Alabama Statewide Math Contest - Round 1 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 1

Geometry

Geometry Question # 1

Geometry
Algebra II
Comprehensive Part 1
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Team

Question # 1
Question # 2

Geometry Question # 1

RESET :

A right circular cylinder with a height of 6 has a surface area of 54π. Find its volume.

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Question # 1
Question # 2

Geometry Question # 1

Answer:

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Question # 1
Question # 2

Geometry Question # 1

Answer: 54π

Geometry Question # 2

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Question # 1
Question # 2

Geometry Question # 2

RESET :

Points A, B, C and D are on the circle, with secant lines $\overline{AC}$ and $\overline{BD}$ intersecting at point E. If $m\overset{\frown}{BC} = 60°$ and $m\angle BEC = 50°$, find $m\angle ECD$, in degrees.

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Question # 1
Question # 2
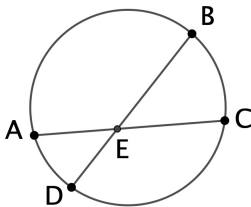
Geometry Question # 2

Answer:

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Question # 1
Question # 2

Geometry Question # 2

Answer: 20°

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Question # 3
Question # 4

Round 1

Algebra II

Geometry
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Question # 3
Question # 4

Algebra II Question # 3

Geometry
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Question # 3
Question # 4

Algebra II Question # 3

RESET :

If $x = 1$ is a solution to $x^3 + 2x^2 - 31x + 28 = 0$, find the larger of the other two solutions.

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Question # 3
Question # 4

Algebra II Question # 3

Answer:

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Team

Question # 3
Question # 4

Algebra II Question # 3

Answer: 4

Algebra II Question # 4

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Question # 3
Question # 4

Algebra II Question # 4

RESET :

If a and b are solutions to the equation $(x - 1)(x + 1) = 8$, find the value of ab.

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Question # 3
Question # 4

Algebra II Question # 4

Answer:

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Question # 3
Question # 4

Algebra II Question # 4

Answer: -9

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Question # 5
Question # 6

Round 1

Comprehensive Part 1

Geometry
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Comprehensive Part 1
Comprehensive Part 2
Team

Question # 5
Question # 6

Comprehensive Part 1
Question # 5

Geometry
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Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 5

RESET :

The graphs of $y = x^2$ and $y = 2x^2 - 3x + 2$ intersect at points A and B. What is the midpoint of segment $\overline{AB}$?

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Question # 5
Question # 6

Comprehensive Part 1 Question # 5

Answer:

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Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 5

Answer: $\left(\dfrac{3}{2}, \dfrac{5}{2}\right)$

Comprehensive Part 1
Question # 6

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Question # 5
Question # 6

Comprehensive Part 1 Question # 6

RESET :

If $\sin \alpha = \dfrac{1}{2}$, find $1 - \tan^2 \alpha$.

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Question # 5
Question # 6

Comprehensive Part 1 Question # 6

Answer:

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Team

Question # 5
Question # 6

Comprehensive Part 1 Question # 6

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

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Question # 7
Question # 8

Round 1

Comprehensive Part 2

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2
Question # 7

Geometry
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Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 7

RESET :

Let $\star$ be defined by $a \star b = a^2 + 2^b$. If $5 \star b = 41$, what is b?
Provide your answer as an integer or simplified fraction.

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Question # 7
Question # 8

Comprehensive Part 2 Question # 7

Answer:

Geometry
Algebra II
Comprehensive Part 1
Comprehensive Part 2
Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 7

Answer: 4

Geometry
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
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Question # 7
Question # 8

Comprehensive Part 2 Question # 8

RESET :

Write the expression $\dfrac{8i}{2-2i} + 3i - 4$ in the form $a + bi$, where i is the imaginary unit.

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Question # 7
Question # 8

Comprehensive Part 2 Question # 8

Answer:

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Team

Question # 7
Question # 8

Comprehensive Part 2 Question # 8

Answer: $-6 + 5i$

Round 1

Team

Team Question # 9

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Team

Question # 9
Question # 10

Team Question # 9

RESET :

Find the summation of

Volume of a right square based pyramid with a height of 5 and a
base side of length 3

$+$

Measure of an exterior angle in a regular pentagon

$+$

Radius of circle defined by $x^2 + 6x + y^2 - 12y = 4$

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Team

Question # 9
Question # 10

Team Question # 9

Answer:

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Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 9

Answer: 94

Team Question # 10

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Algebra II
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Comprehensive Part 2
Team

Question # 9
Question # 10

Team Question # 10

RESET :

A sequence is defined by $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 4$.
Suppose $a_4 = 20$, $a_5 = 36$, and $a_7 = 121$. What is a_3?

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Question # 9
Question # 10

Team Question # 10

Answer:

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Question # 9
Question # 10

Team Question # 10

Answer: 9

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Team

Question # 9
Question # 10

End of Round 1