Alabama Statewide Math Contest - Round 1 Division 2

University of Alabama at Birmingham

April 6, 2019

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

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 Question # 1

RESET

A right, hexagonal prism has a height equal to the side length of the regular hexagon bases. If the area of each hexagon base is $24\sqrt{3}$, what is the volume of the prism?

Geometry Question # 1

Answer:

Geometry Question # 1

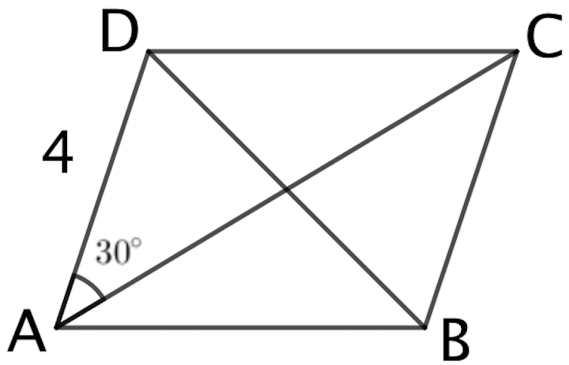
Answer: $96\sqrt{3}$

Geometry Question # 2

Geometry Question # 2

RESET

A particular parallelogram $ABCD$ has perpendicular diagonals $\overline{AC}$ and $\overline{BD}$. If $AD = 4$, and the measure of angle $\angle CAD = 30°$, find the area of the parallelogram.



Geometry Question # 2

Answer:

Geometry Question # 2

Answer: $8\sqrt{3}$

Round 1

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

RESET		

Bobby is 4 times as old as Tom. Tom is 3 years older than Sam. The sum of all three boys' ages is 27. How old is Tom?

Algebra II & Trig Question # 3

Answer:

Algebra II & Trig Question # 3

Answer: 5

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

RESET

Find the sum of the squares of the solutions to the equation

$$2ix^2 + 7x - 3i = 0$$

Algebra II & Trig Question # 4

Answer:

Algebra II & Trig Question # 4

Answer: -9.25

Round 1

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

RESET		

When multiplied out, $14! = 87,17X,291,200$, where X represents a single digit. Find the value of X.

Comprehensive Part 1 Question # 5

Answer:

Comprehensive Part 1 Question # 5

Answer: 8

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

RESET		

Find the solution to $2 \cdot 3^{2x-1} = 1 - 3^{x-1}$.

Comprehensive Part 1 Question # 6

Answer:

Comprehensive Part 1 Question # 6

Answer: 0

Round 1

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

RESET

Find the smallest integer value satisfying the inequality

$$\frac{x^2 + x - 6}{4 - x} < 0$$

Comprehensive Part 2 Question # 7

Answer:

Comprehensive Part 2 Question # 7

Answer: -2

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET

A recursive sequence is defined by $a_k = a_{k-1} + a_{k-2} + a_{k-3}$ for $k \geq 4$. If $a_6 = 7$, $a_7 = 10$, and $a_9 = 28$, find a_5.

Comprehensive Part 2 Question # 8

Answer:

Comprehensive Part 2 Question # 8

Answer: -6

Round 1

Team

Team Question # 9

Team Question # 9

RESET		

A number is a palindrome if it reads the same forwards as it does backwards. Find the sum of the three smallest **prime** palindromes greater than 100.

Team Question # 9

Answer:

Team Question # 9

Answer: 383

Team Question # 10

Team Question # 10

RESET		

Find the value of k for which the graph of the function $f(x) = 2x^2 - 12x + k$ has its vertex on the x-axis.

Team Question # 10

Answer:

Team Question # 10

Answer: 18

End of Round 1