"Math is Cool" Masters – 2017-18

April 21, 2018

8th Grade 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. Bad sportsmanship may result in disqualification.*
- *Calculators or any other aids may not be used on any portion of this contest.*
- *Unless stated otherwise:*
  - *For problems dealing with money, a decimal answer should be given.*
  - *Express all rational, non-integer answers as reduced common fractions.*
- *For fifth and sixth grade, all fractions and ratios must be reduced.*
- *Counting or natural numbers refer to the numbers 1,2,3,4 and so on and do NOT include 0.*
- *Units are not necessary unless it is a problem that deals with time and, in that case, am or pm is needed. 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 filled out at the top of the 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 also 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

You may NOT be seated next to anyone from your school. If you are MOVE NOW to avoid being disqualified! 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.*

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8th Grade Mental Math Contest

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#	Problem
1	A round pecan pie has a radius of six inches. One quarter of the pie has already been eaten. What is the area of what is left, in square inches and in terms of pi?
2	As a common fraction, what is the probability of rolling a twenty-sided die and getting a multiple of three?
3	The mean of a set of five numbers is nineteen. What is the sum of the five numbers?
4	Solve the equation five X plus seven equals forty-two, for X.
5	Jill is at a party with a piñata. She is blindfolded and spun around six hundred and thirty degrees clockwise. How many more degrees should she continue moving clockwise until she will be facing the piñata again?
6	How many square units are in the area of the region bounded by the X and Y axes and the line Y equals negative X plus four?
7	Grant eats cheerios on twenty percent of all mornings. How many mornings out of a normal three-hundred-sixty-five-day calendar year does he eat cheerios?
8	Shaina bikes two miles from home to school at six miles per hour. She then realizes she forgot her backpack and bikes home and back to school again at twelve miles per hour. How many minutes did she bike in total?

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Total Correct: KEY

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

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

ALGEBRA - Individual Contest – Score Sheet
DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	34 [minutes]		
2	20		
3	6 [ways]		
4	2 [cm]		
5	7/10		
6	1/4		
7	11		
8	12341234		
9	27		
10	5 [zeros]		
11	[x =] 2		
12	50		
13	63 [jolly ranchers]		
14	4		
15	1/2		
1-15 TOTAL:			

	Answer	1 or 0	1 or 0
16	62 [inches]		
17	8/13		
18	E		
19	747 [cents]		
20	123		
21	50 [%]		
22	28π [in^2]		
23	15x + 3xy + 3xz (any order)		
24	3 [values]		
25	6		
26	2.625×10^{20}		
27	180 [meters]		
28	1120 [seconds]		
29	-5/2		
30	4.6		
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31	3		
32	21		
33	1/6		
34	1/5		
35	50		
36	6		
37	14 [strings]		
38	362880 [ways]		
39	9720		
40	16 [marbles		
31-40 TOTAL:			

ALGEBRA

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April 21, 2018

Total Correct:

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

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

ALGEBRA - 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:			

ALGEBRA

"Math is Cool" Masters – 2017-18

April 21, 2018

Total Correct: KEY

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

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

GEOMETRY - Individual Contest – Score Sheet
DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	20		
2	6 [ways]		
3	7/10		
4	1/4		
5	5 [lines of symmetry]		
6	11		
7	12341234		
8	27		
9	5 [zeros]		
10	[x =] 2		
11	50		
12	63 [jolly ranchers]		
13	4		
14	4 [numbers]		
15	1/2		
1-15 TOTAL:			

	Answer	1 or 0	1 or 0
16	35 [puzzles]		
17	8/13		
18	E		
19	123		
20	50 [%]		
21	28π [in^2]		
22	15x + 3xy + 3xz (any order)		
23	3 [values]		
24	6		
25	2.625×10^{20}		
26	180 [meters]		
27	1120 [seconds]		
28	207.36 [in^3]		
29	-21/10		
30	$\sqrt{26}$ [units]		
16-30 TOTAL:			

	Answer	1 or 0	1 or 0
31	3		
32	21		
33	1/6		
34	1/5		
35	50		
36	8/9		
37	6		
38	14 [strings]		
39	9720		
40	16 [marbles		
31-40 TOTAL:			

GEOMETRY

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Total Correct:

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

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

GEOMETRY - 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:			

GEOMETRY

“Math is Cool” Masters – 2017-18

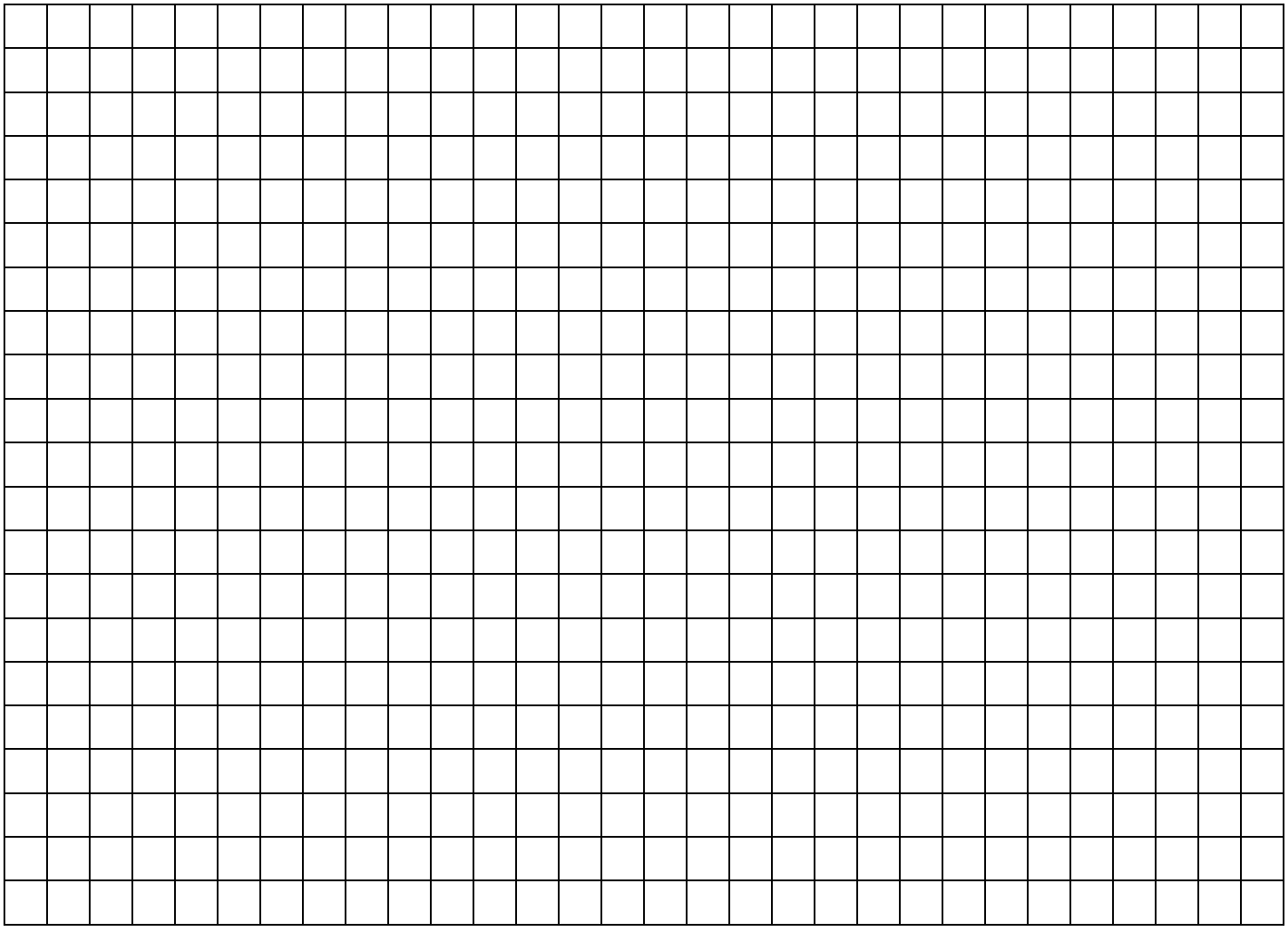
April 21, 2018

ALGEBRA - 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 – ALGEBRA - 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.

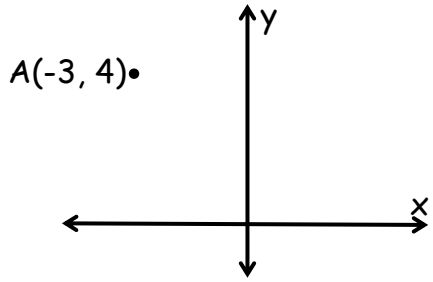
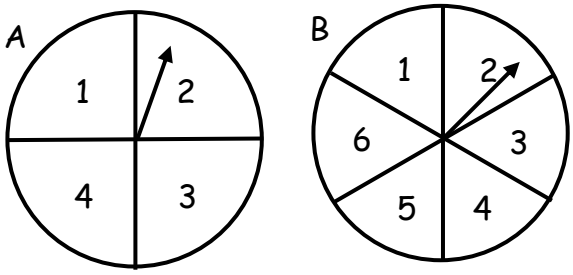


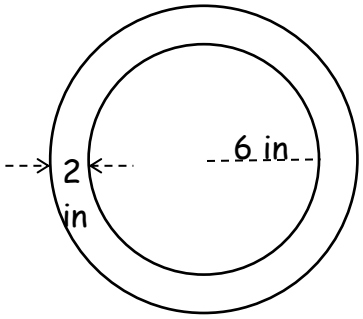
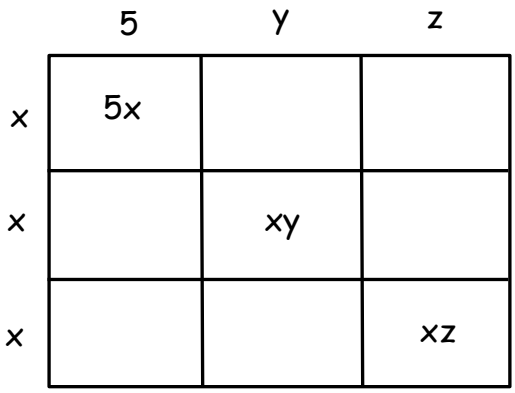
"Math is Cool" Masters – 2017-18

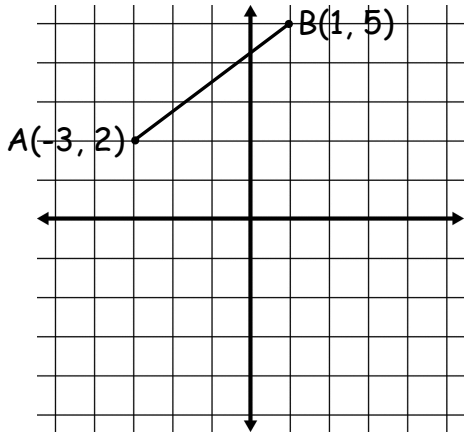
April 21, 2018

ALGEBRA - Individual Contest

	Questions 1-30: 2 points each
1	What is the number of minutes that elapse from 11:37 AM to 12:11 PM on the same day?
2	When $\frac{7}{8}$ is expressed as a decimal, what is the sum of its digits?
3	What is the number of distinct ways to put the five letters A, B, C, D, and E in order if the first letter must be B and the fourth letter must be A?
4	The volume of a rectangular box is 120 cm^3. The length and width of the box are 6 cm and 10 cm. What is the height of the box, in centimeters?
5	During any given hour a particular traffic light is red for a total of 18 minutes. As a common fraction, what is the probability that the light will not be red when I drive past this traffic light?
6	As a common fraction, what is the ratio of $\frac{y}{x}$ if 2x = 8y?
7	What is the remainder when 95 is divided by 14?
8	What is the product of 1234 and 10001?
9	Evaluate: $9(4 - 7) + 2 \cdot 3^3$
10	When the expression $2^6 \cdot 3^4 \cdot 5^5 \cdot 7^2$ is multiplied out to make one large number, that number ends with some consecutive zeros. What is the number of consecutive zeros on the end of this number?
11	Solve for x: $3(x - 1) = -7 + 5x$
12	In the following sequence, every term starting with 4 and moving right is determined by adding the two previous terms together. What is the value of x? 9, -5, 4, -1, 3, 2, 5, ___, ___, ___, ___, x
13	Eight gummy bears cost the same as twelve starburst chews. Fifteen starburst chews cost the same as twenty-one jolly ranchers. How many jolly ranchers cost the same as thirty gummy bears?

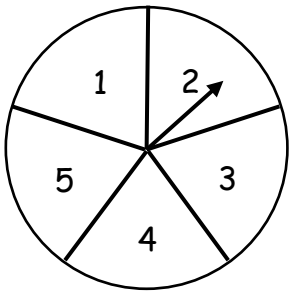
14	The point A(-3, 4) is reflected over the y-axis on a coordinate plane. What is the y-coordinate of the image A'? 
15	Spinner A is spun, then spinner B is spun. The resulting numbers are added. As a common fraction, what is the probability that the sum is even? The four sections on spinner A have equal area and the six sections on spinner B have equal area. 
16	A rectangle has one side of length 24 inches and the length of one of its diagonals is 25 inches. What is the number of inches in the perimeter of the rectangle?
17	As a common fraction, what is the probability of randomly drawing a card from a standard deck that is either a black card or a face card (jack, queen, or king)?
18	Given that x divided by y is a positive even integer, write the letter(s) of the following statement(s) that must always be true in the answer space. A) y is an integer B) x is an even integer C) $x > y$ D) $xy > 1$ E) None of the above
19	Raimie bought three yo-yos at an average cost of $2.50 per yo-yo. If no two yo-yos cost the same amount and all three yo-yo's cost at least one cent, what is the maximum number of cents that she could have paid for one of the yo-yos?
20	What is the smallest three-digit number having the property that the sum of its digits equals the product of its digits?
21	Marsenne primes are prime numbers with the form $2^n - 1$, where n is an integer. For example, $2^3 - 1 = 7$, so 7 is a Marsenne prime. For n = {1, 2, 3, 4, 5, 6, 7, 8}, what percent of the numbers in the form $2^n - 1$ are Marsenne primes?

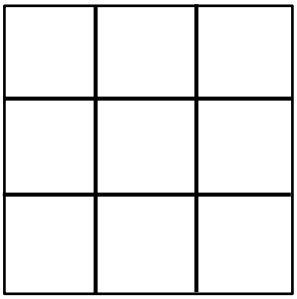
22	A circular mirror has a frame that is uniformly 2 inches wide. The radius of the mirror is 6 inches. In terms of π, what is the number of square inches in the area of the frame? 
23	In the figure there are 9 nonoverlapping rectangles. Three of the rectangles have an expression that represents the area written inside them. The combined area of the 9 rectangles can be expressed as 3x(5 + y + z) or, as a second expression, _____ + _____ + _____, where each blank represents the combined area of each vertical stack of 3 rectangles. What is this second expression for the combined area of the 9 nonoverlapping rectangles? 
24	The 3-digit number 3*a*4 has 4 as its ones digit, *a* as its tens digit, and 3 as its hundreds digit. If the quotient of 3*a*4 and 8 is an integer, then what is the number of single-digit values that *a* could have?
25	A positive integer, *p*, is the product of a multiple of three and a perfect square. Additionally, *p* is the product of three and an even number. What is the smallest possible value of *p*?
26	According to www.worldometers.info there are currently approximately 7,500,000,000 humans alive on earth. According to National Geographic there are an estimated 35,000,000,000 skin cells in a human body. In scientific notation, what is the total number of human skin cells on earth?

27	Bobbi and Danelle both start at the same time and place and run in the same direction around a 720-meter track. Bobbi completes one lap in 2 minutes and runs at an average rate that is one and one-third times as fast as Danelle's average rate. At the moment Bobbi finishes her lap, what is the number of meters Danelle needs to still run to complete one lap?
28	A water tank has two valves that can be used to drain it. If the tank is completely full, it takes 14 minutes to drain it opening only valve A. When both valves are open, it takes 8 minutes to drain the full tank. What is the number of seconds in the length of time it takes for the full tank to drain, if only valve B is open.
29	As a common fraction, what is the product of the two solutions to the equation $2x^2 - 3x - 5 = 0$?
30	A segment has endpoints A(-3, 2) and B(1, 5). Point C is placed on $\overline{AB}$ such that AC:BC = 4:1. As a decimal, what is the sum of the coordinates of point C? 

Challenge Questions: 3 pts each

31	In the polynomial $3x^2 - 5x$, the numbers 3 and 5 are called coefficients. When $(x + 2)(x - 3)(x + 4)$ is multiplied together to make another polynomial, what is the coefficient of its x^2-term?
32	In the given inequality, 50 and 100 are base-10 numbers. The number 123 is a base-*n* number, where *n* is an integer. What is the sum of the values of *n* which make the inequality true? $50 < 123_n < 100$

33	Brenna wrote a list of all the ways to add four distinct positive whole numbers whose sum is 15. For example, one of the ways would be 1 + 2 + 3 + 9 = 15. The order of the four distinct positive whole numbers does not matter, so she would not also write 1 + 3 + 2 + 9 = 15, because these are the same four numbers, just in a different order. If Brenna were to multiply the four distinct positive whole numbers instead of adding them, as a common fraction, what is the probability that their product would be greater than 100?
34	For the spinner shown, assume each number has an equal probability of being spun. The spinner is spun 5 times and the 5 results are used to generate a 5-digit number. For example, if the 1st spin results in 2, the 2nd spin results in 5, the 3rd spin results in 2, the 4th spin results in 1, and the 5th spin results in 3, then the 5-digit number generated would be 25213. As a common fraction, what is the probability that the 5-digit number is divisible by 4? 
35	A data set with eight distinct positive integers has a mean of 40 and a median of 31. When they are put in order from least to greatest, with the first term being the least and the eighth term being the greatest, what is the positive difference between the largest and smallest possible value for the sixth term?
36	Two intelligent, honest students are sitting together at lunch one day when their math teacher hands them each a card. "Your cards each have an integer on them," the teacher tells them. "The product of the two numbers is either 12, 15 or 18. The first to correctly guess the number on the other's card wins." The first student looks at her card and says, "I don't know what your number is." The second student looks at her card and says, "I don't know what your number is, either." The first student then correctly says, "*Now* I know your number." What number is on the loser's card?

37	How many distinct infinite strings of digits have the following properties: 4) The sum of any three consecutive digits is 9. 5) Any given set of three consecutive digits is a repeat of the three digits that both precede and follow them. 6) Any given set of three consecutive digits consists of three distinct digits. The infinite strings . . . 801801801 . . . , and . . . 180180180 . . . , are considered the same. The infinite strings . . . 801801801 . . . , and . . . 810810810 . . . , are considered distinct.
38	What is the number of distinct ways that the digits 1 through 9 can be arranged in a 3-by-3 sudoku square? 
39	What is the largest four-digit integer having the prime factorization $2^a \times 3^b \times 5^c$, where a, b and c are each positive integers?
40	An urn contains some black and some white marbles. What is the minimum possible number of total marbles that can be in the urn such that the probability of drawing two black marbles in a row without replacement is $\frac{1}{8}$?

ALGEBRA

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GEOMETRY - Individual Contest

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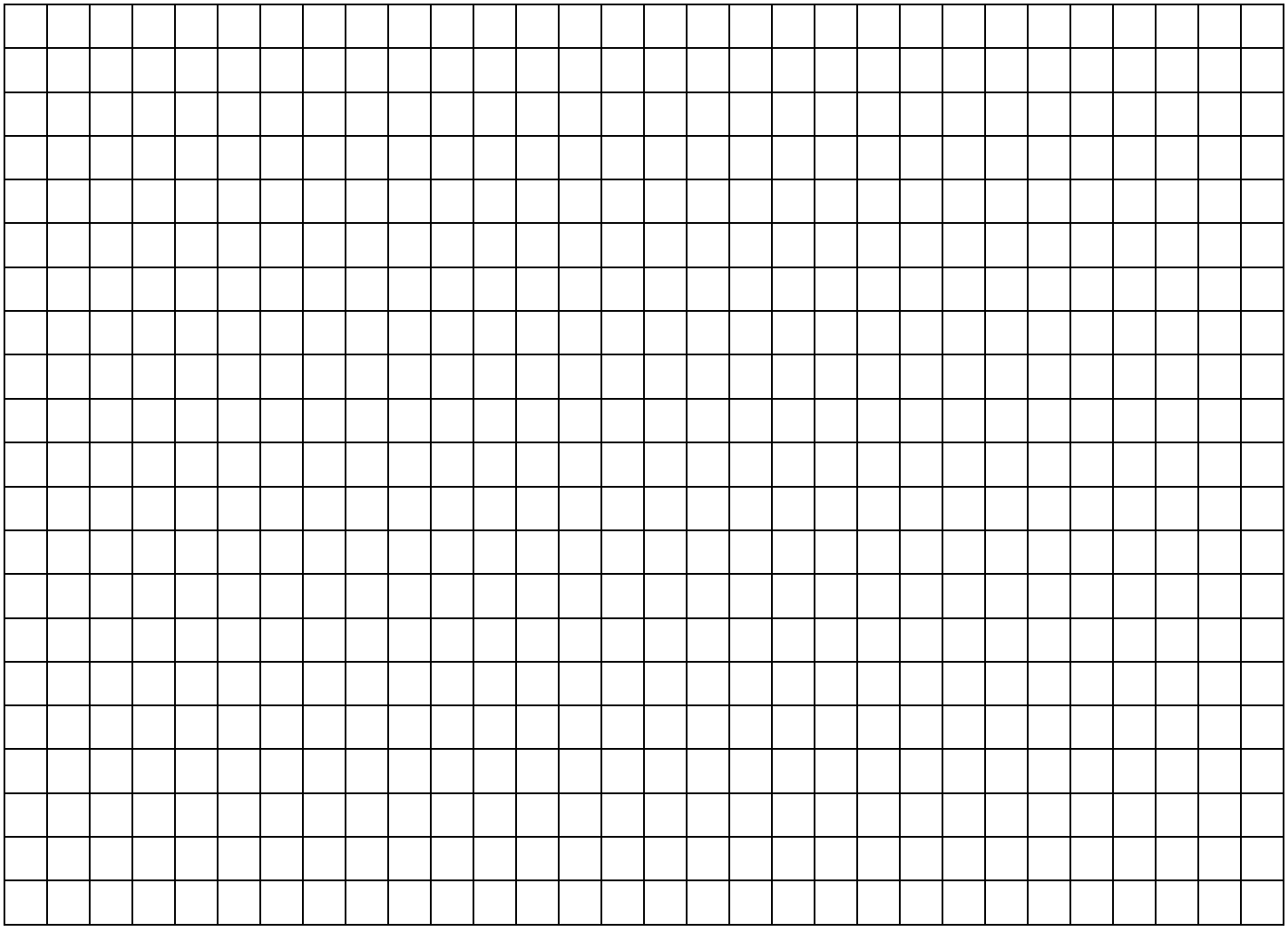

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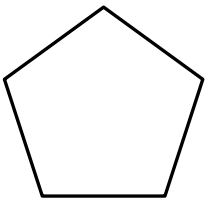
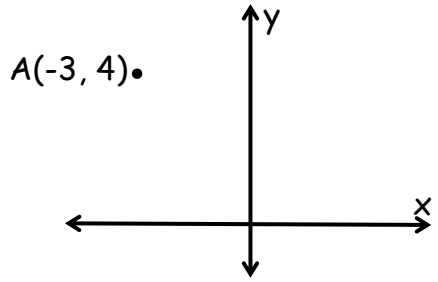
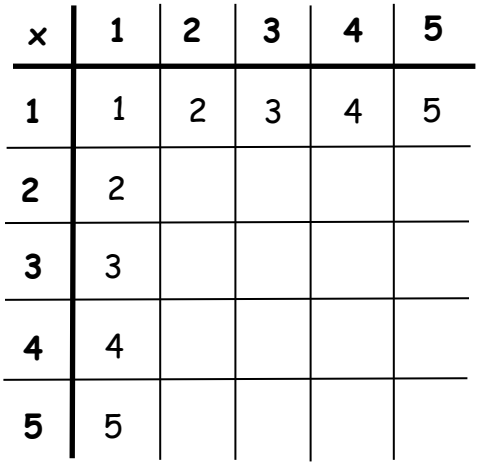
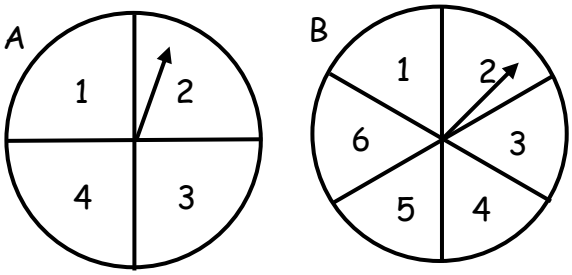
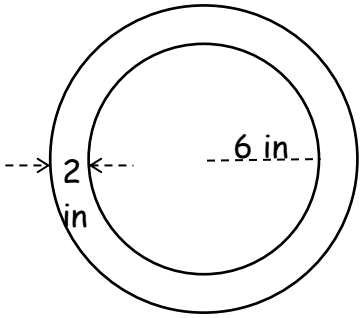
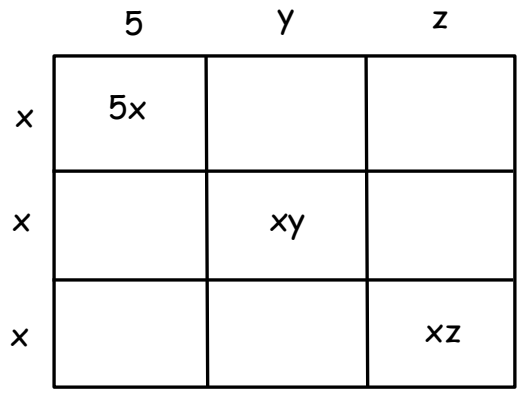
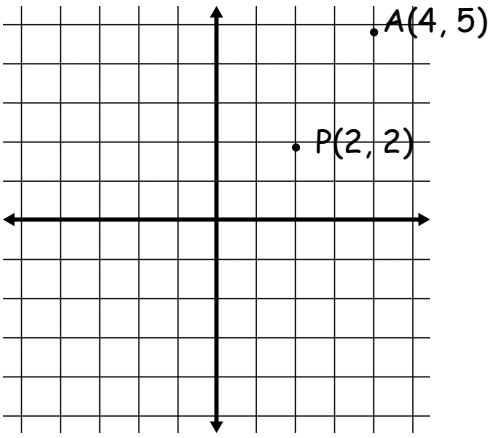
GEOMETRY - Individual Contest

	Questions 1-30: 2 points each
1	When $\frac{7}{8}$ is expressed as a decimal, what is the sum of its digits?
2	What is the number of distinct ways to put the five letters A, B, C, D, and E in order if the first letter must be B and the fourth letter must be A?
3	During any given hour a particular traffic light is red for a total of 18 minutes. As a common fraction, what is the probability that the light will not be red when I drive past this traffic light?
4	As a common fraction, what is the ratio of $\frac{y}{x}$ if $2x = 8y$?
5	How many lines of symmetry does a regular pentagon have? 
6	What is the remainder when 95 is divided by 14?
7	What is the product of 1234 and 10001?
8	Evaluate: $9(4 - 7) + 2 \cdot 3^3$
9	When the expression $2^6 \cdot 3^4 \cdot 5^5 \cdot 7^2$ is multiplied out to make one large number, that number ends with some consecutive zeros. What is the number of consecutive zeros on the end of this number?
10	Solve for x: $3(x - 1) = -7 + 5x$
11	In the following sequence, every term starting with 4 and moving right is determined by adding the two previous terms together. What is the value of x? 9, -5, 4, -1, 3, 2, 5, ___, ___, ___, ___, x
12	Eight gummy bears cost the same as twelve starburst chews. Fifteen starburst chews cost the same as twenty-one jolly ranchers. How many jolly ranchers cost the same as thirty gummy bears?

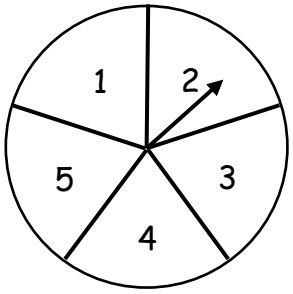
13	The point A(-3, 4) is reflected over the y-axis on a coordinate plane. What is the y-coordinate of the image A'? 
14	The 5 x 5 times table shown has the first row and column filled in. If the rest of the numbers were filled in there would be a total of twenty-five numbers in the table. Within the table of twenty-five numbers (not including the numbers above or to the left of the dark lines), how many numbers appear exactly once each? 
15	Spinner A is spun, then spinner B is spun. The resulting numbers are added. As a common fraction, what is the probability that the sum is even? The four sections on spinner A have equal area and the six sections on spinner B have equal area. 
16	When David and Audrey finished crossword puzzle number 40 in their book of 200 crossword puzzles, they realized they had completed $\frac{1}{5}$ of the puzzles in the book. How many more puzzles do they need to solve in order to have solved $\frac{3}{8}$ of the puzzles in the book?

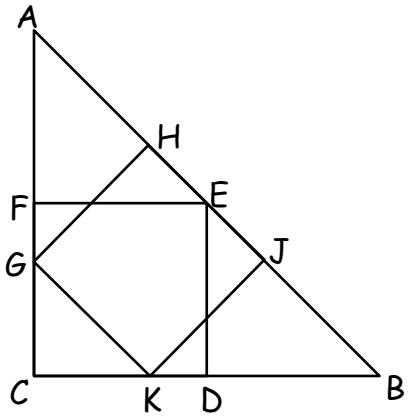
x	1	2	3	4	5
1	1	2	3	4	5
2	2				
3	3				
4	4				
5	5				

17	As a common fraction, what is the probability of randomly drawing a card from a standard deck that is either a black card or a face card (jack, queen, or king)?
18	Given that x divided by y is a positive even integer, write the letter(s) of the following statement(s) that must always be true in the answer space. A) y is an integer B) x is an even integer C) $x > y$ D) $xy > 1$ E) None of the above
19	What is the smallest three-digit number having the property that the sum of its digits equals the product of its digits?
20	Marsenne primes are prime numbers with the form $2^n - 1$, where n is an integer. For example, $2^3 - 1 = 7$, so 7 is a Marsenne prime. For n = {1, 2, 3, 4, 5, 6, 7, 8}, what percent of the numbers in the form $2^n - 1$ are Marsenne primes?
21	A circular mirror has a frame that is uniformly 2 inches wide. The radius of the mirror is 6 inches. In terms of π, what is the number of square inches in the area of the frame? 
22	In the figure there are 9 nonoverlapping rectangles. Three of the rectangles have an expression that represents the area written inside them. The combined area of the 9 rectangles can be expressed as $3x(5 + y + z)$ or, as a second expression, _____ + _____ + _____, where each blank represents the combined area of each vertical stack of 3 rectangles. What is this second expression for the combined area of the 9 nonoverlapping rectangles? 

23	The 3-digit number 3a4 has 4 as its ones digit, a as its tens digit, and 3 as its hundreds digit. If the quotient of 3a4 and 8 is an integer, then what is the number of single-digit values that a could have?
24	A positive integer, p, is the product of a multiple of three and a perfect square. Additionally, p is the product of three and an even number. What is the smallest possible value of p?
25	According to www.worldometers.info there are currently approximately 7,500,000,000 humans alive on earth. According to National Geographic there are an estimated 35,000,000,000 skin cells in a human body. In scientific notation, what is the total number of human skin cells on earth?
26	Bobbi and Danelle both start at the same time and place and run in the same direction around a 720-meter track. Bobbi completes one lap in 2 minutes and runs at an average rate that is one and one-third times as fast as Danelle's average rate. At the moment Bobbi finishes her lap, what is the number of meters Danelle needs to still run to complete one lap?
27	A water tank has two valves that can be used to drain it. If the tank is completely full, it takes 14 minutes to drain it opening only valve A. When both valves are open, it takes 8 minutes to drain the full tank. What is the number of seconds in the length of time it takes for the full tank to drain, if only valve B is open.
28	A rectangular plastic tarp has a thickness of 6 one-thousandths of an inch and a length and width of 12 feet by 20 feet. As a decimal, what is the number of cubic inches in the volume of plastic that the tarp is made of?
29	As a common fraction, what is the product of the two solutions to the equation $10x^2 - 29x - 21 = 0$?
30	Point A' is the image of the point A(4, 5) after a 90 degree counterclockwise rotation about point P(2, 2). In simplest radical form, what is the number of units in the length of $\overline{AA'}$? 

Challenge Questions: 3 pts each

31	In the polynomial $3x^2 - 5x$, the numbers 3 and 5 are called coefficients. When $(x + 2)(x - 3)(x + 4)$ is multiplied together to make another polynomial, what is the coefficient of its x^2-term?
32	In the given inequality, 50 and 100 are base-10 numbers. The number 123 is a base-*n* number, where *n* is an integer. What is the sum of the values of *n* which make the inequality true? $50 < 123_n < 100$
33	Brenna wrote a list of all the ways to add four distinct positive whole numbers whose sum is 15. For example, one of the ways would be 1 + 2 + 3 + 9 = 15. The order of the four distinct positive whole numbers does not matter, so she would not also write 1 + 3 + 2 + 9 = 15, because these are the same four numbers, just in a different order. If Brenna were to multiply the four distinct positive whole numbers instead of adding them, as a common fraction, what is the probability that their product would be greater than 100?
34	For the spinner shown, assume each number has an equal probability of being spun. The spinner is spun 5 times and the 5 results are used to generate a 5-digit number. For example, if the 1st spin results in 2, the 2nd spin results in 5, the 3rd spin results in 2, the 4th spin results in 1, and the 5th spin results in 3, then the 5-digit number generated would be 25213. As a common fraction, what is the probability that the 5-digit number is divisible by 4? 
35	A data set with eight distinct positive integers has a mean of 40 and a median of 31. When they are put in order from least to greatest, with the first term being the least and the eighth term being the greatest, what is the positive difference between the largest and smallest possible value for the sixth term?

36	There are two ways to inscribe a square in an isosceles right triangle, as shown. One way is for two of the sides of the square to lie on top of the legs of the triangle and have one vertex on the hypotenuse (square CDEF). The other way is for one of the sides to lie on top of the hypotenuse and have one vertex on each leg (square GHJK). As a common fraction, what is the ratio of the area of square GHJK to square CDEF? 
37	Two intelligent, honest students are sitting together at lunch one day when their math teacher hands them each a card. "Your cards each have an integer on them," the teacher tells them. "The product of the two numbers is either 12, 15 or 18. The first to correctly guess the number on the other's card wins." The first student looks at her card and says, "I don't know what your number is." The second student looks at her card and says, "I don't know what your number is, either." The first student then correctly says, "*Now* I know your number." What number is on the loser's card?

38	How many distinct infinite strings of digits have the following properties: 7) The sum of any three consecutive digits is 9. 8) Any given set of three consecutive digits is a repeat of the three digits that both precede and follow them. 9) Any given set of three consecutive digits consists of three distinct digits. The infinite strings . . . 801801801 . . . , and . . . 180180180 . . . , are considered the same. The infinite strings . . . 801801801 . . . , and . . . 810810810 . . . , are considered distinct.
39	What is the largest four-digit integer having the prime factorization $2^a \times 3^b \times 5^c$, where a, b and c are each positive integers?
40	An urn contains some black and some white marbles. What is the minimum possible number of total marbles that can be in the urn such that the probability of drawing two black marbles in a row without replacement is $\frac{1}{8}$?

GEOMETRY

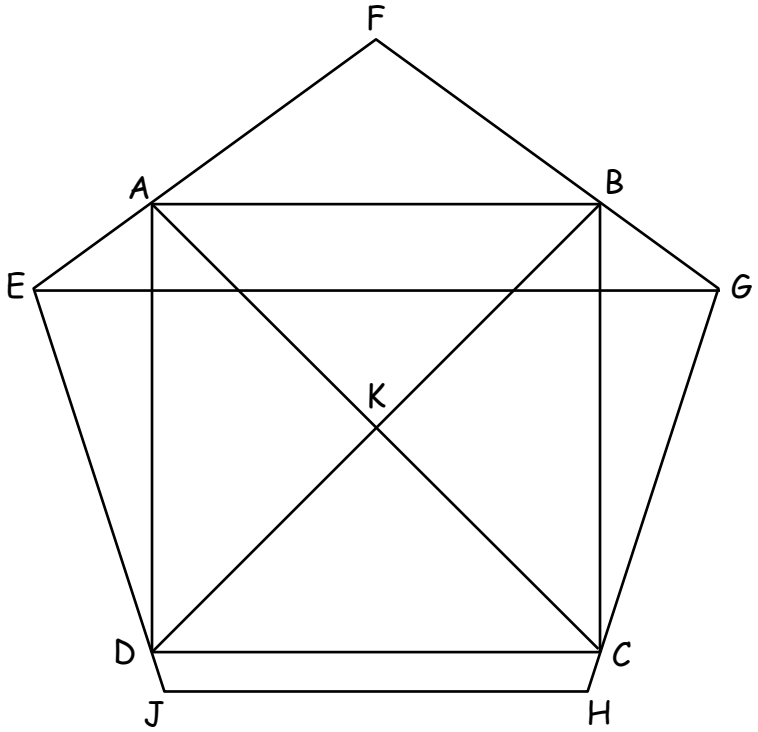
"Math is Cool" Masters – 2017-18

April 21, 2018

8th Grade Team Multiple Choice Contest

Use for questions 1-4

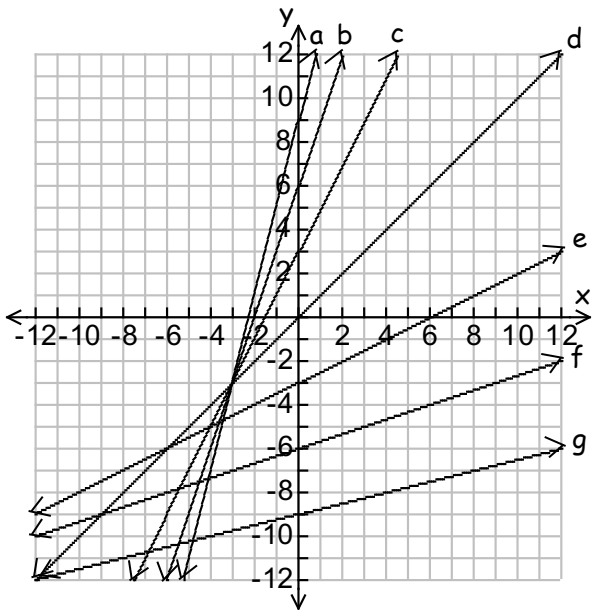
Square ABCD has been inscribed inside regular pentagon EFGHJ such that $\overline{CD}$ is parallel to $\overline{JH}$. (Note: the word regular means that each of the interior angles in the pentagon is the same number of degrees and each of the sides of the pentagon is the same length.) Each of the vertices of ABCD lies on one of the remaining four sides of EFGHJ. The sum of the three interior angles of any triangle is 180°, the sum of the four interior angles of any quadrilateral is 360°, and the sum of the five interior angles of any pentagon is 540°. The diagonals of square ABCD intersect at point K.



1	What is the number of degrees in the measure of ∠AKB? Note: the middle letter in the name, ∠AKB, is the location of the vertex of the angle. A) 45° B) 80° C) 90° D) 92° E) 96°
2	What is the number of degrees in the measure of ∠F? A) 72° B) 96° C) 104° D) 108° E) 112°
3	Which angle is congruent (has the same degree measure) to ∠DJH? A) ∠GCD B) ∠CBF C) ∠ADC D) ∠KBG E) ∠FAC
4	Which pair of angles are complementary (their measures add up to 90°)? A) ∠AKD & ∠ADK B) ∠AED & ∠JDC C) ∠FEG & ∠FGE D) ∠CBK & ∠CGE E) ∠CDJ & ∠GCB

Use for questions 5-7

The seven lines in the following diagram each have a distinct equation. They are labeled in order as a, b, c, d, e, f, and g, such that line a has the greatest slope and line g the least.



5	What is the equation for line a, in the form y = mx + b ? A) y = 3x + 9 B) y = 4x + 6 C) y = 3x + 6 D) y = 4x + 9 E) y = 5x + 9
6	The average equation of two lines is determined by adding the two equations together and then dividing the result by two. What is the average equation of lines f and g? A) $y = \frac{7}{12}x$ - 7.5 B) $y = \frac{1}{7}x$ - 7.5 C) $y = \frac{7}{24}x$ + 7.5 D) $y = \frac{7}{6}x$ - 7.5 E) $y = \frac{7}{24}x$ - 7.5
7	The average equation of seven lines is determined by adding the seven equations together and then dividing the result by seven. What is the sum of the slope and y-intercept of the average equation of lines a, b, c, d, e, f and g? A) $\frac{11}{7}$ B) $\frac{19}{12}$ C) $\frac{67}{42}$ D) $\frac{34}{21}$ E) $\frac{133}{95}$

Use for questions 8-10

There is a card game with 128 cards. Sixty-four of the cards have 2s written on them, thirty-two have 4s written on them, sixteen have 8s written on them, eight have 16s written on them, four have 32s written on them, two have 64s written on them, one has 128 written on it, and one has 256 written on it.

8 As a common fraction, what is the probability of first drawing a 2, putting the card back in the deck, and then drawing a 4?

A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) $\frac{5}{8}$ E) $\frac{3}{4}$

9 During the course of the game sixteen cards are laid out on a table, as shown. What is the product of these sixteen cards as a power of 2?

128	256	2	64
16	32	32	16
4	16	8	4
2	8	4	2

A) 2^{32} B)2^{37} C) 2^{48} D) 2^{58} E) 2^{61}

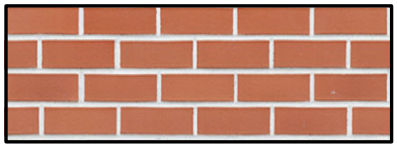
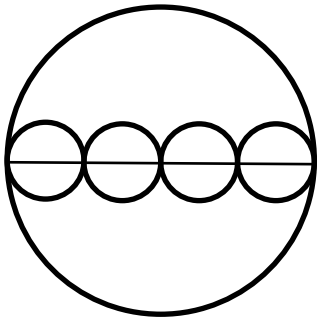
10 One card is drawn randomly from the deck, and then shuffled back in, and a second card is drawn. As a common fraction, what is the probability that the second card is the cube root of the first card?

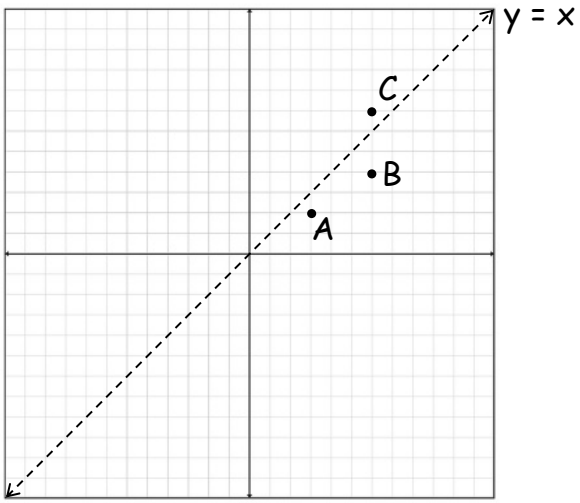
A) $\frac{98}{128}$ B) $\frac{33}{512}$ C) $\frac{17}{256}$ D) $\frac{1}{64}$ E) $\frac{1}{8192}$

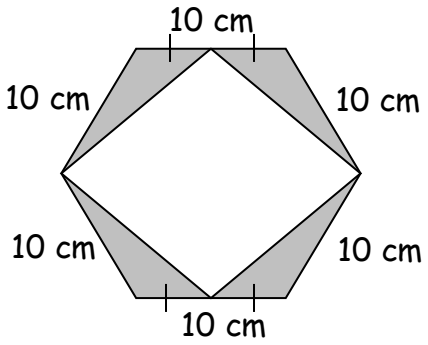
"Math is Cool" Masters – 2017-18

April 21, 2018

8th Grade Team Contest

1	What is the smallest prime number that is the middle number in a set of five consecutive numbers, where each of the other four numbers is a composite number?
2	Gerry is building a brick wall. The height of each brick is 2.25 inches. There is a mortar joint between each row of bricks that is 0.5 inches tall and the first row of bricks is laid on a bed of mortar that is 0.5 inches tall. What is the minimum number of rows of bricks needed to ensure that the wall is at least 4 feet tall? 
3	As a common fraction, what is the probability of randomly selecting a ginger cookie first from jar 1 and then an oatmeal cookie from jar 2? Jar 1 contains: 4 ginger cookies 5 sugar cookies  Jar 2 contains: 3 ginger cookies 4 sugar cookies 5 oatmeal cookies 
4	In the figure there is a large circle with circumference C and four congruent small circles each with circumference c. Adjacent pairs of the four congruent circles are tangent to each other and the two outer ones are internally tangent to the large circle. As a common fraction, what is the ratio of c to C? 

5	One of the common sizes of vinyl record is a 78 rotation per minute (rpm) record that has a diameter of 25 centimeters. As a fraction in lowest terms and in terms of π, what is the speed of a speck of dust fixed to the outside edge of the record in meters per second while the record is playing? There are 100 centimeters in a meter.
6	Three points form a triangle on a coordinate plane: A (3, 2), B (6, 4), and C (6, 7). A is then reflected over the dotted line with the equation y = x to become A' and B is reflected over the x-axis to become B'. As a decimal and in square units, what is the positive difference between the areas of triangles ABC and A'B'C? 
7	The results of a survey of 72 people about pets is shown. As a common fraction, what is the probability that a person surveyed has a cat, given than they also have a dog? Has a dog / Doesn't have a dog / Total Has a cat: 37 / 21 / 58 Doesn't have a cat: 17 / 7 / 24 Total: 54 / 28 / 82

8	A quadrilateral is drawn inside a regular hexagon as shown. Two vertices of the quadrilateral correspond with two of the hexagon's vertices. The other two vertices of the quadrilateral correspond with the midpoints of two opposite sides of the hexagon. The sides of the hexagon are each 10 centimeters long. In simplest radical form, what is the number of square centimeters in the shaded area? 
9	Evaluate the following expression in the form $a + \sqrt{b}$, where a and b are distinct positive integers: $$\sqrt{6 + 2\sqrt{5}}$$
10	The sum of two numbers is 30 and the product of the two numbers is three-seventeenths of the square of one of the numbers. As a decimal, what is the smaller of the two numbers?

"Math is Cool" Masters – 2017-18

April 21, 2018

8th Grade Robert Dirks' Relay Contest Questions & Key

RELAYS - 5 minutes per relay – 15% of team score

There is no talking during this event and you must always be facing forward. Person #1 will be given an answer sheet(s) and will need to fill out the top. The proctor will hand out a strip of paper to each person. These need to be face down on your desk until it is time for the relay to start. Once the relay begins, everyone may turn over their strip of paper and begin working. You may write on the strip of paper to come up with your answer. However, when person #1 figures out his/her problem, he/she will record ***just his/her final answer*** *on the answer sheet and pass only the answer sheet back to the person behind. This continues until person #4 puts an answer on the answer sheet and gives it to the proctor. A correct answer from person #1, #2 and #3 is worth 1 point each. A correct answer from person #4 is worth 2 points making each relay worth 5 points. You will see the expression* ***TNYWG*** [Proctor: write this on the board] *which means: "the number you will get". This is where you put your teammate's answer that they pass back to you, and then you should be able to solve your question. Once the relay begins, turn over your strip of paper and* ***make sure you have the right person number.*** *Remember, no talking and remain facing forward to avoid being disqualified!*

	Relay #1	**Answer**
Person 1	Find the value of x in the following equation: 12x – 5 = 67	[x=] 6
Person 2	Francis knows how to make 3 different flavors of cake, 5 kinds of icing, and TNYWG types of decorative designs on top. How many unique cakes can she make, using one flavor, one type of frosting and one decorative design?	90 [cakes]
Person 3	A shark is swimming across a lagoon at a rate of TNYWG centimeters per second. How many meters wide is the lagoon if it takes the shark a total of 6 minutes to swim across it?	324 [meters]
Person 4	What is the median of all the positive integer factors of TNYWG?	18
	Relay #2	**Answer**
Person 1	What is the sum of the first five positive multiples of 10?	150
Person 2	Out of a pool of TNYWG jurors, 60 are wearing suits and 50 are wearing high heels. 70 are wearing neither a suit nor high heels. As a percentage, what is the probability that a juror picked at random is wearing both a suit and high heels?	20 [%]
Person 3	In the equation 2x + y = TNYWG, how many distinct ordered pairs (x, y) are there in which x and y are positive integers?	9 [pairs]
Person 4	In simplest radical form, how many inches are in the space diagonal of a rectangular prism with length TNYWG inches and both width and height of TNYWG ÷ 3 inches?	3√11 [inches]

"Math is Cool" Masters – 2017-18

8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND #1 – SET 1

#	Problem	Answer
1	What is the product of fourteen, one-fifth, and twenty-five?	70
2	What is the slope of the line represented by the equation: two X plus Y equals five?	-2
3	As a common fraction, what is the product of one-sixth times twelve-thirteenths?	2/13 or "2 over 13" or "2 out of 13"
4	A triangle has a hypotenuse of thirteen centimeters and a leg of length five centimeters. How many centimeters are in the length of the other leg of the triangle?	12 [cm]
5	If X equals two, Y equals six, and X squared times Y times Z equals one hundred and twenty, what is the value of Z?	5
6	Art, Ben, Cal, and Dan are playing doubles tennis. What is the number of distinct ways two teams can be formed with these four players?	3 [ways]
7	What is the measure, in degrees, of the smaller angle made by the hands of a clock at eleven thirty am?	165 [degrees]
8	Robin Hood is competing in an archery contest against four other people. His probability of winning is exactly sixty percent more than the individual probability of each of the others. As a percentage, what is the probability that he loses?	32 [%]
9	Line K passes through the points negative two comma one, and four comma five. As a common fraction, what is the slope of the line that is perpendicular to line K?	-3/2 or 3/-2 or "-3 over 2" or "3 over -2"
10	If Y squared equals three X and X equals four Y, what is the value of X?	48

"Math is Cool" Masters – 2017-18

8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND #2 – SET 2

#	Problem	Answer
1	What is the volume, in cubic inches, of a cube with surface area one hundred and fifty square inches?	125 [inches cubed]
2	Kate shoots fifteen free throws and nine make it in the basket. At this rate, how many free throws could she expect to make if she shoots one hundred times?	60 [free throws]
3	As a common fraction, what is the probability of rolling three identical numbers on three fair six-sided dice?	1/36 or "1 over 36" or "1 out of 36"
4	What is the remainder when ninety-one is divided by seven?	0
5	Seven pirates have a chest of gold pieces that they intend to share. During the night, one pirate sneaks off with half of it. The next day the remaining six pirates evenly split up the rest, leaving a remainder of three pieces. What is the smallest number of gold pieces that could've been in the chest?	18 [gold pieces]
6	The square root of eighty-nine lies between two consecutive integers. What is the sum of those two integers?	19
7	What is the area, in square units, of the triangular region enclosed by the X and Y axes and the line with equation Y equals negative one-half X plus five?	25 [square units]
8	What is the greatest prime factor of one hundred and two?	17
9	What is the mean of the following data set: forty-nine, fifty-two, fifty-one, and sixty?	53
10	A palindrome is a number that reads the same forwards as backwards. What is the smallest number in base ten that will be a three-digit palindrome when written in base five?	26

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8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND #3 – SET 3

#	Problem	Answer
1	An equilateral triangle has a perimeter of forty-eight centimeters. What is the number of centimeters in the length of one side?	16 [cm]
2	Which two-digit prime number has the largest sum when you add its two digits together?	89
3	What is forty percent of one hundred and twenty-five?	50
4	A circular dart board has a radius of ten inches. In the center of the board is a smaller circle with radius two inches. Jade throws one dart and it hits the board somewhere. As a common fraction, what is the probability that it hit inside the smaller circle?	1/25 or "1 over 25" or "1 out of 25"
5	What is the product of two thousand times eighteen?	36000
6	What is the number of units in the distance between the points negative seven comma one and five comma negative four?	13 [units]
7	A cylindrical drinking glass is exactly sixty percent full of water. In terms of pi, how many cubic inches are in the volume of the water, if the height of the glass is five inches and the radius is two inches?	12 pi [cubic inches]
8	Moana is sailing from one island to another at an average speed of thirty miles per hour. After ninety minutes, the wind shifts and her average speed increases to forty miles per hour. How many miles will she have travelled after a total of three hours of sailing?	105 [miles]
9	As a common fraction, what is the quotient of three-sevenths divided by fifteen-forty-seconds?	6/5 or "6 over 5"
10	What is the sum of the distinct prime factors of four hundred and sixty-five?	39

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COLLEGE KNOWLEDGE BOWL ROUND #4 – SET 4

#	Problem	Answer
1	Zelda picks a number in her head, adds forty to it, multiplies the result by three-halves and then adds five. The final result is seventy-seven. What was her number to begin with?	8
2	What is the sum of the digits in the decimal representation of five-eighths?	13
3	What is the sum of the prime numbers between fifty and sixty?	112
4	What is the product of forty-three times eight?	344
5	Josh flips a coin with one hand while rolling a die with the other. As a common fraction, what is the probability of him getting both a head and a six?	1/12 or "1 over 12" or "1 out of 12"
6	A triangle has one side length of twenty centimeters. The lengths of the other two sides are whole numbers in a ratio of three to four. In centimeters, what is the smallest possible perimeter the triangle could have?	41 [cm]
7	What is the sum of the prime factors of four hundred sixty-two?	23
8	As a common fraction, what is the median of the following data set: one-half, six-sevenths, three-eighths, and three-fourths?	5/8 or "5 over 8"
9	If a car is driving at an average rate of fifty miles per hour, how many minutes will it take the car to travel thirty-five miles?	42 [mins]
10	The line with equation Y equals two X plus five is rotated one hundred and eighty degrees around the origin on a coordinate plane. What is its new equation?	Y= 2X-5

"Math is Cool" Masters – 2017-18

8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND #5 – SET 5

#	Problem	Answer
1	What is the sum of the fourth powers of each of the first four positive integers?	354
2	As a common fraction, what is the probability of rolling a prime number on a twenty sided die?	2/5 or "2 over 5" or "2 out of 5"
3	A wizard casts a spell on a cube that doubles each of its side lengths. As a common fraction, what is the ratio of its starting volume to its ending volume?	1/8 or "1 over 8" or "1 out of 8"
4	What is the product of eighty-four times five?	420
5	Which positive integer value of X is a solution to the equation: X times X plus X equals thirty?	[X=] 5
6	How many degrees are in the sum of the interior angles of a hexagon?	720 [degrees]
7	What is the least common multiple of the following terms: four to the third power, five to the second power, and two to the fifth power?	1600
8	How many positive integer factors does four hundred and eighty have?	24 [factors]
9	A sink with a capacity for ten gallons of water is accidentally left running. The water is coming out at an average rate of one pint per five minutes and the drain is plugged. After how many minutes from the time the water was first turned on will the sink overflow? There two pints in one quart.	400 [minutes]
10	An ice cream cone is completely filled with ice cream and has a hemisphere of ice cream mounded on top. The cone has a radius of three inches and height of seven inches, and the ice cream on top has the same radius as the cone. What is the total volume, in cubic inches and in terms of pi, of the ice cream?	39 pi [inches cubed]

"Math is Cool" Masters – 2017-18

8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND #6 – SET 6

#	Problem	Answer
1	As a common fraction, what is the quotient of five divided by three eighths?	40/3 or "40 over 3'
2	On any given day, the probability of Buffy slaying a vampire is eighty percent. On days when she slays a vampire, there is a fifty percent chance she'll finish her homework. As a percentage, what is the probability that today she slays a vampire and finishes her homework?	40 [%]
3	The prime factorization of two thousand can be written in the format "A to the B power times C to the D power". What is the sum of A, B, C, and D?	14
4	What is the number of centimeters in the height of a trapezoid with an area of forty-two square centimeters and bases of length five and seven centimeters?	7 [cm]
5	There are frogs and ducks gathered around a pond. In total, there are fifty-two legs and twenty-four wings. How many frogs are there?	7 [frogs]
6	What is the value of X in the equation two X plus two Y equals Y squared plus one, when Y equals thirteen?	72
7	A packet of gummy bears has three red, three green, and three yellow and two are pulled out at random. As a common fraction, what is the probability that they will both be the same color?	$\frac{1}{4}$ or "1 over 4" or "1 out of 4"
8	In terms of pi, what is the number of square inches in the total surface area of a cylinder with radius four inches and height ten inches?	112 pi [sq in]
9	If two to the power two X is one thousand and twenty-four, what is the value of X?	5
10	A given number, when written down in base nine, is represented by the digits two thousand and eighteen. How would that number be written in base ten?	1475

"Math is Cool" Masters – 2017-18

8th GRADE - April 21, 2018

COLLEGE KNOWLEDGE BOWL ROUND – EXTRA

#	Problem	Answer
1	I have a deck of thirty cards with the numbers one through thirty written on them. As a common fraction, what is the probability of drawing a card with the digit two on it?	2/5 or "2 over 5" or "2 out of 5"
2	Circle A has a radius of four inches, and circle B has a circumference of twelve pi inches. As a common fraction, what is the ratio of the area of Circle A to the area of Circle B?	4/9 or "4 to 9" or "4 over 9" or "4 out of 9"
3	What is the remainder when three hundred is divided by thirteen?	1
4	What is the product of the first five prime numbers?	2310
5	What is the value of X in the following equation: four X plus five equals five X minus seven?	[X=] 12
6	Rose is in a chili-pepper-eating contest. After each pepper she takes a breather for ninety seconds multiplied by the number of peppers she has already eaten. If each pepper takes ten seconds to eat, and there are five peppers in all, how many total seconds will have elapsed when she finishes the last pepper?	950 [secs]

Final Score:

KEY

(Out of 8)

"Math is Cool" Masters -- 2017-18
8th Grade

Student Name _____ Team #_____

School Name _____ Proctor Name_____ Room #_____

Mental Math – 30 sec per question

8 problems read orally to everyone - Approximately 8% of Individual Score - 25% of team score
You may NOT be seated next to anyone from your school. If you are MOVE NOW to avoid being disqualified! 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	27 pi [sq in]		
2	3/10 or "3 over 10" or "3 out of 10"		
3	95		
4	[x=] 7		
5	90 [degrees]		
6	8 [sq units]		
7	73 [mornings]		
8	40 [minutes]		

"Math is Cool" Masters – 2017-18
8th Grade

Final Score:
KEY

School Name_____Team #_____

Proctor Name _____Room #_____

First Score

(out of 20)

Team Multiple Choice Contest – 15 minutes – 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. When you are prompted to begin, tear off the colored sheet, pass out a copy of the test to each team member, and begin testing. ***Since this is a multiple choice test, ONLY a letter response should be listed as an answer on the answer sheet.***

Correct responses are worth 2 points, incorrect responses are worth -1 point and no response is 0 points.

DO NOT WRITE IN SHADED REGIONS

	Answer	-1, 0 or 2	-1, 0 or 2
1	C		
2	D		
3	A		
4	E		
5	D		
6	E		
7	B		
8	A		
9	D		
10	C		

"Math is Cool" Masters – 2017-18
8th Grade

Final Score:
KEY

School Name_____Team #_____

Proctor Name_____Room #_____

First Score

(out of 10)

Team Contest – Score Sheet – 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 a 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	23		
2	18 [rows]		
3	$\frac{5}{27}$		
4	$\frac{1}{4}$		
5	$\frac{13\pi}{40}$ or $\frac{13}{40}\pi$ [meters per second]		
6	17.5 [sq. units]		
7	$\frac{37}{54}$		
8	$50\sqrt{3}$ [cm^2]		
9	$1 + \sqrt{5}$		
10	4.5		

"Math is Cool" Masters -- 2017-18

8th Grade

KEY

RELAY # 1

Answer for person # 1	Answer for person # 2	Answer for person # 3	Answer for person # 4
[x=] 6	90 [cakes]	324 [meters]	18
1 or 0	1 or 0	1 or 0	2 or 0

RELAY # 2

Answer for person # 1	Answer for person # 2	Answer for person # 3	Answer for person # 4
150	20 [%]	9 [pairs]	$3\sqrt{11}$ [inches]
1 or 0	1 or 0	1 or 0	2 or 0

Final Score:

(Out of 8)

"Math is Cool" Masters -- 2017-18
8th Grade

Student Name _____ Team #_____

School Name _____ Proctor Name_____ Room #_____

Mental Math – 30 sec per question

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

"Math is Cool" Masters – 2017-18
8th Grade

Final Score:

School Name_____Team #_____

Proctor Name _____Room #_____

First Score

(out of 20)

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2			
3			
4			
5			
6			
7			
8			
9			
10			

“Math is Cool” Masters – 2017-18
8th Grade

Final Score:

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1			
2			
3			
4			
5			
6			
7			
8			
9			
10			