Alabama Statewide Math Contest - Round 4 Division Two

University of North Alabama

April 15, 2023

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. 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.

Rules

Rules

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:

Sample Problem

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

Round 4

Geometry

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 1
Question # 2

Geometry Question # 1

Geometry
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Comprehensive Part 1
Comprehensive Part 2
Team

Question # 1
Question # 2

Geometry Question # 1

RESET :

In the figure below, $AE = 5$, $DE = 4$, $BC = 12$, and $\angle ADE$ and $\angle ACB$ are right angles. Find the length of $\overline{EC}$.

Geometry
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Question # 1
Question # 2
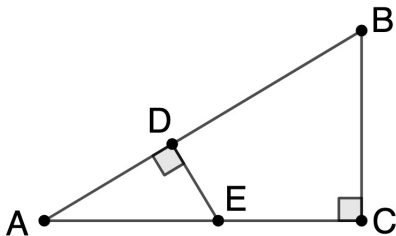
Geometry Question # 1

Answer:

**Geometry**
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Team

Question # 1
Question # 2

Geometry Question # 1

Answer: 4

Geometry Question # 2

Geometry
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Team

Question # 1
Question # 2

Geometry Question # 2

RESET   :

In trapezoid $ABCD$, $m\angle BAD = 60°$, $m\angle CDA = 30°$, $AB = 10$ and $BC = 15$. Find the area of the trapezoid.

Geometry
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Question # 1
Question # 2
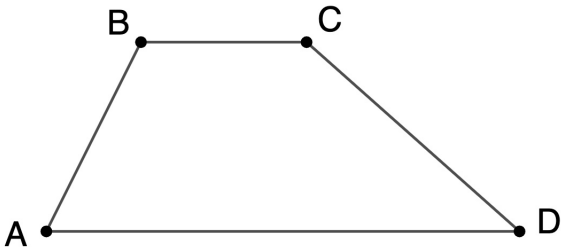
Geometry Question # 2

Answer:

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Question # 1
Question # 2

Geometry Question # 2

Answer: $125\sqrt{3}$

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Team

Question # 3
Question # 4

Round 4

Algebra II

Geometry
Algebra II
Comprehensive Part 1
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Team

Question # 3
Question # 4

Algebra II Question # 3

Geometry
Algebra II
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Team

Question # 3
Question # 4

Algebra II Question # 3

RESET :

If $(x + y)^2 = 169$ and $(x - y)^2 = 121$, find xy.

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Team

Question # 3
Question # 4

Algebra II Question # 3

Answer:

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 3
Question # 4

Algebra II Question # 3

Answer: 12

Algebra II Question # 4

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Question # 3
Question # 4

Algebra II Question # 4

RESET :

Find the smallest solution of the equation $x^4 - 7x^2 + 12 = 0$.

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Question # 3
Question # 4

Algebra II Question # 4

Answer:

Geometry
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Comprehensive Part 1
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Team

Question # 3
Question # 4

Algebra II Question # 4

Answer: -2

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Team

Question # 5
Question # 6

Round 4

Comprehensive Part 1

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1
Question # 5

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 5

RESET　：

Find the distance between the two solutions to $x^2 + 3x + 3 = 0$ in the complex plane.

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Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 5

Answer:

Geometry
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Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 5

Answer: $\sqrt{3}$

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Team

Question # 5
Question # 6

Comprehensive Part 1
Question # 6

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 6

RESET :

A geometric sequence has $a_1 = \dfrac{1}{2}$, $a_2 = -1$, $a_3 = 2$, and $a_4 = -4$.
Find a_{10}.

Geometry
Algebra II
Comprehensive Part 1
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Question # 5
Question # 6

Comprehensive Part 1 Question # 6

Answer:

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 6

Answer: -256

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Round 4

Comprehensive Part 2

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2
Question # 7

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 7

RESET :

The line $y = 2x - 1$ intersects a circle at $x = -3$ and $x = 1$ in such a way that the secant line formed is a diameter of the circle. Find the area of the circle.

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Question # 7
Question # 8

Comprehensive Part 2 Question # 7

Answer:

Geometry
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Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 7

Answer: 20π

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Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2
Question # 8

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 8

RESET :

Find the coefficient of the x term of the expansion of $(2x + 3)^3$.

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Question # 7
Question # 8

Comprehensive Part 2 Question # 8

Answer:

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 8

Answer: 54

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Algebra II
Comprehensive Part 1
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Team

Question # 9
Question # 10

Round 4

Team

Team Question # 9

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 9

RESET :

How many non-empty subsets of $\{1, 2, 3, 4, 5, 6, 7\}$ consist of only odd integers?

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Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 9

Answer:

Geometry
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Comprehensive Part 1
Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 9

Answer: 15

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 10

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 10

RESET :

Find the value of

$$81^{1/4} + \cos^2\left(\frac{19\pi}{4}\right) + i^{10} + \log_{121} 11$$

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Question # 9
Question # 10

Team Question # 10

Answer:

Geometry
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Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 10

Answer: 3

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 9
Question # 10

End of Round 4