Alabama Statewide Math Contest - Round 4 Division Two

University of North Alabama

April 9, 2016

Round 4

Geometry

Geometry Question # 1

Geometry Question # 1

RESET		

Polygon $ABCDEFGHIJ$ is a regular decagon (ten-sided figure). If sides $\overline{AB}$ and $\overline{CD}$ are extended to meet at point K, what is $m\angle BKC$?

Geometry Question # 1

Answer:

Geometry Question # 1

Answer: 108°

Geometry Question # 2

Geometry Question # 2

RESET		

The difference between the measures of two supplementary angles is 38°. What is the measure of the smaller angle?

Geometry Question # 2

Answer:

Geometry Question # 2

Answer: 71°

Round 4

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

RESET

For what value of c will the equation $x^2 + y^2 + 8x - 10y = c$ have as its graph a circle of radius 7?

Algebra II & Trig Question # 3

Answer:

Algebra II & Trig Question # 3

Answer: 8

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

RESET

The following system has a single solution (a, b).

$$\begin{cases} 3x - 4y &= x - y + 4 \\ 2x + 6y &= 5y - 4 \end{cases}$$

Find $a + b$.

Algebra II & Trig Question # 4

Answer:

Algebra II & Trig Question # 4

Answer: -3

Round 4

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

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If $8^{2n} = \left(2^{4n-1}\right)^3$, then what is the value of n?

Comprehensive Part 1 Question # 5

Answer:

Comprehensive Part 1 Question # 5

Answer: $\frac{1}{2}$

Comprehensive Part 1
Question # 6

Comprehensive Part 1 Question # 6

RESET		

Evaluate $\tan\left(\frac{20\pi}{3}\right)$.

Comprehensive Part 1 Question # 6

Answer:

Comprehensive Part 1 Question # 6

Answer: $-\sqrt{3}$

Round 4

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

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Solve for x where $\log_2(x) + \log_2(x^4) = 15$

Comprehensive Part 2 Question # 7

Answer:

Comprehensive Part 2 Question # 7

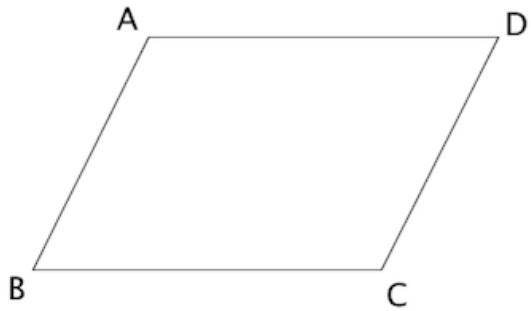
Answer: 8

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET		

In rhombus $\square ABCD$, acute angle $\angle B$ has $\sin \angle B = \frac{2}{3}$. If $AB = 12$, find the area of the rhombus.



Comprehensive Part 2 Question # 8

Answer:

Comprehensive Part 2 Question # 8

Answer: 96

Round 4

Team

Team Question # 9

Team Question # 9

RESET		

In regular hexagon $ABCDEF$, a segment connecting non-adjacent vertices has length $6\sqrt{3}$. What is the maximum area of such a hexagon?

Team Question # 9

Answer:

Team Question # 9

Answer: $54\sqrt{3}$

Team Question # 10

Team Question # 10

RESET		

In the $xy-$plane, the segment with endpoints $(-5, 0)$ and $(25, 0)$ is a diameter of a circle. If $(x, 15)$ is on the circle, then what is x?

Team Question # 10

Answer:

Team Question # 10

Answer: 10

End of Round 4