Alabama Statewide Math Contest - Round 1 Division Two

University of North Alabama

April 9, 2016

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 and left as rational numbers. 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

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

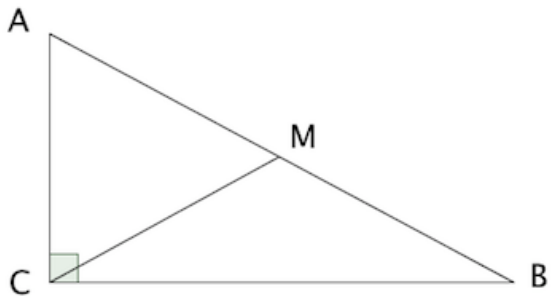
Geometry

Geometry Question # 1

Geometry Question # 1

RESET		

Let $\triangle ABC$ be a right triangle with $\overline{AC} \perp \overline{CB}$, $\overline{CM}$ a median of the triangle and $m\angle CBA = 23°$. Find the $m\angle ACM$.



Geometry Question # 1

Answer:

Geometry Question # 1

Answer: 67°

Geometry Question # 2

Geometry Question # 2

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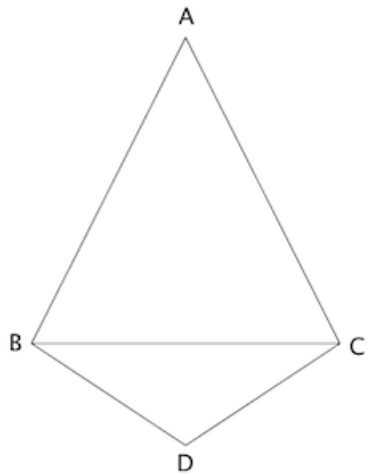
In the figure shown, $\triangle ABC$ is equilateral with side length 2. If $m\angle ABD = m\angle ACD = 90°$, find the area of quadrilateral $\square ABDC$.



Geometry Question # 2

Answer:

Geometry Question # 2

Answer: $\dfrac{4\sqrt{3}}{3}$

Round 1

Algebra II & Trig

Algebra II & Trig Question # 3

Algebra II & Trig Question # 3

RESET

The inequality $2 < 7 - 3|2x + 1|$ has its solution as an interval of the form (a, b). What is $a + b$?

Algebra II & Trig Question # 3

Answer:

Algebra II & Trig Question # 3

Answer: -1

Algebra II & Trig Question # 4

Algebra II & Trig Question # 4

RESET		

Let $g(x) = \frac{1}{x}$. What is $g(1 - 3i)$, where $i = \sqrt{-1}$? Put your answer in standard form.

Algebra II & Trig Question # 4

Answer:

Algebra II & Trig Question # 4

Answer: $\frac{1}{10} + \frac{3}{10}i$

Round 1

Comprehensive Part 1

Comprehensive Part 1
Question # 5

Comprehensive Part 1 Question # 5

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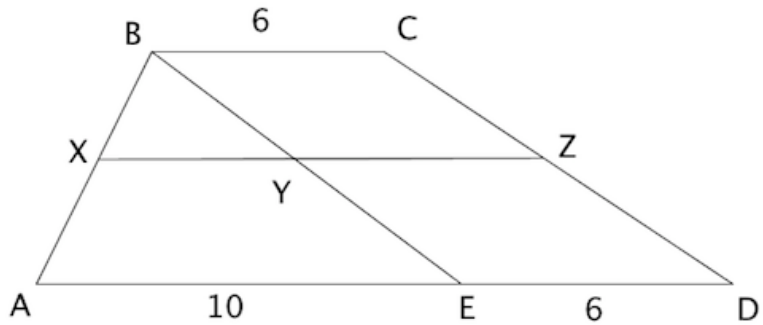
In trapezoid $\square ABCD$, segment $\overline{XZ}$ is a median, $BC = ED = 6$ and $AE = 10$. Find XY.



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 smallest solution to the equation $x + 4|3x - 1| = 7$.

Comprehensive Part 1 Question # 6

Answer:

Comprehensive Part 1 Question # 6

Answer: $-\frac{3}{11}$

Round 1

Comprehensive Part 2

Comprehensive Part 2
Question # 7

Comprehensive Part 2 Question # 7

You've forgotten the password to your iPhone. Based on the smudges on the screen, you've figured out that it is a four-digit passcode consisting of the numbers 1, 5, 6, and 8, but you cannot remember in which order. What is the probability that you guess the code correctly the first time?

Comprehensive Part 2 Question # 7

Answer:

Comprehensive Part 2 Question # 7

Answer: $\frac{1}{24}$

Comprehensive Part 2
Question # 8

Comprehensive Part 2 Question # 8

RESET		

What is the value of $\csc\theta$ if $\theta = \tan^{-1}\frac{3}{5}$?

Comprehensive Part 2 Question # 8

Answer:

Comprehensive Part 2 Question # 8

Answer: $\frac{\sqrt{34}}{3}$

Round 1

Team

Team Question # 9

Team Question # 9

RESET		

At Sonic you can choose from 8 flavors to add into your drink. In how many ways can you add 1, 2, or 3 different flavors into your drink?

Team Question # 9

Answer:

Team Question # 9

Answer: 92

Team Question # 10

Team Question # 10

RESET

If $f(x) = x^9 + x^6 + x^4 - x + c$ is divisible by $x + 1$, then what is the value of c?

Team Question # 10

Answer:

Team Question # 10

Answer: -2

End of Round 1