"Math is Cool" Championships – 2008-09

Sponsored by:

Algebra 1 – November 7, 2008

Individual Contest

Tear this sheet off and fill out top of answer sheet on following page prior to the start of the test.

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.*
- *All radicals must be simplified and all denominators must be rationalized.*
- *Units are not necessary unless it is a problem that deals with time and in that case, a.m. or p.m. 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 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 also be scored as a 0.*

INDIVIDUAL TEST - 35 minutes

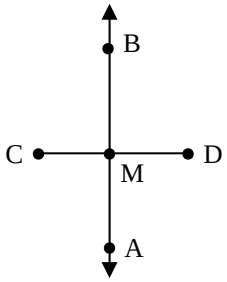
When you are prompted to begin, tear off the colored sheet and begin testing. Make sure your name and school are recorded on the answer sheet. Each problem is scored as 1 or 0. Record your answers on the score sheet. No talking during the test. You will be given a 5 minute time warning.

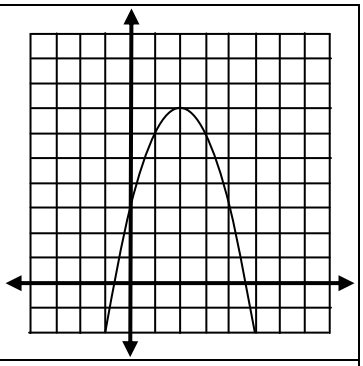
"Math is Cool" Championships – 2008-09

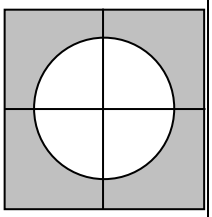
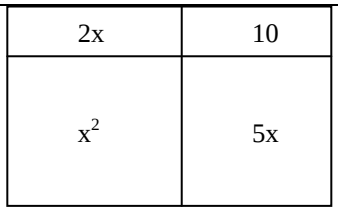
Sponsored by:

Algebra I – November 7, 2008

Individual Contest

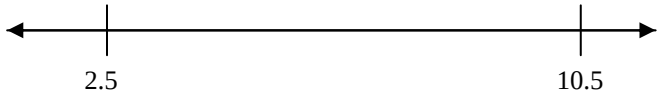
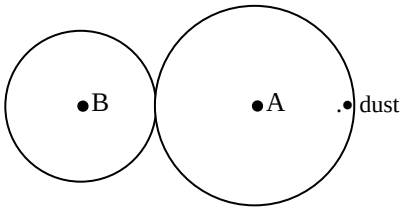
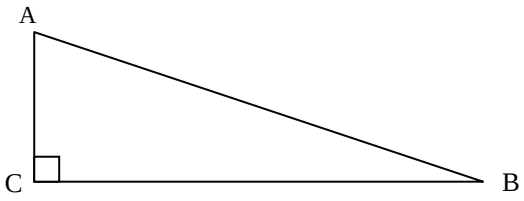
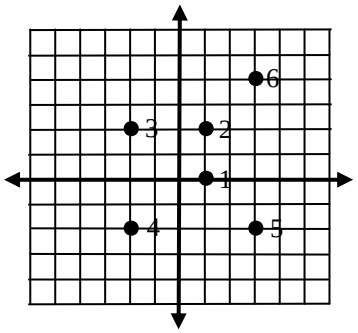
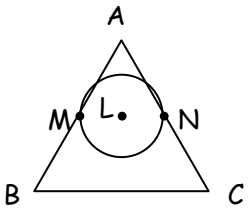
1	How many dots are in the given drawing? . . . .
2	What is the positive difference between 12,345 and the number you get when you reverse its digits?
3	Wendy has a collection of quarters. She is able to stack them in seven piles of equal height or five piles of equal height. What is the least number of quarters in her collection?
4	If commas are placed as they often are after each group of three digits, how many commas would be in the product of 238 and 4,123?
5	Numbers are written in boxes A and B in the row of boxes shown. The number to be written in box C is the product of the numbers in box A and box B. The number to be written in box D is the product of the numbers in box B and box C. If this pattern continues, what is the number to be written in box F? 2 | 3 | | | | | A B C D E F
6	How many digits are in the product of 2^3 and 3^4?
7	Franny loves the sound of her own voice. For every minute that goes by she expects to be talking an average of 36 seconds. If she actually meets her expectation, during how many minutes will she be talking in a 90-minute stretch?
8	Amy draws a segment that is 5 units long on a coordinate plane drawn on graph paper. The segment is neither horizontal nor vertical. What is the minimum number of grid squares containing a portion of the segment if each grid square is 1 unit by 1 unit? A grid square is not considered to contain a portion of the segment if the segment only shares a single point with the perimeter of the grid square.
9	How many positive even three-digit integers are there?
10	Segment AB goes through the midpoint M of segment CD and segment AB is perpendicular to segment CD. The length of segment CD is 18 units and point A is 40 units from point M. What is the ratio of $\frac{DM}{AM}$? Express your answer as a common fraction. 

11	For the given graph, what is the abscissa (abscissa = the x-coordinate) of the highest point on the curve? The side length of each grid square is one unit. 
12	If $(ab)^5 = 11^5$ and a and b are positive integers, what is a + b?
13	A circle with radius 2 centimeters rolls across a table that is 45 centimeters long. What number of complete rotations is the circle able to make if it rolls parallel to the edge of the table for its entire length? Give answer as a whole number.
14	A standard die is rolled three times. What is the probability that a prime number is rolled on exactly one of the three rolls?
15	On a standard clock, what is the number of degrees in the smaller angle formed by the minute hand and the hour hand at 10:12 pm?
16	Benny solved the following equation, but he made one mistake. 1) $-2(x - 4) = 5x - 10$ 2) $-2x - 8 = 5x - 10$ 3) $-7x - 8 = -10$ 4) $-7x = -2$ 5) $x = \frac{2}{7}$ Write the number of the equation that is not a correct simplification of the equation above it.
17	The reciprocal of n is 1 divided by n. What is the reciprocal of .27272727 . . . ?
18	If $a \nabla b = \lvert a^2 - b^2 \rvert$ then what is the value of $2 \nabla 7$?
19	Any number that can be written as the quotient of two integers is a rational number. Write the letter of the largest rational number in the following list: A) $\frac{10}{3}$ B) $\sqrt{10}$ C) π D) $\sqrt{12.25}$ E) $\frac{31}{9}$
20	The geometric mean of a and b is $\sqrt{ab}$. What is the geometric mean of 3 and 4? Answer in simplest radical form.
21	Jesse walks exactly once around a rectangular pool with dimensions 12 feet by 8 feet. If Jesse always remains exactly 2 feet from the edge of the pool, what is the number of feet in the distance Jesse walks?
22	For a rectangle with an area of 60 square inches, the length varies inversely with the width and can be modeled by the equation $L = \frac{60}{W}$. How many positive integer ordered pairs (W,L) would be on the graph of this equation?
23	A cylindrical coffee mug has a radius of 2 inches and a height of 4 inches. When Fran pours herself a cup of coffee she likes to leave room for 2 cubic inches of cream. If, after pouring coffee and adding cream, her mug is exactly full to the rim, what is the quotient when the number of cubic inches of coffee in her mug is divided by the number of cubic inches of cream in her mug?
24	A t-shirt manufacturing company charges its customers $34 plus $2.50 per shirt. Write an equation in slope-intercept form (y = mx + b) to represent this situation. Use n for the number of t-

	shirts and C for the amount charged by the t-shirt company.
25	The set F {3, 6, 9, 12, 15, 18, 21, 24, 27, 30} has ten unique elements. A subset of set F is defined as a set containing anywhere from zero to ten inclusive of the elements in set F. How many subsets of set F contain exactly eight elements?
26	What is the number of seconds in the time period between 7:45 am and 8:02 am, the same day?
27	A square of side length 2 centimeters is divided into four 1 cm by 1 cm squares. The centers of each of these four smaller squares lie on the circumference of a circle as shown. What is the number of square centimeters in the area of the shaded region? 
28	What is the positive difference between the number of distinct ways to arrange the letters in the word HARRY and the number of distinct ways to arrange the letters in the word POTTER?
29	One way to represent the area of the following diagram is as the sum of the areas of its four parts: $x^2 + 5x + 2x + 10$, which can be simplified to $x^2 + 7x + 10$. Write another expression in terms of x and in the form (a + b)(c + d) to represent the area of the diagram, where a + b represents the length and c + d represents the width of the diagram. 
30	Joel is walking at a rate of 1.5 meters per second on a 140-meter-long moving walkway. He is walking in the same direction that the walkway is moving. Jennifer is standing on the moving walkway and it takes her 40 seconds to go from one end of the walkway to the other. How many seconds does it take Joel to go from one end of the moving walkway to the other?

Challenge Questions

31	Bobby has twenty-one refrigerator magnets as shown, with a letter of the alphabet printed on each one. He wants to make the phrase RUBBER BABY BUGGY BUMPER. Bobby sets aside one R and three Bs to be the first letter of each word. He then randomly selects five letters. What is the probability that he selects the five letters needed to complete the first word of the phrase? A B B B B B B E E G G M P R R R U U U Y Y
32	How many units are in the distance between the two lines with the equations y = 4x and y = 4x + 17?
33	Given the equation: $y = 4(\frac{1}{2})^x$ What is the value of y when x = 6? Express your answer as a power of 2.
34	Maggie lives 975 meters from school and Ming lives 425 meters from the same school. Ming's house is on Maggie's route to school. Maggie walks at a constant rate of 80 meters per minute and Ming walks at a constant rate of 50 meters per minute to school. If they both leave for school at the same time, after how many seconds will the two first be 20 meters apart from each other?

35	How many points are located between 2.5 and 10.5 on the given number line with coordinates of the form $\sqrt{a}$, where a is a positive integer? 
36	Two circular wheels are placed next to each other. Wheel A spins in a clockwise direction, wheel B spins in a counterclockwise direction, and points on the perimeters of the two wheels move at the same speed. The wheels' edges are sticky and a speck of dust on the edge of Wheel A and directly in line with segment AB will transfer to the edge of Wheel B when it reaches the point where the two wheels are closest to each other, and then back to the edge of Wheel A after making a complete rotation along the edge of Wheel B. The radius of Wheel A is 8 inches and the radius of Wheel B is 5 inches. During the time it takes Wheel A to spin two complete rotations, what is the ratio of the length of the dust speck's path on Wheel B to the length of its path on Wheel A? 
37	Points A and B are both on the graph of the equation $y = \frac{24}{x}$. What is the slope of line AB if the x-coordinate of A is the smallest prime number and the x-coordinate of B is the largest negative even integer?
38	The sine ratio of angle ABC in right triangle ABC is defined as AC:AB. If AC:AB = 7:25, how many units are in the shortest possible integer length of BC? 
39	On a coordinate plane, Marcia puts dot #1 one unit directly to the right of the origin (0,0), then puts dot #2 two units directly above dot #1, then puts dot #3 three units directly to the left of dot #2, then puts dot #4 four units directly below dot #3. She continues this process so that dot n + 1 is always n + 1 units directly right, up, left or down of dot n. How many units are in the area of the circle whose diameter has dot #6 and dot #4 as endpoints? Answer as an improper fraction in terms of π. 
40	Equilateral ΔABC has side lengths of 10 inches. The midpoint of $\overline{AB}$ is M and the midpoint of $\overline{AC}$ is N. One diameter of circle L has endpoints at M and N. What is the length, in inches, of segment $\overline{CL}$? 

"Math is Cool" Championships – 2008-09

Sponsored by:

Geometry – November 7, 2008

Individual Contest

Tear this sheet off and fill out top of answer sheet on following page prior to the start of the test.

GENERAL INSTRUCTIONS applying to all tests:

- *Good sportsmanship is expected throughout the competition by all 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.*
- *All radicals must be simplified and all denominators must be rationalized.*
- *Units are not necessary unless it is a problem that deals with time and in that case, a.m. or p.m. 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 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 also be scored as a 0.*

INDIVIDUAL TEST - 35 minutes

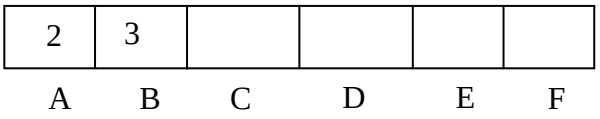
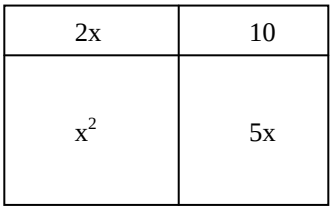
When you are prompted to begin, tear off the colored sheet and begin testing. Make sure your name and school are recorded on the answer sheet. Each problem is scored as 1 or 0. Record your answers on the score sheet. No talking during the test. You will be given a 5 minute time warning.

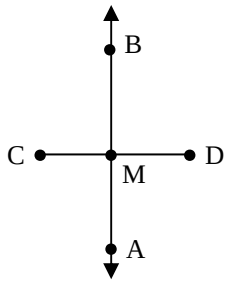
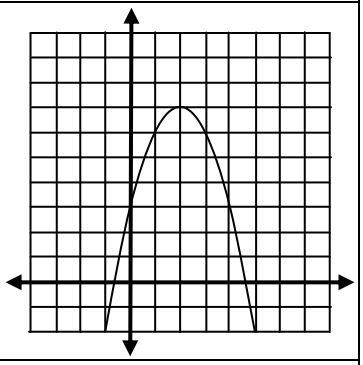
"Math is Cool" Championships – 2008-09

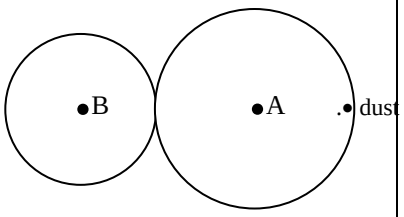
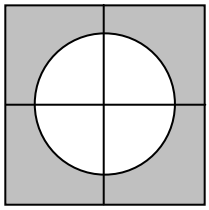
Sponsored by:

Geometry – November 7, 2008

Individual Contest

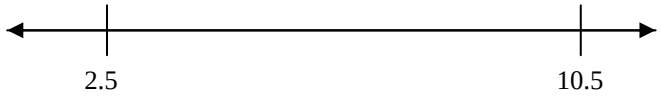
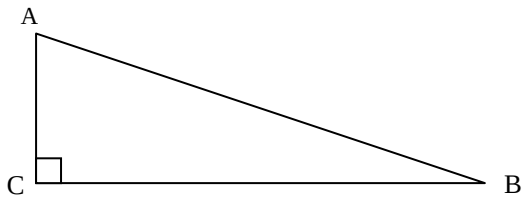
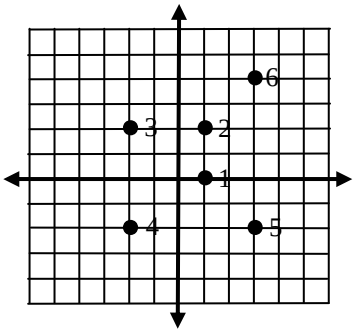
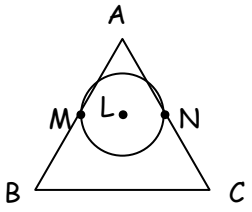
1	Wendy has a collection of quarters. She is able to stack them in seven piles of equal height or five piles of equal height. What is the least number of quarters in her collection?
2	What is the quotient when the digit in the thousands place is divided by the digit in the millions place for the following integer: 2,130,104
3	Briana has arranged three shells in a row and labeled them A, B and C from left to right. Briana switches shells A and B, then switches shells B and C, then switches shells A and C. Does shell B end up in the left, middle or right position?
4	If commas are placed as they often are after each group of three digits, how many commas would be in the product of 238 and 4,123?
5	Numbers are written in boxes A and B in the row of boxes shown. The number to be written in box C is the product of the numbers in box A and box B. The number to be written in box D is the product of the numbers in box B and box C. If this pattern continues, what is the number to be written in box F? 
6	Joanna starts at 465 and counts down to 0 by fives. Roberta starts at 644 and counts down to 0 by sevens. If both Joanna and Roberta say their starting numbers and every number as they count down, including 0, who will say more numbers?
7	How many digits are in the product of 2^3 and 3^4?
8	Franny loves the sound of her own voice. For every minute that goes by she expects to be talking an average of 36 seconds. If she actually meets her expectation, during how many minutes will she be talking in a 90-minute stretch?
9	What is the positive difference between the number of distinct ways to arrange the letters in the word HARRY and the number of distinct ways to arrange the letters in the word POTTER?
10	One way to represent the area of the following diagram is as the sum of the areas of its four parts: $x^2 + 5x + 2x + 10$, which can be simplified to $x^2 + 7x + 10$. Write another expression in terms of x and in the form $(a + b)(c + d)$ to represent the area of the diagram, where $a + b$ represents the length and $c + d$ represents the width of the diagram. 
11	How many positive integers are factors of 90?
12	What is the product of 259 and 261?
13	What is the sum of the distinct prime factors of 1716?

14	Segment AB goes through the midpoint M of segment CD and segment AB is perpendicular to segment CD. The length of segment CD is 18 units and point A is 40 units from point M. What is the ratio of $\frac{DM}{AM}$? Express your answer as a common fraction. 
15	For the given graph, what is the abscissa (abscissa = the x-coordinate) of the highest point on the curve? The side length of each grid square is one unit. 
16	If $(ab)^5 = 11^5$ and a and b are positive integers, what is a + b?
17	A circle with radius 2 centimeters rolls across a table that is 45 centimeters long. What number of complete rotations is the circle able to make if it rolls parallel to the edge of the table for its entire length? Give answer as a whole number.
18	A standard die is rolled three times. What is the probability that a prime number is rolled on exactly one of the three rolls?
19	On a standard clock, what is the number of degrees in the smaller angle formed by the minute hand and the hour hand at 10:12 pm?
20	Benny solved the following equation, but he made one mistake. 1) $-2(x - 4) = 5x - 10$ 2) $-2x - 8 = 5x - 10$ 3) $-7x - 8 = -10$ 4) $-7x = -2$ 5) $x = \frac{2}{7}$ Write the number of the equation that is not a correct simplification of the equation above it.
21	The reciprocal of n is 1 divided by n. What is the reciprocal of .27272727 . . . ?
22	The set F {3, 6, 9, 12, 15, 18, 21, 24, 27, 30} has ten unique elements. A subset of set F is defined as a set containing anywhere from zero to ten inclusive of the elements in set F. How many subsets of set F contain exactly eight elements?
23	If $a \nabla b = \lvert a^2 - b^2 \rvert$ then what is the value of $2 \nabla 7$?
24	Write the letter of the largest rational number in the following list: A) $\frac{10}{3}$ B) $\sqrt{10}$ C) π D) $\sqrt{12.25}$ E) $\frac{31}{9}$
25	Jesse walks exactly once around a rectangular pool with dimensions 12 feet by 8 feet. If Jesse always remains exactly 2 feet from the edge of the pool, what is the number of feet in the distance Jesse walks?

26	Twin primes are pairs of prime numbers that differ by two. For example, 29 and 31 are twin primes. If the mean of the smallest pair of single-digit twin primes is A and the mean of the largest pair of two-digit twin primes is B, what is B divided by A?
27	A t-shirt manufacturing company charges its customers $34 plus $2.50 per shirt. Write an equation in slope-intercept form (y = mx + b) to represent this situation. Use n for the number of t-shirts and C for the amount charged by the t-shirt company.
28	Two circular wheels are placed next to each other. Wheel A spins in a clockwise direction, wheel B spins in a counterclockwise direction, and points on the perimeters of the two wheels move at the same speed. The wheels' edges are sticky and a speck of dust on the edge of Wheel A and directly in line with segment AB will transfer to the edge of Wheel B when it reaches the point where the two wheels are closest to each other, and then back to the edge of Wheel A after making a complete rotation along the edge of Wheel B. The radius of Wheel A is 8 inches and the radius of Wheel B is 5 inches. During the time it takes Wheel A to spin two complete rotations, what is the ratio of the length of the dust speck's path on Wheel B to the length of its path on Wheel A? 
29	A square of side length 2 centimeters is divided into four 1 cm by 1 cm squares. The centers of each of these four smaller squares lie on the circumference of a circle as shown. What is the number of square centimeters in the area of the shaded region? 
30	Joel is walking at a rate of 1.5 meters per second on a 140-meter-long moving walkway. He is walking in the same direction that the walkway is moving. Jennifer is standing on the moving walkway and it takes her 40 seconds to go from one end of the walkway to the other. How many seconds does it take Joel to go from one end of the moving walkway to the other?

Challenge Questions

31	Given the equation: $y = 4(\frac{1}{2})^x$ What is the value of y when x = 6? Express your answer as a power of 2.
32	Bobby has twenty-one refrigerator magnets as shown, with a letter of the alphabet printed on each one. He wants to make the phrase RUBBER BABY BUGGY BUMPER. Bobby sets aside one R and three Bs to be the first letter of each word. He then randomly selects five letters. What is the probability that he selects the five letters needed to complete the first word of the phrase? A B B B B B B E E G G M P R R R U U U Y Y
33	Maggie lives 975 meters from school and Ming lives 425 meters from the same school. Ming's house is on Maggie's route to school. Maggie walks at a constant rate of 80 meters per minute and Ming walks at a constant rate of 50 meters per minute to school. If they both leave for school at the same time, after how many seconds will the two first be 20 meters apart from each other?
34	A cylindrical coffee mug has a radius of 2 inches and a height of 4 inches. When Fran pours herself a cup of coffee she likes to leave room for 2 cubic inches of cream. If, after pouring coffee and adding cream, her mug is exactly full to the rim, what is the quotient when the number of cubic inches of coffee in her mug is divided by the number of cubic inches of cream in her mug?

35	How many points are located between 2.5 and 10.5 on the given number line with coordinates of the form $\sqrt{a}$, where a is a positive integer? 
36	How many units are in the distance between the two lines with the equations y = 4x and y = 4x + 17?
37	Points A and B are both on the graph of the equation $y = \frac{24}{x}$. What is the slope of line AB if the x-coordinate of A is the smallest prime number and the x-coordinate of B is the largest negative even integer?
38	The sine ratio of angle ABC in right triangle ABC is defined as AC:AB. If AC:AB = 7:25, how many units are in the shortest possible integer length of BC? 
39	On a coordinate plane, Marcia puts dot #1 one unit directly to the right of the origin (0,0), then puts dot #2 two units directly above dot #1, then puts dot #3 three units directly to the left of dot #2, then puts dot #4 four units directly below dot #3. She continues this process so that dot n + 1 is always n + 1 units directly right, up, left or down of dot n. How many units are in the area of the circle whose diameter has dot #6 and dot #4 as endpoints? Answer as an improper fraction in terms of π. 
40	Equilateral ΔABC has side lengths of 10 inches. The midpoint of $\overline{AB}$ is M and the midpoint of $\overline{AC}$ is N. One diameter of circle L has endpoints at M and N. What is the length, in inches, of segment $\overline{CL}$? 

"Math is Cool" Championships – 2008-09

Sponsored by:

8th Grade – November 7, 2008

Individual Multiple Choice Contest

The first season of Mathland's MathBall League (the MML) has just wrapped up. Five teams (the Feynman Ferrets, the Descartes Dinos, the Poincare Parrots, the Brache Bats and the Godel Goats) each played a total of 80 games during the season. Below is a grid documenting the season. Teams' wins are read horizontally, their losses vertically. For example, the Feynman Ferrets won 9 and lost 1 against the Brache Bats. The second table shows each team's gender make-up.

Wins \ Losses	Feynman Ferrets	Descartes Dinos	Poincare Parrots	Brache Bats	Godel Goats
Feynman Ferrets		10	12	9	12
Descartes Dinos	0		30	30	5
Poincare Parrots	18	0		6	4
Brache Bats	1	0	4		18
Godel Goats	18	5	6	12	

	# of Girls	# of Boys
Feynman Ferrets	5	5
Descartes Dinos	6	4
Poincare Parrots	8	2
Brache Bats	2	8
Godel Goats	4	6

1	How many games did the Goats win during the season?				
	A) 28	B) 39	C) 41	D) 43	E) 65
2	What was the mean number of games won per team?				
	A) 40	B) 40.5	C) 41	D) 43	E) 50
3	Which team won the fewest number of games during the season?				
	A) Ferrets	B) Dinos	C) Parrots	D) Bats	E) Goats
4	How many more games throughout the season did girls win than boys, regardless of what team they played on?				
	A) 28	B) 58	C) 78	D) 100	E) Answer not given
5	In the first game of the season, the Bats defeated Ferrets. After the final game of their rivalry, ActionMathNews interviewed two players at random from the winning team. What is the probability that they were not both girls?				
	A) 44/45	B) 7/9	C) 28/45	D) 2/9	E) Answer not given

RESTATED: The first season of Mathland's MathBall League (the MML) has just wrapped up. Five teams (the Feynman Ferrets, the Descartes Dinos, the Poincare Parrots, the Brache Bats and the Godel Goats) each played a total of 80 games during the season. Below is a grid documenting the season. Teams' wins are read horizontally, their losses vertically. For example, the Feynman Ferrets won 9 and lost 1 against the Brache Bats. The second table shows each team's gender make-up.

Wins \ Losses	Feynman Ferrets	Descartes Dinos	Poincare Parrots	Brache Bats	Godel Goats
Feynman Ferrets		10	12	9	12
Descartes Dinos	0		30	30	5
Poincare Parrots	18	0		6	4
Brache Bats	1	0	4		18
Godel Goats	18	5	6	12	

	# of Girls	# of Boys
Feynman Ferrets	5	5
Descartes Dinos	6	4
Poincare Parrots	8	2
Brache Bats	2	8
Godel Goats	4	6

6	Following a game between the Parrots and the Goats, the teams met on the field to congratulate one another. Players on opposing teams gave each other high fives, each boy and each girl on the same team gave each other high fives, boys on the same team shook hands with each other, and girls on the same team shook hands with each other. How many more high fives were given than handshakes? A) 80 B) 85 C) 90 D) 95 E) Answer not given
7	Next season, the MML will standardize its season so each team still plays 80 games and will play each of the other teams exactly 20 times. If the ratio of wins and losses in games between the Ferrets and the Parrots is the same next season as it was this season, how many times will the Ferrets beat the Parrots? A) 8 B) 10 C) 12 D) 15 E) Answer not given
8	Sarah the Seer is a psychic and she believes she knows who will win the most games in the upcoming season. Without revealing the name she has given the following clues as to which team it will be: i) The team that won the most games this season will not win the most next season. ii) The team that will win the most games has the same number of letters in its mascot name as another team in the league. iii) The team that will win the most games has fewer letters in its mascot name than at least one other team. Which team does Sarah the Seer believe will win the most games? A) Ferrets B) Dinos C) Parrots D) Bats E) Goats
9	The gender make-up for the league is 25 girls and 25 boys. There is a new league rule that each team must have at least four boys and four girls. There are exactly ten players on each team. In how many ways can five teams be composed, such that each team has at least four boys and at least four girls? For this problem consider only differences in gender make-up of the team, and not differences among individuals. For example a team with boys Jim, John, Jack and Joe and girls Sarah, Sally, Sue, Sharon, Shelly and Shana is considered to have the same gender make-up as the team with boys Art, Andrew, Aaron and Alex and girls Mary, Marie, Molly, Missie, Mimi and Marion. A) 51 B) 243 C) 600 D) 2601 E) Answer not given

"Math is Cool" Championships – 2008-09

Sponsored by:

8th Grade – November 7, 2008

Team Contest

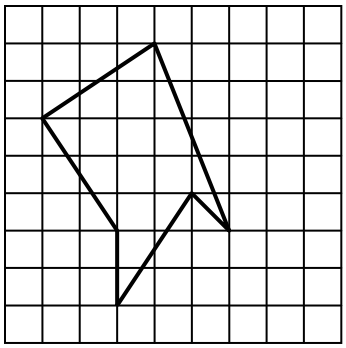
1	I count to 450 by 7s, starting with 9 ("9, 16, …", and so on). How many multiples of 14 will I say?
2	The probability that I forget to take my lunch to school on any given morning is one-eighth. The probability that I forget my lunch and miss the bus on any given morning is one-twentieth. If the two events are independent, what is the probability that I miss the bus on any given morning?
3	A square of area 144 square units has its width halved and its length increased by 5 units. By how many square units does its area increase? (If the area decreases, your answer will be negative.)
4	Using the numbers 1, 2, 3, 4, 5, 6, 7, and 8 exactly once each, a set of 4 fractions can be created (eg, $\frac{1}{2},\frac{3}{4},\frac{5}{6},\frac{7}{8}$). How many distinct sets of 4 fractions can you create using these numbers such that all fractions are reduced and no fraction is greater than 1? (Two sets are distinct if any of their members are different, but not if only the order of listing their members is different.)
5	Find $\frac{b}{a}@\left(a@b\right)$, given that $a=\frac{b}{3}$, $b=6$, and $x@y=y^{x-1}-xy$.
6	Two points are randomly placed on a circle with circumference 12π. What is the probability that the distance between the points is less than 6 units?
7	The three angles of triangle ABC are in the ratio $A:B:C=3:4:5$. Let $\underline{A}$, $\underline{B}$, and $\underline{C}$ indicate the complements of angles A, B, and C respectively. What is the ratio of $\underline{A}:\underline{B}:\underline{C}$? Give your answer in simplest colon form, as shown.
8	Two dice are rolled and a 2-digit positive integer is created using the number showing on the first die as the tens digit and the number showing on the second die as the units digit. What is the probability that this number is divisible by 4 but not by 3?
9	Roger wrote a counting number that has all its digits different. The median value of its digits is 4. If 56 times the smallest digit is equal to 14 times the largest digit, find the positive difference between the largest and smallest possible numbers that Roger could have written.
10	The slope of line ℓ is undefined. Line m is perpendicular to line ℓ. Line m is rotated 45° clockwise to form the image line m'. What is the slope of the image line m'?

"Math is Cool" Championships – 2008-09

Sponsored by:

8th Grade – November 7, 2008

Pressure Round Contest

1	Let $A = n \cdot n$, $B = 10n + n$, $C = n!$, $D = n + n$, and $E = n^n$. What is the smallest positive integer value of n for which the correct order of these values, when listed from smallest to largest, is DABCE? (If two or more values are tied, they may be listed in any order.)
2	Chords are drawn in a circle so as to divide the circle into 79 regions, not necessarily equal in area. What is the minimum number of chords that must be drawn?
3	A calendar page for the month of June of a certain year is laid out as usual as a grid of squares, with each row representing a 7-day week. The first column is Sunday. Three 2 by 2 square blocks of dates are chosen from this calendar, and the 4 numbers in each block are added. The three sums are 80, 100, and 56, respectively. What is the earliest possible date for the last Sunday in this month?
4	What is the number of square units in the area of the hexagon shown? Answer as a mixed number. 
5	Two standard dice are rolled. One is red and one is white. The white die has a prime number showing on top. What is the probability that the number showing on top of the red die is larger than the number showing on top of the white die?

"Math is Cool" Championships – 2008-09

Sponsored by:

8th Grade – November 7, 2008

Mental Math Contest

PERSON 1		
1.1	During the summer Melanie listens to her Ipod 40 percent of the time that she is up and out of bed. Melanie went to bed at 3:00 am and got up at noon on each of the sixty-two days of July and August. How many hours did she listen to her Ipod?	372 [hours]
1.2	How many composite integers from ten to thirty have digits that are both prime?	3
1.3	June hikes to the top of a hill in the shape of a hemisphere. The circumference of the base of the hill is 8000 pi feet. What is the altitude at the top of the hill if the base is at sea level?	4000 [feet]
1.4	What is the least common multiple of 1, 2, 3, 4 and 5?	60
PERSON 2		
2.1	It takes six workers twelve hours to paint a warehouse. How many hours would it take eight workers to paint the same warehouse?	9 [hours]
2.2	Circle P has a radius of 5 centimeters. What is the ratio of the circumference of circle P to the area of circle P? Answer as a common fraction.	2/5
2.3	Jerome runs at a pace of 5 meters per second. Benny starts at the same time and place and runs in the same direction as Jerome. Benny runs at a pace of 5.2 meters per second. How many meters behind Benny will Jerome be after 4 minutes?	48 [meters]
2.4	What is the sum in centimeters of the lengths of the three longest diagonals of a regular hexagon with sides of length 9 centimeters?	54 [cm]
PERSON 3		
3.1	A trapezoid has an area of 30 square inches. The sum of the lengths of the two parallel edges is 40 inches. What is the number of inches in the height of the trapezoid? Answer as a decimal.	1.5 [inches]
3.2	Betty is facing north. She turns to her right 90 degrees three times. What direction is she facing?	West
3.3	What is the product of the first four positive integers that can be written as the sum of two consecutive integers?	105
3.4	The second number in an arithmetic sequence is 8 and the sixth number is 28. What is the ninth number in this sequence?	43
PERSON 4		
4.1	A rectangular drawing is photocopied at the 70 percent setting. This means that the length and width of the drawing in the photocopy are 70 percent of the length and width of the original. By what percentage is the area of the original drawing reduced?	51 [percent]
4.2	What is the number of inches in the perimeter of a square whose diagonal measures 3 times the square root of 2 inches?	12 [inches]
4.3	What is the largest three-digit integer whose digits are all prime numbers?	777
4.4	What is the fifth largest positive factor of 36?	6

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #1 – SET A

#	Problem	Answer
1	My iPod has five songs that start with an A, eight songs that start with a Z, twenty-two songs that start with a C, and fifteen songs that start with an K. What is the probability of randomly choosing a song that starts with a Z?	4/25
2	Evaluate eighteen factorial divided by the quantity twenty factorial divided by nineteen.	1/20
3	Amy can eat a cantaloupe in six minutes. Alice can eat a cantaloupe in eighteen minutes. Alberta can eat a cantaloupe in twelve minutes. If they all eat together, how many minutes will it take them to eat thirty-three cantaloupes?	108 [minutes]
4	Miya is five feet five inches tall and stands one-hundred twenty-one inches away from a streetlight that is ten feet tall. How tall is Miya's shadow, in feet and inches?	11 feet 11inches
5	Randy watches while Trevor builds a dam. Randy notices that for every rock Trevor adds, the current slows five centimeters per second. For every log Trevor adds, the current slows thirteen centimeters per second. After building the dam, the river is slowed by one point six one meters per second and twenty-one logs and rocks were used by Trevor. How many logs did Trevor use?	7 [logs]
6	Convert one two six one base seven to base eight.	Seven four four [base 8]
7	In the game of blackjack an ace and a face card add up to a winning score of twenty-one. If I deal myself an ace on the first card, what is the probability that I'll get a face card with the second card from the deck?	$\frac{4}{17}$
	Extra Problem – Only if Needed	
8	Evaluate one factorial divided by zero factorial.	1

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #2- SET A

#	Problem	Answer
1	Matt is making cookies. For dry ingredients he uses four cups of flour, one pint of sugar, and one-fourth of a quart of chocolate chips. How many gallons of dry ingredients does he use?	7/16 [gallons]
2	Harry and Cedric are racing. If Harry has a ten second head start and flies at eight meters per second, and Cedric flies at eleven meters per second. How many meters from the finish line Cedric catch Harry if the course is three hundred meters?	20/3 [meters]
3	I catch seventy-two fish, tag them, and return them to the pond. If I then catch fifty fish and three of them are tagged, how many fish are in the pond?	1200 [fish]
4	What is the positive difference between the probability of drawing the ace of spades from a standard deck of cards and drawing the ace of hearts from the same deck once the ace of spades has been removed from the deck?	$\frac{1}{2652}$
5	A cow is tethered by thirty-six foot rope on the corner of a fifty by fifty foot building. What is the maximum area, in square feet, that the cow can roam?	972 pi [square feet]
6	I buy a shirt that is on sale at sixty percent off. I pay thirty-four dollars and fifty-six cents for the shirt which includes eight percent sales tax. What was the original price of the shirt, in dollars?	80 [dollars]
7	On a coordinate plane, the point negative three comma five is reflected over the line with the equation y equals negative one half x plus one. What are the coordinates of the reflected point?	(-5, 1)
	Extra Problem – Only if Needed	
8	What is the smallest positive integer with exactly eight positive factors?	24

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #3- SET A

#	Problem	Answer
1	Find the eighth term in the geometric sequence: one, two , four, and so on.	128
2	Find x if four raised to the quantity two x plus three is equal to thirty-two raised to the quantity two x minus six.	6
3	Tricia and Tom run towards each other. Tricia runs at five meters per second, and Tom runs at six meters per second. They start one-hundred fifty-four meters apart. In how many seconds will they run into each other?	14 [seconds]
4	Given that you have a red card in your hand, what is the probability that it is not a face card?	10/13
5	Helen buys a cup of one-hundred percent concentration coffee. How many ounces of water must she add to the coffee to dilute it by sixty percent?	16/3 [ounces]
6	What is the volume of a cone with slant height twenty point five centimeters and radius four point five centimeters? Give your answer in cubic centimeters.	135 pi [cubic centimeters]
7	If Amanda needs to choose a lieutenant, captain, and a colonel out of ten people, how many permutations are there?	720 [permutations]
	Extra Problem – Only if Needed	
8	Three vertices of a parallelogram are located on a coordinate plane at one comma four, negative two comma four, and zero comma one. Give all possible sets of coordinates for the fourth vertex.	(-1,7) (-3,1) (3,1) All three required

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #1 - SET B

#	Problem	Answer
1	Edward the Vampire enjoys eating mountain lions. Edward runs at a constant speed of twenty meters per second and a mountain lion can run away at eight meters per second. Edward spots a mountain lion one kilometer away and they both begin to run at the same time. How long in seconds does it take Edward to catch the mountain lion, as a mixed number?	83 1/3 [seconds]
2	Bella is going to prom with Edward and must choose a dress and a shawl. If she has three-hundred one dresses and two-hundred ninety-nine shawls to choose from, how many outfit combinations are there?	89999 [outfits]
3	The probability that Edward bites Bella is twelve over forty-nine. The probability that Jasper bites Bella is four over eleven. What is the probability that Edward bites Bella and Jasper does not?	12/77
4	An outdoor sculpture is in the shape of a regular tetrahedron with edge length fifteen feet. If you disregard the base, what is the number of square feet in the surface area of the sculpture?	$\frac{675\sqrt{3}}{4}$ [square feet]
5	Alice is making a bracelet for Bella's birthday using seven different beads. How many different bracelets can she make?	360 [bracelets]
6	A circle with radius five units is drawn on a coordinate plane with its center at the origin. How many points lie inside the circle whose coordinates are both even integers?	21 [points]
7	What is the positive difference between the sum of the first nineteen positive odd integers and the sum of the first eighteen positive even integers?	19
	Extra Problem – Only if Needed	
8	Rosalie is diluting twenty milliliters of one-hundred percent anti-freeze for her Ferrari. How many milliliters of water should Rosalie add to make a seventy-five percent solution?	20/3 [milliliters]

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #2- SET B

#	Problem	Answer
1	What is the smallest prime number greater than three-hundred?	307
2	If two to the quantity three x minus four is equal to eight to the quantity four x plus two, what is the value of x?	-10/9
3	An irregular pentagon has angle measures of one-hundred twenty, x plus twenty, two x minus fifty, three x plus forty, and eighty degrees. What is the value of the smallest angle, in degrees?	60 [degrees]
4	What is the probability of getting three heads when you flip five coins?	5/16
5	A triangle has points at one comma two, five comma negative three, and negative three comma negative one. What is the area of the triangle?	16
6	Thomas and Izzie are walking towards each other, Thomas at one meter per second and Izzie at one and a half meters per second. A bunny starts at Izzie and hops between the two at a constant rate of three meters per second. If Thomas and Izzie are thirty meters apart, how many total meters has the bunny traveled before the two collide?	36 [meters]
7	Twenty-seven cookies are to be distributed among three people. If each person must receive at least one cookie, how many ways can the cookies be distributed?	325 [ways]
	Extra Problem – Only if Needed	
8	If the ratio of side lengths of two pentagons is seven to nine, what is the ratio of their areas?	49/81

"Math is Cool" Championships – 2008-09

Sponsored by:

7th & 8th Grade – November 7, 2008

COLLEGE KNOWLEDGE BOWL ROUND #3- SET B

#	Problem	Answer
1	My soup can has a radius of five centimeters and a height of point two meters. If I want to make a label for the soup can, what is the perimeter of the label, in centimeters?	20pi + 40
2	The first three numbers of a geometric series are twenty-seven, nine, and three. What is the seventh term of the sequence?	1/27
3	I deposit one-hundred dollars into a bank account and receive interest at a rate of three percent annually. How much money do I have after two years?	$106.09
4	I give half of my jelly beans to Joe and one fifth of the remaining to Erica. They each give me two jelly beans back. If I now have sixteen jelly beans, how many did I have originally?	30 [jelly beans]
5	What is the probability of drawing a red card and then drawing the ace of spades from a standard deck of cards, without replacement?	1/102
6	A concave polygon has at least one interior angle that is greater than one hundred eighty degrees. What is the maximum number of diagonals that can be drawn in a concave hexagon?	8 [diagonals]
7	Jenny runs a three mile race at an average rate of eight miles per hour. To the nearest tenth of a minute, how many minutes does it take her to complete the race?	22.5 [minutes]
	Extra Problem – Only if Needed	
8	Twin primes are pairs of consecutive prime numbers that differ by two. There are an infinite number of twin primes. Between one and one hundred, how many pairs of consecutive prime numbers differ by three?	0

"Math is Cool" Championships – 2008-09

Algebra 1 – November 7, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:

KEY

First Score

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	29 [dots]		
2	41,976		
3	35 [quarters]		
4	1		
5	1944		
6	3 [digits]		
7	54 [minutes]		
8	4 [grid squares]		
9	450 [integers]		
10	9/40		
11	2 [units]		
12	12		
13	3 [rotations]		
14	3/8		
15	$126^{[\circ]}$		
16	2		
17	11/3		
18	45		
19	D		
20	$2\sqrt{3}$		

	Answer	1 or 0	1 or 0
21	$40 + 4\pi$ [feet]		
22	12 [pairs]		
23	$8\pi - 1$		
24	$C = 2.50n + 34$ or $C = 34 + 2.50n$		
25	45 [subsets]		
26	1020 [seconds]		
27	$\frac{8-\pi}{2}$ [cm^2] or $4 - \frac{\pi}{2}$ [cm^2]		
28	300 [ways]		
29	(x + 2)(x + 5) [any order]		
30	28 [seconds]		
31	9/1547		
32	$\sqrt{17}$ [units]		
33	[y =] 2^{-4}		
34	2865/4 [seconds]		
35	104 [points]		
36	5/11		
37	6		
38	1 [unit]		
39	$61\pi/4$ [$units^2$]		
40	$\frac{5\sqrt{7}}{2}$ [inches]		

"Math is Cool" Championships – 2008-09

Geometry – November 7, 2008

Final Score:

KEY

First Score

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1	35 [quarters]		
2	0		
3	Right		
4	1		
5	1944		
6	Joanna		
7	3 [digits]		
8	54 [minutes]		
9	300 [ways]		
10	$(x + 2)(x + 5)$ [any order]		
11	12 [integers]		
12	67599		
13	29		
14	9/40		
15	2 [units]		
16	12		
17	3 [rotations]		
18	3/8		
19	$126^{[\circ]}$		
20	2		

	Answer	1 or 0	1 or 0
21	11/3		
22	45 [subsets]		
23	45		
24	D		
25	$40 + 4\pi$ [feet]		
26	18		
27	$C = 2.50n + 34$ or $C = 34 + 2.50n$		
28	5/11		
29	$\frac{8 - \pi}{2}$ [cm^2] or $4 - \frac{\pi}{2}$ [cm^2]		
30	28 [seconds]		
31	[y =] 2^{-4}		
32	9/1547		
33	2865/4 [seconds]		
34	$8\pi - 1$		
35	104 [points]		
36	$\sqrt{17}$ [units]		
37	6		
38	1 [unit]		
39	$61\pi/4$[$units^2$]		
40	$\frac{5\sqrt{7}}{2}$ [inches]		

"Math is Cool" Championships – 2008-09

8th Grade – November 7, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Final Score:
KEY

First Score

(out of 18)

INDIVIDUAL MULTIPLE CHOICE - 15 minutes

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	C		
2	A		
3	D		
4	C		
5	A		
6	C		
7	A		
8	E		
9	A		

"Math is Cool" Championships – 2008-09

8th Grade – November 7, 2008

Final Score:
KEY

First Score

(out of 20)

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Team Contest – Score Sheet

TEAM TEST - 15 minutes

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 ***2 or 0****. Record all answers on the colored answer sheet.*

DO NOT WRITE IN SHADED REGIONS

	Answer	2 or 0	2 or 0
1	0 [multiples]		
2	2/5		
3	-42 [sq units]		
4	18 [sets]		
5	54		
6	1/3		
7	3:2:1		
8	1/6		
9	87184		
10	-1		

"Math is Cool" Championships – 2008-09

8th Grade – November 7, 2008

Final Score:
KEY

First Score

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

PRESSURE ROUND - 10 minutes

When it is time to begin, you will be handed a packet of questions. There is a copy of the questions for each team member. Two minutes after the start of the test you are expected to submit an answer for one of the questions (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 questions; its maximum value is two points. This process will continue until all the questions are answered and each consecutive question'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 question 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.

Pressure Round Answers

	Answer
1	[n=] 5
2	12 [chords]
3	[June] 26[th]
4	$14\frac{1}{2}$ [square units]
5	4/9