"Math is Cool" Championships – 2010-11

Sponsored by:

November 5th, 2010

Pre-Algebra 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:

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- *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.*
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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. 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.

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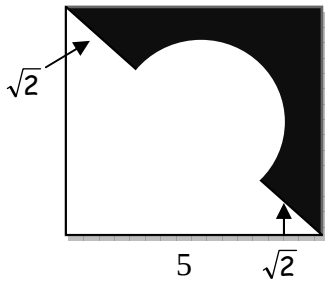
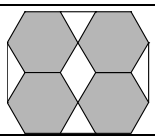
Pre-Algebra Individual Contest

	Questions 1-30: 2 points each
1	Write the 5-digit counting number that has the digit 6 in the thousands' place, with the remaining digits being 3.
2	Write the following number in scientific notation: 34,000,000
3	At sunrise the plains were filled with buffalo. A tourist startled the buffalo and 324 ran away. Eight hundred and twenty-one buffalo remained. How many buffalo were present at sunrise?
4	Find the value of $\underline{d}$, where $\underline{d}$ is an unknown digit. $1567 + \underline{d}12 = 1879$
5	This year, 555 students rode buses to the butterfly festival. Each bus can haul 37 students. How many buses are needed to haul all the students?
6	What is the sum of the prime numbers between 12 and 20?
7	Fully simplify the fraction $\frac{30}{45}$
8	Simplify: $\frac{21}{6} \div \frac{27}{4}$ Reduce to lowest terms.
9	How many positive multiples of 9 are less than 50?
10	Solve for x: $x + 7 = 10$
11	Solve for x: $2x + 3 = 17$
12	What is the area in square units of a rectangle with sides of length 8 and 5 units?
13	Ami took a test with 75 questions. She answered two-thirds of the questions correctly. How many questions did Ami answer correctly?
14	What is the degree measure of each of the angles in an equilateral triangle?
15	Two fair six-sided (cubical) dice are rolled. What is the probability that the sum of the two dice is 7?
16	What is the product of 124 and 116?
17	Aang is a master of the five elements — fire, water, earth, air, and chocolate. While fighting fire lord Ozai, he can mix any two different elements together into one attack. If only one combination of elements will defeat Ozai, what is the probability, as a fraction, that Aang defeats him with one attack?
18	Jimmy is a five-headed monster. Yihao is a ten-headed monster. Suman correctly claims that he has a number of heads that is 2 times the quantity 4 more than the sum of the heads of Yihao and

	Jimmy. How many heads does Suman have?
19	What is the perimeter, in centimeters, of a regular dodecagon with side length of 4 centimeters?
20	If the angles in degrees of a triangle are 2x-4, 7x+3 and 4x-1, what is the value of x?
21	How many distinct positive factors does 180 have?
22	Dongyang loves to recycle. He recycles bottles, cups, milk jugs and almost anything he can get his hands on. The problem is, sometimes he gets too excited and accidentally mistakes trash for something that can be recycled. One day, he stumbles upon a pile of garbage and recyclable items. Of the 50 items, 17 are recyclable, but due to his excitement, he thinks 25 of them are recyclable. What fraction of the unrecyclable items did Dongyang mistake for recyclable items?
23	Two Mathletes can write 12 problems in 5 minutes. How many minutes would it take ten Mathletes to write 168 problems?
24	If today is **FRIDAY,** then what day of the week will it be 256 days from now?
25	Let $A\Omega B$ equal $B(3A+B)$B. What is $\left(\frac{7}{2}\right)\Omega\left(\frac{4}{5}\right)$? Express your answer as a mixed number in simplest terms.
26	Find the perimeter, in inches, of a triangle with angles 30°, 60° and 90° where the length of the hypotenuse is 6 inches. Express your answer in simplest radical form.
27	Evaluate: $\left(3^2\times 1+4\right)\left(3+2\right)^3+9\div 3$
28	Evaluate: 65_7+123_4 as a base 10 number.
29	Find the equation, in slope-intercept form, of the line perpendicular to $2x+3y=15$ and intersecting the point (4, 10).
30	The picture has a square of side length 5 inches. The diagonal of the square divides it into a shaded and unshaded region. Then a circle is removed from the center of the square. Find the area of the remaining shaded region in square inches. Assume all measurements are in inches. 

Challenge Questions: 3 pts each

31	When Julia makes vegetable soup, she adds herbs chosen from parsley, sage, rosemary, thyme, oregano, and mint. She uses either 2 or 3 different herbs, but if she uses parsley, she always adds two other herbs. She never uses sage and rosemary together. How many ways can Julia choose herbs for her soup?
32	Each side of a certain regular polygon is a whole number of inches, and each interior angle is a whole number of degrees. If the perimeter of the polygon is 50 inches, what is the largest possible sum of the interior angles, in degrees?
33	When I pour juice from a pitcher into a glass, I always spill 10% of it. When I pour juice from one glass into another glass, I always spill 20% of it. I tried to pour all the juice from a pitcher into a glass, then all the juice from that glass into a second glass. I ended up with 8 fluid ounces of juice in the second glass. As a mixed number, how many fluid ounces of juice did I spill?
34	When a certain seashell is tossed, it lands either opening-up or opening-down. When it is tossed twice, the odds against landing opening-up both times are 55 to 9. What is the probability, as a fraction, that the shell will land opening-up when it is tossed once?
35	A certain dollar bill has an 8-digit serial number in which one digit appears exactly 3 times and a second digit appears exactly twice. The other 3 digits are all different. If the sum of the digits is 30, what is the largest possible value of this serial number?
36	The volume of a box (right rectangular prism) is 216 cubic cm. The box has two faces of area $36\sqrt{2}$ square cm each and two faces of area $36\sqrt{3}$ square cm each. What is the combined area, in square cm, of the two remaining faces?
37	Find the number of square units in the total area of the octagon pictured, given that the four shaded polygons in its interior are regular and congruent, with side length 3 units. 
38	My Reversing Calculator reverses the digits of all positive integers I enter, but correctly performs calculations on the reversed numbers. When it displays the results of the calculations, however, the displayed number has its digits reversed. (For example, I enter $17+25$ and get 321 as the displayed answer.) When I enter 287 minus a second positive integer n, the displayed answer is 815. What is n?
39	Natasha divides her collection of 2010 pennies equally among 30 jars. She then takes the pennies from one of these jars and puts them into cups. She puts 1 penny in the first cup, 2 pennies in the second cup, 3 pennies in the third cup, and so on, with each cup having one more penny than the last, as far as she is able to do so. She won't have enough pennies for the last cup to follow the pattern, however. How many pennies will be in the last cup?
40	A 9-digit number can be broken without changing the order of the digits into 8 overlapping pairs of digits (so $abcdefghi$ becomes $ab, bc, cd, de, ef, fg, gh, hi$). Given the 9-digit number 557319137, I change exactly 2 of the 9 digits to create a new 9-digit number. When I break my new number as described, I create eight different 2-digit prime numbers. What is my new number?

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November 5th, 2010

Algebra 1 Individual Contest

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INDIVIDUAL TEST - 35 minutes

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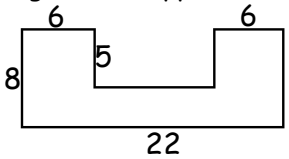
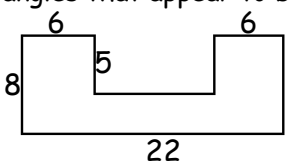
Algebra 1 Individual Contest

	Questions 1-30: 2 points each
1	At sunrise the plains were filled with buffalo. A tourist startled the buffalo and 324 ran away. Eight hundred and twenty-one buffalo remained. How many buffalo were present at sunrise?
2	Write $\frac{29}{4}$ as a mixed number.
3	Evaluate: $\frac{5}{7}+\frac{1}{3}-\frac{2}{21}$
4	Solve for x: 2x + 3 = 17
5	Find the sum of 14,298 and 13,988.
6	Two angles are supplementary. The measure of one angle is 72°. What is the measure, in degrees, of the other angle?
7	One standard 6-sided (cubical) die is rolled. As a reduced fraction, what is the probability that it will show a number greater than 4?
8	What is the area in square units of a rectangle with sides of length 8 and 5 units?
9	Ami took a test with 75 questions. She answered two-thirds of the questions correctly. How many questions did Ami answer correctly?
10	The measures of two angles in a triangle are 25° and 17°. What is the degree measure of the third angle?
11	Simplify: $-5-4(-9-(3-5)-6(3)-5)$
12	Solve for x: $5x+3(5x+3)-2=17$
13	Two fair six-sided (cubical) dice are rolled. What is the probability that the sum of the two dice is 7?
14	What is the perimeter, in inches, of the figure shown? All side lengths are given in inches. (All angles that appear to be 90° are.) 
15	What is the area, in square inches, of the figure shown? All side lengths are given in inches. (All angles that appear to be 90° are.) 
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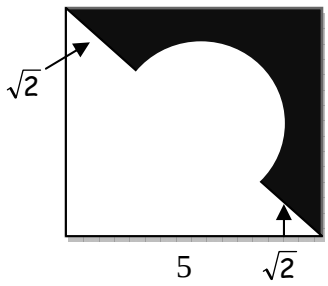
30	The picture has a square of side length 5 inches. The diagonal of the square divides it into a shaded and unshaded region. Then a circle is removed from the center of the square. Find the area of the remaining shaded region in square inches. Assume all measurements are in inches. 

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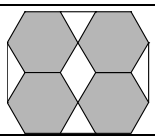
37	Find the number of square units in the total area of the octagon pictured, given that the four shaded polygons in its interior are regular and congruent, with side length 3 units. 
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Geometry Individual Contest

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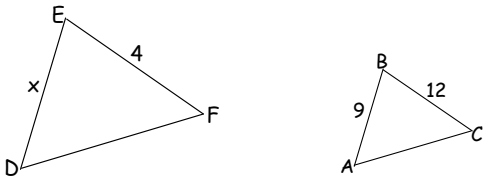
Geometry Individual Contest

	Questions 1-30: 2 points each
1	What is the sum of the prime numbers between 12 and 20?
2	Simplify: $\frac{21}{6} \div \frac{27}{4}$ Reduce to lowest terms.
3	Find the sum of 14,298 and 13,988.
4	The measures of two angles in a triangle are 25° and 17°. What is the degree measure of the third angle?
5	Simplify: $-5-4(-9-(3-5)-6(3)-5)$
6	In what quadrant is the point (-5, -2) on the coordinate plane?
7	Find the shortest distance between the two points whose coordinates are (2, 3) and (6, 6).
8	What is the degree measure of each of the angles in an equilateral triangle?
9	How many sides does a heptagon have?
10	Solve for x: $5x+3(5x+3)-2=17$
11	Triangles ABC and DEF are similar. Find the number of units in the side length marked x. (Diagrams not drawn to scale.) 
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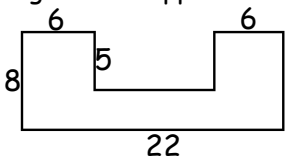
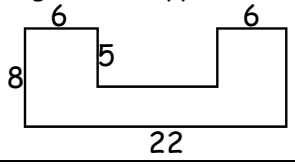
14	What is the perimeter, in inches, of the figure shown? All side lengths are given in inches. (All angles that appear to be 90° are.) 
15	What is the area, in square inches, of the figure shown? All side lengths are given in inches. (All angles that appear to be 90° are.) 
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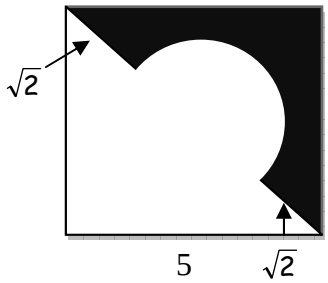
30	The picture has a square of side length 5 inches. The diagonal of the square divides it into a shaded and unshaded region. Then a circle is removed from the center of the square. Find the area of the remaining shaded region in square inches. Assume all measurements are in inches. 

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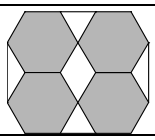
37	Find the number of square units in the total area of the octagon pictured, given that the four shaded polygons in its interior are regular and congruent, with side length 3 units. 
38	My Reversing Calculator reverses the digits of all positive integers I enter, but correctly performs calculations on the reversed numbers. When it displays the results of the calculations, however, the displayed number has its digits reversed. (For example, I enter $17+25$ and get 321 as the displayed answer.) When I enter 287 minus a second positive integer n, the displayed answer is 815. What is n?
39	Natasha divides her collection of 2010 pennies equally among 30 jars. She then takes the pennies from one of these jars and puts them into cups. She puts 1 penny in the first cup, 2 pennies in the second cup, 3 pennies in the third cup, and so on, with each cup having one more penny than the last, as far as she is able to do so. She won't have enough pennies for the last cup to follow the pattern, however. How many pennies will be in the last cup?
40	A 9-digit number can be broken without changing the order of the digits into 8 overlapping pairs of digits (so $abcdefghi$ becomes $ab, bc, cd, de, ef, fg, gh, hi$). Given the 9-digit number 557319137, I change exactly 2 of the 9 digits to create a new 9-digit number. When I break my new number as described, I create eight different 2-digit prime numbers. What is my new number?