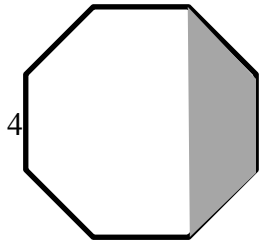
Answer for Question # _____ Answer: _____

“Math is Cool” Championships – 2019-20

#sponsor

11-12 Grade – #date

Pressure Round Contest

1	The product of three consecutive integers is 990. What is the middle integer?
2	Find the missing term in the sequence below. $0, -1, 3, -6, \_\_\_\_, -15, 21, -28 \ldots$
3	Evaluate the dot product: $\langle 2 \quad 5 \rangle \cdot \langle -1 \quad 3 \rangle$
4	In the regular octagon pictured to the right, what is the area of the shaded portion? 
5	Evaluate the infinite expression $2 - (2 - \big(2 - \big(2 - (\ldots)\sqrt{3}\big)\sqrt{3}\big)\sqrt{3})\sqrt{3}$

"Math is Cool" Championships – 2019-20

11-12 Grade – #date

Final Score:

KEY

Proctor Name _____ Room #_____

SCHOOL NAME _____ Team #_____

PRESSURE ROUND - 10 minutes – 5 problems - 5 rounds – 15% of team score

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 (it can simply be a guess). The maximum value of this answer is 1 point. In another two minutes you are expected to submit another answer to one of the four remaining problems; its maximum value is two points. This process will continue until all the problems are answered and each consecutive problem's worth will go up 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 and told to hold your answer sheet up in the air. You may keep working as the 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.

Pressure Round Answers

	Answer
1	10
2	10
3	13
4	$8 + 8\sqrt{2}$
5	$\sqrt{3} - 1$

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High School

School: _____ Team #_____

Proctor: _____ Room #_____

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

Do not use tally marks.

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High School

School: _____ Team #_____

Proctor: _____ Room #_____

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

Do not use tally marks.

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COLLEGE BOWL ROUND 1

#	Problem	Answer
1	How many positive factors does two thousand twenty have?	12 [factors]
2	To the nearest thousandth, what is twenty-four divided by twenty-one?	1.143
3	A book costs twenty dollars. Its price is reduced by ten percent, and then increased by ten percent for sales tax. What is the final price?	[$]19.80
4	Not counting zero, what is the sum of the first four even numbers in the Fibonacci sequence?	188
5	In a room of forty people, how many distinct handshakes can be made?	780 [handshakes]
6	How many of the first ten positive perfect squares end in nine?	2 [squares]
7	A thirty-six-gallon bucket starts empty. It fills up at a rate of four gallons per minute, but empties at a rate of three point eight gallons per minute. How many hours will it take for the bucket to be full?	3 [hours]
8	What is the product of the digits of five to the fifth power?	30
9	What is the area of a square with a diagonal measuring eight root two inches?	64 [sq inches]
10	What is the sum of the first nine prime numbers?	100

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COLLEGE BOWL ROUND 2

#	Problem	Answer
1	How many ways are there to choose three students from a group of seven students?	35 [ways]
2	What is one squared, plus two cubed, plus three to the fourth power?	90
3	What is one hundred mod twenty-five	0
4	What is the harmonic mean of two, three, and six?	3
5	In the binomial expansion of five a plus eight b to the fourth power, what is the coefficient of the term which has a b-squared in it?	9,600
6	The single one is the 0^{th} row in Pascal's Triangle. From row zero to row five, how many unique numbers appear in Pascal's Triangle?	7 [numbers]
7	If the day before yesterday was Saturday, what day is fifty-three days from the day after tomorrow?	Sunday
8	What is the positive difference between the degree measure of interior angles of a regular pentagon and a regular dodecagon?	42 [degrees]
9	What is the sum of the prime numbers between ninety and one hundred?	97
10	If x plus y equals five, and x minus y equals five, what does x to the power of y equal?	1

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COLLEGE BOWL ROUND 3

#	Problem	Answer
1	If you flip a coin three times, what is the probability of having at least one tail?	7/8
2	What is the sum of all integers from forty-one to one hundred forty, inclusive?	9050
3	Evaluate three to the fifth power, minus three to the fourth power.	162
4	What is the smallest possible positive integer value of x that satisfies the inequality x squared minus five x plus six is greater than four x minus twelve?	1
5	What is the area of a triangle with vertices seven comma two, thirteen comma eight, and nineteen comma two?	36 [sq units]
6	The largest three-digit base seven number is what number, in base five?	2332 [base 5]
7	Two identical cones are attached at the base to make a spindle. If each cone had a radius of three and a height of eight, what is the surface area of the spindle?	$6\pi\sqrt{73}$ [units^2]
8	What is three and seven twelfths divided by four and one half?	$\frac{43}{54}$
9	What is the maximum integer length of the last side of a triangle containing sides of lengths seventeen inches and eight inches?	24 [inches]
10	How many factors are there in two thousand nineteen?	4 [factors]

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COLLEGE BOWL ROUND 4

#	Problem	Answer
1	What is the area of a trapezoid with base lengths of seven and fifteen and a height of six?	66 [units]
2	Two thousand twenty is the sum of four consecutive numbers. What is the sum of the middle two numbers?	1,010
3	What is the geometric mean of twenty-seven, one hundred twenty-five and three hundred forty-three?	105
4	What is one half, plus one third, plus one fifth, plus one sixth, plus one tenth?	13/10
5	What is the twenty-fourth term in the arithmetic sequence whose fourth term is eight and whose common difference is one point five?	38
6	What is the area of a hexagon inscribed within a circle with area one hundred pi?	$150\sqrt{3}$
7	How many ways can you rearrange the letters in the word MISSISSIPPI, spelled M-I-S-S-I-S-S-I-P-P-I?	34,650 [ways]
8	In a group of numbers, one, two, four, fifty-six, four, and eighty-one, what is the difference between the range and mode?	76
9	What is the least common multiple of sixty and seventy?	420
10	If I have the same number of pennies, nickels, dimes and quarters in my pocket, how many cents do I have, given I have twenty coins in total?	205 [cents]

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COLLEGE BOWL ROUND 5

#	Problem	Answer
1	What is the height of a square pyramid with a volume of seventy-two cubic centimeters and a base side length of three centimeters?	24 [cm]
2	On a farm with chickens and cows, there are twenty heads and seventy legs. How many cows are on the farms?	15 [cows]
3	Round the square root of two thousand nineteen to the nearest whole number.	45
4	What is the date of the two hundred seventeenth day in the year two thousand nineteen? State month and day.	August 5 or 8-5
5	What is the sum of all prime numbers between ninety and one hundred ten?	517
6	What is the first term of a geometric sequence if its third term is fourteen and its seventh term is forty-two?	$\frac{63}{8}$
7	A circle has a circumference of sixteen pi feet. What is the area of half a hexagon with a side length equal to the radius of the circle?	$48\sqrt{3}$ [square feet]
8	How many ways can you rearrange the letters in the word "ACADEMIC", spelled A-C-A-D-E-M-I-C?	10080 [ways]
9	What are the last two digits of eleven to the sixteenth power?	61
10	What is the twentieth digit after the decimal point in the decimal form of four sevenths?	7

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COLLEGE BOWL ROUND 6

#	Problem	Answer
1	What is ninety-eight squared minus four?	9600
2	How many zeros are at the end of forty factorial?	9 [zeros]
3	List all possible values for x given that x squared plus two x minus one hundred twenty equals zero.	[x =] -12 & 10
4	Aaron summed the first fifty counting numbers, skipping two consecutive numbers, and got a total of one thousand two hundred. What is the larger of the two numbers that Aaron skipped?	38
5	If n factorial ends in exactly eight zeroes, what is the largest possible value for n?	39
6	What is the average of the first seven perfect squares?	20
7	A store sells iPhone and Galaxy phones. The iPhone is four times more likely to be sold than a Galaxy. If sales are independent, then, as a fraction, what is the probability that the next two phones sold are the same?	17/25
8	What is the perimeter of a rhombus with diagonals of length six feet and eight feet?	20 [feet]
9	What is the lowest common multiple of three, four, five, six, and seven?	420
10	What is twenty-five percent of one eighth of one thousand?	125/4

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COLLEGE BOWL - EXTRA

#	Problem	Answer
1	What is the sum of twenty-one consecutive integers, where the least integer is negative nine?	21
2	What is the tens digit of six to the thirtieth power?	7
3	What is the cube root of the product of negative two hundred fifty-six and two hundred fifty?	-40
4	If I write down the set of the first eleven factorials, not including zero, how many times will I write the digit zero?	9 [times]
5	What is one half, divided by one third, divided by one fourth, divided by one fifth?	30
6	Two sides of a triangle are four and eleven. What is the sum of all possible integer side lengths of the third side?	77