"Math is Cool" Masters – 2007-08

Sponsored by:

Pre-Algebra – January 26, 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.*
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- *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.*
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- *Do not round any answers unless stated otherwise.*
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- *Blank answer sheets and answer sheets with no name will also be scored as a 0.*

INDIVIDUAL TEST - 35 minutes

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"Math is Cool" Masters – 2007-08

Sponsored by:

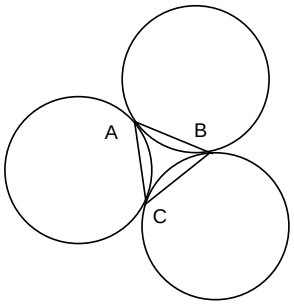
Pre-Algebra – January 26, 2008

Individual Contest

1	What is the product of the digit in the tens place and the digit in the thousandths place in the following number? 572.31604
2	What is the largest two-digit integer that is a multiple of 17?
3	Evaluate: $2.5^2 - 7.5 + 1.5^2$
4	What is the area, in square feet, of a circle with diameter 8ft?
5	What is the perimeter in feet of a right triangle with a leg of length 18 feet and a hypotenuse of length 30 feet?
6	Joe wants to purchase a pair of binoculars. The cost of the binoculars is $30.00 plus sales tax of 8%. How much, in dollars, will he need to pay in total to purchase the binoculars?
7	Evaluate: 29 x 31
8	$\frac{27}{29}$ is P times as large as $\frac{3}{29}$. What is the value of P?
9	Evaluate: $\sqrt{7^2 + 24^2}$
10	Evaluate $1_8 + 1_5$ and express the result in base 2.
11	Evaluate: 32.5 ÷ 0.25
12	What is the circumference, in inches, of a circle with radius 7 inches?
13	Evaluate: $3^3 - 2^3$
14	Michael walks 15 blocks due northeast from his home. Then he turns and walks 8 blocks due southwest. At this point, how many blocks from his home is he?
15	Patti likes to spin in circles until she gets dizzy, at which point she stops. If she spins 16 times per minute and it takes her $3\frac{1}{2}$ minutes to get dizzy, how many times will she spin in a circle?
16	Find the median of the mean and the mode of the following data set: {2, 3, 5, 5, 3, 4, 5, 3, 2, 3}. If your answer is not an integer, give it as a decimal.
17	Twelve chips are numbered 1 through 12. Six chips are removed from the set. What is the largest possible odd product that could be obtained by multiplying the remaining six numbers together?

18	The National Mathematics Monument draws 8.3×10^5 visitors per year. On average, how many <u>thousand</u> visitors come to the monument each day? Give your answer as a decimal rounded to the nearest tenth.
19	It takes 5 friends three hours to set up chairs for a concert by their favorite garage band, Box of Frogs. How many hours would it take if 6 friends, working at the same rate, set up the chairs?
20	If x is subtracted from y + 19, the result is 5. What is the result when x is subtracted from y?
21	What is the quotient of the third smallest positive integer multiple of ten and the third smallest prime number?
22	AJ averages exactly 12 points per game for the first five games of the season. How many points per game must he average over the next ten games in order for his overall average to round to 10 points per game?
23	How many distinct two-letter arrangements can be formed with the letters from the word 'BANANA'?
24	Brittney gives Bethany half of her jelly beans. In turn, Bethany gives Melanie half of the jelly beans she received from Brittney. Finally, Melanie gives Bella half of the jelly beans she received from Bethany. If Bella receives 9 jelly beans, how many did Brittney start with?
25	An example of a mixed metaphor is "That's like pulling needles". It's a mixture of "That's like pulling teeth" and "That's like looking for a needle in a haystack". A second mixture of these two metaphors would be, "That's like looking for teeth in a haystack". If Georg has 9 metaphors to draw from in his working vocabulary, how many mixed metaphors can he create? Assume any mixed metaphor only mixes two metaphors and that any pair of metaphors can be combined to form a mixed metaphor in two distinct ways.
26	Evaluate for m if $m = 2n^3$ and $n = -5$.
27	The product of the mth prime number and the nth prime number is 221. What is the sum of m + n?
28	Paula wants to have a barbecue in her backyard. She randomly selects a Saturday or Sunday in August to have the barbecue. If August 1^{st} is on a Thursday, what is the probability that the date (day of the month) she selects will be a prime number?
29	On Monday morning, Elmo is at the bottom of a pit that is 100 feet deep. When he begins to climb out he has a lot of energy, so he is able to climb up 30 feet the first day. With each passing day, however, his energy wanes, so on day two he only climbs 27 feet, on day three he climbs 24 feet, and so on, climbing 3 feet less each day. Every night he slides back down 5 feet. On what day of the week will Elmo climb out of the pit?

Challenge Questions

30	Three circles with radius 8 cm are externally tangent at points A, B and C as shown. What is the number of centimeters in the perimeter of triangle ABC? 
31	In a geometric sequence, each term is multiplied by a constant factor to get the next term of the sequence. In a geometric sequence with the first term 640 and constant factor $\frac{1}{4}$, what is the value of the largest term that is not an integer?
32	Some prime numbers can be generated by replacing n in the formula, $n^2 + n + 11$, with integers. For example, by replacing n with 3, the prime number 23 is generated. What is the smallest positive value of n for which the formula does not generate a prime number?
33	How many distinct data sets of five positive integers have a mean of 3 and a median of 3?
34	A penny, a nickel, a dime, and a quarter are arranged around the edge of a circular turntable. In how many ways can the coins be arranged if we are concerned only with the order of the coins and whether each coin is heads-up or tails-up?
35	A positive two-digit integer "*a*" has its digits reversed to form a new positive two-digit integer "*b*". The integer "*b*" is then doubled to form a positive two-digit integer "*c*". If "*c*" is 41 greater than "*a*", what is "*a*"?
36	Two complementary angles are in the ratio three to seven. What is the number of degrees in the supplement of the larger angle?
37	Tom, Triscia and Annie are competing in the final round of "The Math is Cool 500". It has been calculated that the probability of Tom, Triscia and Annie winning is 2/5, 3/10 and 3/10 respectively. Annie had to pull out of the final round due to unforeseen circumstances. Now, what is the probability of Triscia winning?
38	Katie has a box of eight assorted chocolates, only one of which has an orange center. She flips a coin. If it lands heads up, she eats two chocolates. Otherwise, she eats one chocolate. If she chooses the chocolates at random, what is the probability that she will eat the chocolate with the orange center?
39	A 20 foot ladder is leaning against a wall of a house so that the top and bottom of the ladder are both an integer number of feet from the base of the wall. The top of the ladder slides down by an integer number of feet and the base of the ladder slides away from the house by the same integer number of feet. How many feet are in the distance from the top of the ladder to the ground after this process?
40	How many distinct right triangles can be drawn such that all three vertices are dots on the "grid" provided (which is missing two corner dots)? . . . .

"Math is Cool" Masters – 2007-08

Pre-Algebra – January 26, 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	42		
2	85		
3	1 or 1.0		
4	16π [sq ft]		
5	72 [ft]		
6	[$] 32.40		
7	899		
8	9		
9	25		
10	$10_{[2]}$		
11	130		
12	14π [in]		
13	19		
14	7 [blocks]		
15	56 [times]		
16	3.25		
17	10395		
18	2.3 [thou visitors]		
19	5/2 [hrs]		
20	-14		

	Answer	1 or 0	1 or 0
21	6		
22	9 [points]		
23	8		
24	72 [jelly beans]		
25	72 [mixed metaphors]		
26	-250		
27	13		
28	4/9		
29	Friday		
30	24 [cm]		
31	5/2		
32	10		
33	11		
34	96 [ways]		
35	23		
36	$117^{[\circ]}$		
37	3/7		
38	3/16		
39	12 [ft]		
40	54 [triangles]		

"Math is Cool" Masters – 2007-08

Pre-Algebra – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:

First Score

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
1			
2			
3			
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	Answer	1 or 0	1 or 0
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"Math is Cool" Masters – 2007-08

Sponsored by:

Algebra I – January 26, 2008

Individual Contest

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Algebra I – January 26, 2008

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3	What is the area, in square feet, of a circle with diameter 8ft?
4	What is the perimeter in feet of a right triangle with a leg of length 18 feet and a hypotenuse of length 30 feet?
5	Joe wants to purchase a pair of binoculars. The cost of the binoculars is $30.00 plus sales tax of 8%. How much, in dollars, will he need to pay in total to purchase the binoculars?
6	What is the number of degrees in the obtuse angle of triangle ABC, if the measure of angle A is 37° and the measure of angle B is 25°?
7	If takes Jennifer 6 hours to paint a room. It takes her little brother Ike 8 hours to paint the same room. In one hour, how much more can Jennifer paint than Ike can paint, expressed as a fraction of the room?
8	What is the circumference, in inches, of a circle with radius 7 inches?
9	Evaluate: $3^3 - 2^3$
10	Michael walks 15 blocks due northeast from his home. Then he turns and walks 8 blocks due southwest. At this point, how many blocks from his home is he?
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16	If x is subtracted from y + 19, the result is 5. What is the result when x is subtracted from y?
17	A sphere with radius 8 inches is internally tangent to a sphere with radius 10 inches at point A. A third sphere with radius 6 inches is internally tangent to the sphere with radius 8 inches also at point A. How many inches are between the center of the sphere with radius 10 inches and the center of the sphere with radius 6 inches?
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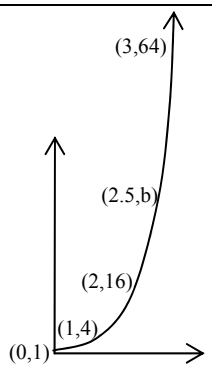
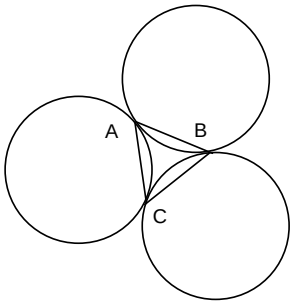
24	Paula wants to have a barbecue in her backyard. She randomly selects a Saturday or Sunday in August to have the barbecue. If August 1st is on a Thursday, what is the probability that the date (day of the month) she selects will be a prime number?
25	What are two numbers that can be substituted for x in the following expression such that the value of the expression is 10? $6x^2 + 17x - 4$
26	On Monday morning, Elmo is at the bottom of a pit that is 100 feet deep. When he begins to climb out he has a lot of energy, so he is able to climb up 30 feet the first day. With each passing day, however, his energy wanes, so on day two he only climbs 27 feet, on day three he climbs 24 feet, and so on, climbing 3 feet less each day. Every night he slides back down 5 feet. On what day of the week will Elmo climb out of the pit?
27	$\sqrt{24}$ is an irrational number because it cannot be expressed as the quotient of two integers. Multiplying by $\sqrt{2}$, also an irrational number, results in another irrational number, $\sqrt{48}$. What is the smallest irrational number of the form $a\sqrt{b}$, where a and b are positive integers, such that when multiplied by $\sqrt{24}$, the result is a rational number?

28	The graph shown represents an exponential function. What is the value of b? 
29	Three circles with radius 8 cm are externally tangent at points A, B and C as shown. What is the number of centimeters in the perimeter of triangle ABC? 

Challenge Questions

30	An ant walks along the edges of a piece of cheese in the shape of a regular tetrahedron so that it walks the entire length of each edge at least once. If the total surface area of the cheese is $25\sqrt{3}$ square inches, what is the minimum possible distance, in inches, that the ant can walk?
31	In a geometric sequence, each term is multiplied by a constant factor to get the next term of the sequence. In a geometric sequence with the first term 640 and constant factor $\frac{1}{4}$, what is the value of the largest term that is not an integer?
32	Some prime numbers can be generated by replacing n in the formula, $n^2 + n + 11$, with integers. For example, by replacing n with 3, the prime number 23 is generated. What is the smallest positive value of n for which the formula does not generate a prime number?
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35	A positive two-digit integer "*a*" has its digits reversed to form a new positive two-digit integer "*b*". The integer "*b*" is then doubled to form a positive two-digit integer "*c*". If "*c*" is 41 greater than "*a*", what is "*a*"?
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39	A 20 foot ladder is leaning against a wall of a house so that the top and bottom of the ladder are both an integer number of feet from the base of the wall. The top of the ladder slides down by an integer number of feet and the base of the ladder slides away from the house by the same integer number of feet. How many feet are in the distance from the top of the ladder to the ground after this process?
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"Math is Cool" Masters – 2007-08

Algebra I – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:

KEY

First Score

STUDENT NAME_____

Individual Contest – Score Sheet

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	Answer	1 or 0	1 or 0
1	42		
2	1 or 1.0		
3	16 π [sq ft]		
4	72 [ft]		
5	[$] 32.40		
6	$118^{[o]}$		
7	1/24		
8	14π [in]		
9	19		
10	7 [blocks]		
11	56 [times]		
12	3.25		
13	10395		
14	2.3 [thou visitors]		
15	5/2 [hrs]		
16	-14		
17	4 [in]		
18	9 [points]		
19	8		
20	72 [jelly beans]		

	Answer	1 or 0	1 or 0
21	72 [mixed metaphors]		
22	-250		
23	13		
24	4/9		
25	2/3 and -7/2		
26	Friday		
27	$\sqrt{6}$ or $1\sqrt{6}$		
28	32		
29	24 [cm]		
30	35 [in]		
31	5/2		
32	10		
33	11		
34	96 [ways]		
35	23		
36	$117^{[°]}$		
37	3/7		
38	3/16		
39	12 [ft]		
40	54 [triangles]		

"Math is Cool" Masters – 2007-08

Final Score:

First Score

Algebra I – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

STUDENT NAME_____

Individual Contest – Score Sheet

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	Answer	1 or 0	1 or 0
1			
2			
3			
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	Answer	1 or 0	1 or 0
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"Math is Cool" Masters – 2007-08

Sponsored by:

Geometry – January 26, 2008

Individual Contest

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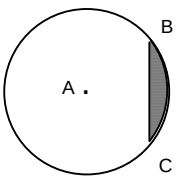
"Math is Cool" Masters – 2007-08

Sponsored by:

Geometry – January 26, 2008

Individual Contest

1	What is the ratio of π to π^3, expressed as a fraction?
2	What is the perimeter in feet of a right triangle with a leg of length 18 feet and a hypotenuse of length 30 feet?
3	Joe wants to purchase a pair of binoculars. The cost of the binoculars is $30.00 plus sales tax of 8%. How much, in dollars, will he need to pay in total to purchase the binoculars?
4	$\frac{27}{29}$ is P times as large as $\frac{3}{29}$. What is the value of P?
5	If takes Jennifer 6 hours to paint a room. It takes her little brother Ike 8 hours to paint the same room. In one hour, how much more can Jennifer paint than Ike can paint, expressed as a fraction of the room?
6	Evaluate $1_8 + 1_5$ and express the result in base 2.
7	What is the circumference, in inches, of a circle with radius 7 inches?
8	Michael walks 15 blocks due northeast from his home. Then he turns and walks 8 blocks due southwest. At this point, how many blocks from his home is he?
9	Patti likes to spin in circles until she gets dizzy, at which point she stops. If she spins 16 times per minute and it takes her $3\frac{1}{2}$ minutes to get dizzy, how many times will she spin in a circle?
10	Alice, Betty, Clara, Donna, and Edith sit in a row of five seats, numbered 1 through 5. How many ways could they be arranged if Alice and Betty sit in odd-numbered seats?
11	What is the quotient of the third smallest positive integer multiple of ten and the third smallest prime number?
12	Circle A has a radius of 6 feet. The length of BC is $6\sqrt{2}$ feet. What is the number of square feet in the area of the shaded region? 
13	Twelve chips are numbered 1 through 12. Six chips are removed from the set. What is the largest possible odd product that could be obtained by multiplying the remaining six numbers together?

14	Isosceles trapezoid ABCD has parallel sides $\overline{AB}$ and $\overline{CD}$. If AB = 15 centimeters and CD = 9 centimeters and its height is 16 centimeters, how many centimeters are in the length of diagonal $\overline{AC}$?
15	It takes 5 friends three hours to set up chairs for a concert by their favorite garage band, Box of Frogs. How many hours would it take if 6 friends, working at the same rate, set up the chairs?
16	If x is subtracted from y + 19, the result is 5. What is the result when x is subtracted from y?
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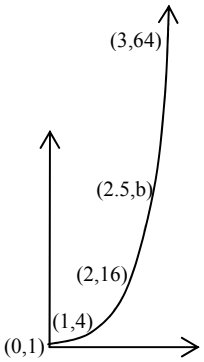
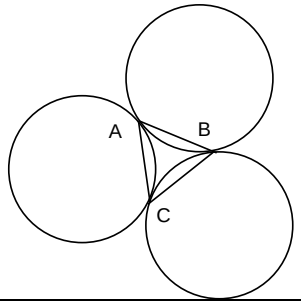
23	The product of the mth prime number and the nth prime number is 221. What is the sum of m + n?
24	Paula wants to have a barbecue in her backyard. She randomly selects a Saturday or Sunday in August to have the barbecue. If August 1st is on a Thursday, what is the probability that the date (day of the month) she selects will be a prime number?
25	What are two numbers that can be substituted for x in the following expression such that the value of the expression is 10? $6x^2 + 17x - 4$
26	On Monday morning, Elmo is at the bottom of a pit that is 100 feet deep. When he begins to climb out he has a lot of energy, so he is able to climb up 30 feet the first day. With each passing day, however, his energy wanes, so on day two he only climbs 27 feet, on day three he climbs 24 feet, and so on, climbing 3 feet less each day. Every night he slides back down 5 feet. On what day of the week will Elmo climb out of the pit?

27	$\sqrt{24}$ is an irrational number because it cannot be expressed as the quotient of two integers. Multiplying by $\sqrt{2}$, also an irrational number, results in another irrational number, $\sqrt{48}$. What is the smallest irrational number of the form $a\sqrt{b}$, where a and b are positive integers, such that when multiplied by $\sqrt{24}$, the result is a rational number?
28	The graph shown represents an exponential function. What is the value of b? 
29	Three circles with radius 8 cm are externally tangent at points A, B and C as shown. What is the number of centimeters in the perimeter of triangle ABC? 

Challenge Questions

30	An ant walks along the edges of a piece of cheese in the shape of a regular tetrahedron so that it walks the entire length of each edge at least once. If the total surface area of the cheese is $25\sqrt{3}$ square inches, what is the minimum possible distance, in inches, that the ant can walk?
31	In a geometric sequence, each term is multiplied by a constant factor to get the next term of the sequence. In a geometric sequence with the first term 640 and constant factor $\frac{1}{4}$, what is the value of the largest term that is not an integer?
32	Some prime numbers can be generated by replacing n in the formula, $n^2 + n + 11$, with integers. For example, by replacing n with 3, the prime number 23 is generated. What is the smallest positive value of n for which the formula does not generate a prime number?
33	How many distinct data sets of five positive integers have a mean of 3 and a median of 3?
34	A penny, a nickel, a dime, and a quarter are arranged around the edge of a circular turntable. In how many ways can the coins be arranged if we are concerned only with the order of the coins and whether each coin is heads-up or tails-up?
35	A positive two-digit integer "*a*" has its digits reversed to form a new positive two-digit integer "*b*". The integer "*b*" is then doubled to form a positive two-digit integer "*c*". If "*c*" is 41 greater than "*a*", what is "*a*"?
36	Two complementary angles are in the ratio three to seven. What is the number of degrees in the supplement of the larger angle?
37	Tom, Triscia and Annie are competing in the final round of "The Math is Cool 500". It has been calculated that the probability of Tom, Triscia and Annie winning is 2/5, 3/10 and 3/10 respectively. Annie had to pull out of the final round due to unforeseen circumstances. Now, what is the probability of Triscia winning?
38	Katie has a box of eight assorted chocolates, only one of which has an orange center. She flips a coin. If it lands heads up, she eats two chocolates. Otherwise, she eats one chocolate. If she chooses the chocolates at random, what is the probability that she will eat the chocolate with the orange center?
39	A 20 foot ladder is leaning against a wall of a house so that the top and bottom of the ladder are both an integer number of feet from the base of the wall. The top of the ladder slides down by an integer number of feet and the base of the ladder slides away from the house by the same integer number of feet. How many feet are in the distance from the top of the ladder to the ground after this process?
40	How many distinct right triangles can be drawn such that all three vertices are dots on the "grid" provided (which is missing two corner dots)? . . . .

"Math is Cool" Masters – 2007-08

Geometry – January 26, 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	$\frac{1}{\pi^2}$		
2	72 [ft]		
3	[$] 32.40		
4	9		
5	1/24		
6	$10_{[2]}$		
7	14π [in]		
8	7 [blocks]		
9	56 [times]		
10	36 [ways]		
11	6		
12	$9\pi - 18$ [sq ft]		
13	10395		
14	20 [cm]		
15	5/2 [hrs]		
16	-14		
17	4 [in]		
18	9 [points]		
19	8		
20	72 [jelly beans]		

	Answer	1 or 0	1 or 0
21	72 [mixed metaphors]		
22	-250		
23	13		
24	4/9		
25	2/3 and -7/2		
26	Friday		
27	$\sqrt{6}$ or $1\sqrt{6}$		
28	32		
29	24 [cm]		
30	35 [in]		
31	5/2		
32	10		
33	11		
34	96 [ways]		
35	23		
36	$117^{[\circ]}$		
37	3/7		
38	3/16		
39	12 [ft]		
40	54 [triangles]		

"Math is Cool" Masters – 2007-08

Geometry – January 26, 2008

School Name_____Team #_____

Proctor Name_____Room #_____

Final Score:

First Score

STUDENT NAME_____

Individual Contest – Score Sheet

DO NOT WRITE IN SHADED REGIONS

	Answer	1 or 0	1 or 0
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	Answer	1 or 0	1 or 0
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