Alabama Statewide Math Contest - Round 4 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

RESET

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

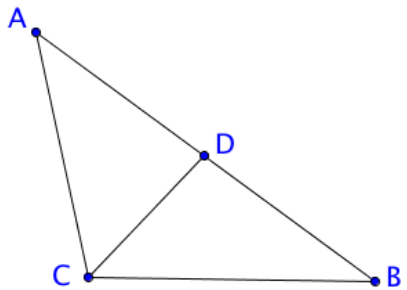
Geometry

Geometry Question # 1

Geometry Question # 1

RESET

In $\triangle ABC$, point D lies on $\overline{AB}$. Determine the measure of $\angle ACD$ in degrees given that $AC = CD = DB$ and $m\angle B = 23°$.



Geometry Question # 1

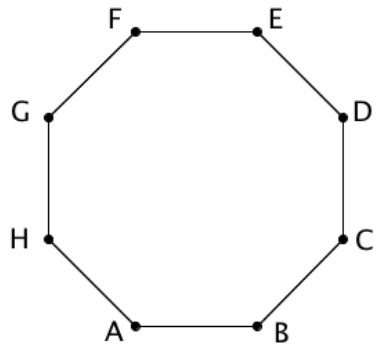
Answer: 88°

Geometry Question # 2

Geometry Question # 2

RESET

A regular octagon *ABCDEFGH* has an area of 6. What is the area of rectangle *ABEF*?



Geometry Question # 2

Answer: 3

Round 1

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

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Let $f(x) = x + 4$ and $g(x) = \sqrt[3]{x}$. Find $\left(g^{-1} \circ f^{-1}\right)(6)$.

Algebra II & Trig Question # 3

Answer: 8

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

RESET

A straight line joins the points $(3, 9)$ and $(-1, 1)$. Determine the x-value of the x-intercept of the line.

Round 1: Algebra II & Trig Question # 4

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

Round 1

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

RESET

A ladder leans against a house with its bottom 5 feet from the house. When its bottom is pulled 2 feet further from the house, the upper end of the ladder slides 4 feet down. How long is the ladder?

Comprehensive Part 1 Question # 5

Answer: $5\sqrt{2}$

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

RESET

Simplify $\sec\theta - \sin\theta\tan\theta$ to a single trigonometric function.

Comprehensive Part 1 Question # 6

Answer: $\cos\theta$

Round 1

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

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Divide $3 - i$ by $1 + i$. Put your answer in $a + bi$ form.

Comprehensive Part 2 Question # 7

Answer: $1 - 2i$

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET

What is the base x if $\log_x \frac{1}{128} = -7$?

Comprehensive Part 2 Question # 8

Answer: 2

Round 1

Team

Team Question # 9

Team Question # 9

RESET

Solve for x:

$$4^x + 4^{x+1} + 4^{x+2} = 42$$

Team Question # 9

Answer: $\frac{1}{2}$

Team Question # 10

Team Question # 10

RESET		

Find the product of all solutions of

$$x^2 e^x - 3e^x = 0.$$

Team Question # 10

Answer: -3

End of Round 4