Alabama Statewide Math Contest - Round 2 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

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 2

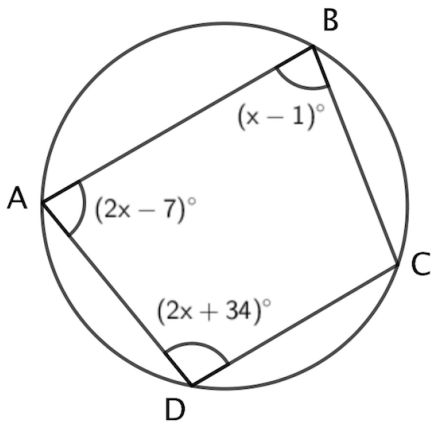
Geometry

Geometry Question # 1

Geometry Question # 1

RESET

Quadrilateral $ABCD$ is inscribed in a circle as shown in the figure, with the measures of angles $\angle DAB = 2x - 7$, $\angle ABC = x - 1$ and $\angle CDA = 2x + 34$. Find the measure of $\angle BCD$.



Geometry Question # 1

Answer:

Geometry Question # 1

Answer: 89°

Geometry Question # 2

Geometry Question # 2

RESET

A right square pyramid with a base side length of 6 inches has a total surface area of 96 square inches. Find the sum of the lengths of the eight edges of the pyramid.

Geometry Question # 2

Answer:

Geometry Question # 2

Answer: $24 + 4\sqrt{34}$

Round 2

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

RESET

The product of $x - 2$ and a polynomial $p(x)$ is $4x^3 - 3x^2 - 7x - 6$. Find the sum of the coefficients of $p(x)$.

Algebra II & Trig Question # 3

Answer:

Algebra II & Trig Question # 3

Answer: 12

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

RESET

If $f(x) = x^2 + 4x + 7$, what is the vertex of the function $g(x) = -2f(x-3) + 4$? Provide your answer as a point (a, b).

Algebra II & Trig Question # 4

Answer:

Algebra II & Trig Question # 4

Answer: $(1, -2)$

Round 2

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

RESET

Find the value of b for which (a, b) is a solution of the system of equations

$$\begin{cases} \frac{5}{x} + \frac{6}{y} = 3 \\ \frac{15}{x} - \frac{7}{y} = 4 \end{cases}$$

Comprehensive Part 1 Question # 5

Answer:

Comprehensive Part 1 Question # 5

Answer: 5

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

RESET

Find the greatest common factor of $x^3 + 3x^2 - 8x - 24$ and $x^2 + 7x + 12$.

Comprehensive Part 1 Question # 6

Answer:

Comprehensive Part 1 Question # 6

Answer: $x + 3$

Round 2

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

RESET		

If $\csc x = \frac{6}{5}$, find $\cos^2 x + \sin x$.

Comprehensive Part 2 Question # 7

Answer:

Comprehensive Part 2 Question # 7

Answer: $\frac{41}{36}$

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET		

What digit appears in the 86th place past the decimal of $\frac{8}{33}$?

Comprehensive Part 2 Question # 8

Answer:

Comprehensive Part 2 Question # 8

Answer: 4

Round 2

Team

Team Question # 9

Team Question # 9

RESET

Find the sum: "the area of a rhombus with diagonals of length 6 and 9" + "the largest solution to $2x^2 - 11x = -5$" + "the radius of the circle $x^2 - 6x + y^2 - 12y + 41 = 0$".

Team Question # 9

Answer:

Team Question # 9

Answer: 34

Team Question # 10

Team Question # 10

RESET		

Let $ABCD$ be a square of side length 2, let E be the midpoint of side $\overline{CD}$, and let F be the point where $\overline{BD}$ intersects $\overline{AE}$. Find the area of quadrilateral $BCEF$.

Team Question # 10

Answer:

Team Question # 10

Answer: $\frac{5}{3}$

End of Round 2