

# Alabama Statewide Math Contest - Round 3 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  $\pi$  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 3

## Geometry

# Geometry Question # 1

# Geometry Question # 1

RESET :

What is the area of a triangle with side lengths 7, 7, and 10?

# Geometry Question # 1

Answer:

# Geometry Question # 1

Answer:  $10\sqrt{6}$

# Geometry Question # 2

## Geometry Question # 2

RESET :

The point  $(2, 6)$  is reflected about the line  $x = -2$  and then about the line  $y = x$ . What is the resultant point?

## Geometry Question # 2

Answer:



## Geometry Question # 2

Answer:  $(6, -6)$

# Round 3

## Algebra II

# Algebra II Question # 3

## Algebra II Question # 3

RESET :

If  $f(x) = x^2 - 2x + 4$ , solve  $f(2x) = 4f(x)$  for  $x$ .

# Algebra II Question # 3

Answer:

# Algebra II Question # 3

Answer: 3

# Algebra II Question # 4

## Algebra II Question # 4

RESET :

Find the solution to  $(33 - 6x)^{-1/5} - 2 = -1$ .



# Algebra II Question # 4

Answer:

# Algebra II Question # 4

Answer:  $\frac{16}{3}$

# Round 3

## Comprehensive Part 1

# Comprehensive Part 1

## Question # 5

## Comprehensive Part 1 Question # 5

RESET :

A bag contains 4 Blue, 4 Green, 4 Red, and 4 Yellow tiles. If you select 2 at random without replacement, what is the probability that neither tile is red?

# Comprehensive Part 1 Question # 5

Answer:

# Comprehensive Part 1 Question # 5

Answer:  $\frac{11}{20}$

# Comprehensive Part 1

## Question # 6



## Comprehensive Part 1 Question # 6

RESET :

The graph of the parabola  $y = ax^2 + bx + c$  goes through points  $(-2, -3)$ ,  $(0, -1)$ , and  $(2, 9)$ . What is the value of  $a + b + c$ ?

# Comprehensive Part 1 Question # 6

Answer:

# Comprehensive Part 1 Question # 6

Answer: 3

# Round 3

## Comprehensive Part 2

# Comprehensive Part 2

## Question # 7

## Comprehensive Part 2 Question # 7

RESET :

Find the largest solution to  $\cos^4 x - \sin^4 x = 0$  on  $[0, 2\pi)$ .

## Comprehensive Part 2 Question # 7

Answer:

## Comprehensive Part 2 Question # 7

Answer:  $\frac{7\pi}{4}$



# Comprehensive Part 2

## Question # 8

## Comprehensive Part 2 Question # 8

RESET :

Find the distance between the two foci of the ellipse  $\frac{x^2}{9} + \frac{y^2}{25} = 1$ .

## Comprehensive Part 2 Question # 8

Answer:

## Comprehensive Part 2 Question # 8

Answer: 8

# Round 3

## Team

# Team Question # 9

## Team Question # 9

RESET :

Find the largest solution to the equation  $16^{x^2+3x-1} = 8^{x^2+3x+2}$ .

## Team Question # 9

Answer:



## Team Question # 9

Answer: 2

# Team Question # 10

## Team Question # 10

RESET :

How many vertical asymptotes does the graph of the function

$$f(x) = \frac{(x - 2) \sin x}{\cos x}$$

have on  $[0, 100\pi)$ ?

## Team Question # 10

Answer:

## Team Question # 10

Answer: 100

# End of Round 3