Alabama Statewide Math Contest - Round 1 Division Two

University of North Alabama

April 11, 2015

Scoring

Scoring

0:00 - 0:30	10 points
0:31 - 1:00	8 points
1:01 - 1:30	6 points
1:31 - 2:00	4 points

If the first person to answer is correct, they receive 2 Bonus Points.

Rules

Rules

1. Answers must be in answer box provided to be counted. Units such as cm, in, etc. are **not** necessary.
2. Fractions must be reduced and left as rational numbers. Improper fractions are acceptable.
3. The numbers π and e must be left as such.
4. Complex numbers must be put into $a + bi$ form.
5. Answers with radicals must be simplified. Denominators must be rationalized.
6. Exponents should be positive.
7. Answers involving trigonometric functions should be simplified as much as possible.
8. $\log(x)$ means $\log_{10}(x)$ and $\ln(x)$ means $\log_e(x)$.
9. The time limit for **all** problems is 2 minutes.

Sample Problem # 1

Sample Problem

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Solve for x in the equation

$$x^2 - 6x - 3 = 0$$

Sample Problem

Answer: $3 + 2\sqrt{3}$,and $3 - 2\sqrt{3}$.

Round 1

Geometry

Geometry Question # 1

Geometry Question # 1

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If $m\angle A$ is four times $m\angle B$ and the complement of $\angle B$ is four times the complement of $\angle A$, determine $m\angle A$ in degrees.

Geometry Question # 1

Answer: 72°

Geometry Question # 2

Geometry Question # 2

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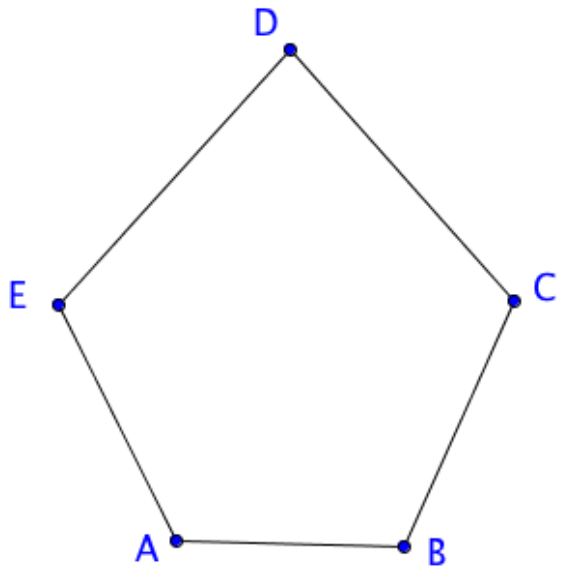
The convex pentagon $ABCDE$ has $m\angle A = m\angle B = 120°$, $EA = AB = BC = 2$ and $CD = DE = 4$. Find the area of $ABCDE$.



Geometry Question # 2

Answer: $7\sqrt{3}$

Round 1

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

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Let $f(x) = 1 - \frac{1}{2x}$, $g(x) = 2 + x$. If $h(x) = f(g(x))$, for what value of x does $h(x) = 0$? Provide your answer as a decimal.

Algebra II & Trig Question # 3

Answer: $-\frac{3}{2}$

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

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Find m so that $2y + x + 3 = 0$ and $3y + mx + 2 = 0$ are perpendicular.

Round 1: Algebra II & Trig Question # 4

Answer: -6

Round 1

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

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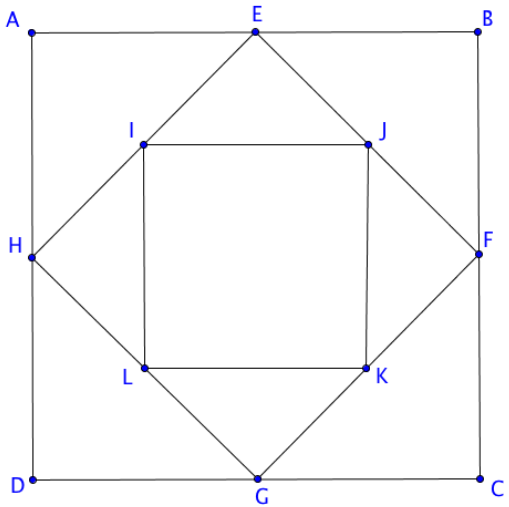
$ABCD$ is a square, with E, F, G, H, I, J, K and L midpoints of their respective line segments. Determine the area of $IJKL$ if the area of $ABCD$ is 12.



Comprehensive Part 1 Question # 5

Answer: 3

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

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Simplify $(\sqrt{12} - \sqrt{-3})(3 + \sqrt{-4})$ to $a + bi$ form.

Comprehensive Part 1 Question # 6

Answer: $8\sqrt{3} + \sqrt{3}i$

Round 1

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

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Find the sum of all values of x where the function

$$f(x) = \frac{3x^2 + 12x + 9}{x + 4}$$

is zero or undefined.

Comprehensive Part 2 Question # 7

Answer: -8

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET

Simplify

$$\frac{\log_3[\log_4(64\log_{10}10)]}{\log_9 3}$$

Comprehensive Part 2 Question # 8

Answer: 2

Round 1

Team

Team Question # 9

Team Question # 9

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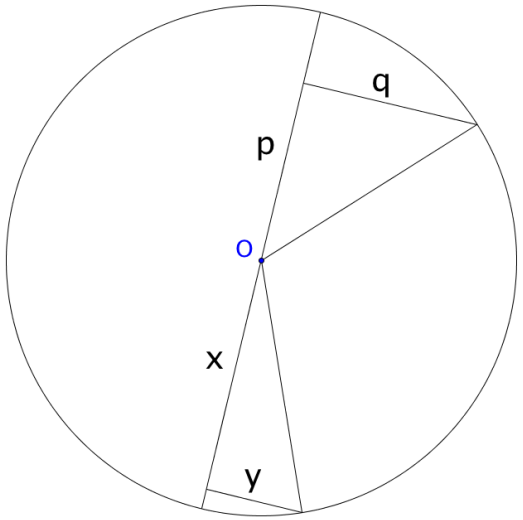
In the figure shown, there are two right triangles with side lengths of x, y, p and q. If point O is the center of the circle, and $x^2 + y^2 + p^2 + q^2 = 98$, what is the circle's area?



Team Question # 9

Answer: 49π

Team Question # 10

Team Question # 10

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A stack of pipes has 30 pipes in the bottom row, 29 pipes in the next row, 28 pipes in the next row, and so on. How many pipes are in the stack if there are 5 pipes in the top row?

Team Question # 10

Answer: 455

End of Round 1