Alabama Statewide Math Contest - Round 2 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

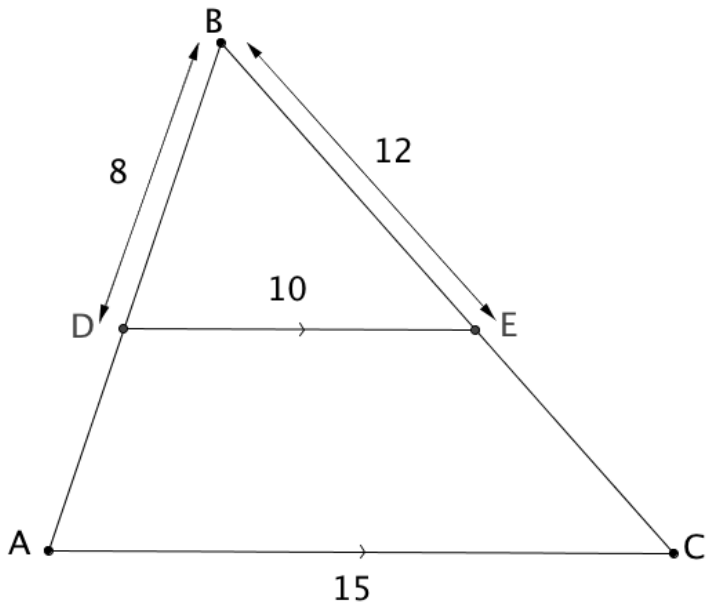
Geometry

Geometry Question # 1

Geometry Question # 1

RESET

In the following figure, $\overleftrightarrow{DE}$ is parallel to $\overleftrightarrow{AC}$, $DB = 8$, $BE = 12$, $DE = 10$ and $AC = 15$. Find $AD + EC$.



Geometry Question # 1

Answer: 10

Geometry Question # 2

Geometry Question # 2

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A regular polygon has interior angles of measure 168°. How many sides does the polygon have?

Geometry Question # 2

Answer: 30

Round 1

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

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Determine the positive integer n that satisfies the equation

$$\frac{1}{2^{10}} + \frac{1}{2^9} + \cdots + \frac{1}{2^5} = \frac{n}{2^{10}}.$$

Algebra II & Trig Question # 3

Answer: 63

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

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If $z = 3 + 4i$, find

$$2z - (\bar{z})^2$$

where $\bar{z}$ is the complex conjugate of z.

Round 1: Algebra II & Trig Question # 4

Answer: $13 + 32i$

Round 1

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

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Solve $\log_4(8 - x) - \log_4(2 - x) = \log_4 3$.

Comprehensive Part 1 Question # 5

Answer: -1

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

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Define an operation $\triangle$ as $a \triangle b = a^2 + b^3$. What is the value of $(2 \triangle 0) \triangle (1 \triangle 1)$?

Comprehensive Part 1 Question # 6

Answer: 24

Round 1

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

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What is the probability that a randomly chosen positive factor of 60 is less than 14?

Comprehensive Part 2 Question # 7

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

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

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The area of a rectangle is 24 square feet. The length of the rectangle is one foot less than three times the width. Find the perimeter of the rectangle.

Comprehensive Part 2 Question # 8

Answer: 22

Round 1

Team

Team Question # 9

Team Question # 9

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A restaurant offers five main dishes, six side dishes and three desserts. Determine the number of different meals consisting of a main dish, two different side dishes, and a dessert a person can order.

Team Question # 9

Answer: 225

Team Question # 10

Team Question # 10

RESET		

Find the solution to the equation

$$\cos^2\theta + 2\cos\theta + 1 = 0$$

on $[0, 2\pi)$.

Team Question # 10

Answer: π

End of Round 2