Directions

• You will have 4 minutes to answer each question.

• The scoring will be 16 points for a correct response in the 1st minute, 12 points for a correct response in the 2nd minute, 8 points for a correct response in the 3rd minute, 4 points for a correct response in the 4th minute. A sliding scale will be used.

• Once your hand has been raised with the answer sheet, it must stay up. If you put your hand down, your answer will be disqualified for that question.

• Your answer must be submitted on the official answer sheet that has been correctly filled out. Otherwise your answer will be disqualified.

• Your answer must be in the specific form that the question asks for.
Directions……

• If not otherwise noted, the answers should be in one of the following generally accepted forms:
  – Denominators rationalized
  – Simplest radical form
  – Fractions, improper fractions, or mixed numbers in simplest form
  – Equations should have integral coefficients in standard form

• No units are necessary
• Calculators are not allowed in any division except Statistics.
• Headphones, beepers, cell phones, or electronic devices are not permitted.
• Sunglasses and hats are not to be worn during the competition.

Are you ready?
1) Find and simplify $f(x) + g(x)$.

$$f(x) = -2x^\frac{5}{6} (3x^{\frac{1}{2}} - 4x^{\frac{-1}{4}})$$

$$g(x) = 8x^{\frac{3}{4}} (-\frac{1}{4} x^{\frac{7}{12}} + \frac{3}{2} x^{\frac{-1}{6}})$$

Are you ready?
2) Write the following using ONE logarithm, only coefficients of 1, and no exponents. Simplify where possible.

$$\frac{1}{7} \left[ 2 \ln(x+3) + \frac{1}{2} \ln(x^2 - 6x + 9) - \ln(x^2 - 14x - 51) \right]$$

Are you ready?
3) Add, simplify and present solution in standard form of a complex number.

\[ \frac{3 + 2i^{49}}{1 - 2i^{64}} + \frac{1 + 2i^{81}}{1 + 3i^{144}} \]
4) Solve the system. Present answer using interval notation.

\[ 0 > x^2 - \frac{7}{2}x - 2 \]

\[ 0 \leq x^2 - 9 \]

Are you ready?
5) Find the distance between the points where the slope of the tangent lines have an undefined slope.

\[ x^2 + y^2 - 4x - 6y - 3 = 0 \]
6) Evaluate $f^{-1}(g^{-1}(10))$ when

$$f(x) = 3\sqrt{x} + 2$$
$$g(x) = \sqrt{x} - 1$$

Are you ready?
7) Find the solution to the equation:

$$\sqrt{4 - x} + \sqrt{4 + x} = x$$

Are you ready?
8) Let $y'$ be the graph of $y = (x - 1)^2 - 4$ rotated $90^\circ$ clockwise about the origin. At how many points do the graphs of $y$ and $y'$ intersect?
9) What is the shortest distance between the graphs of the hyperbola given by
\[ x^2 - y^2 + 9 = 0 \] and the circle given by
\[ x^2 + y^2 - 2y = 0 \]?
10) Find the equation of the circle where the line segment determined by the points $(3, -4)$ and $(-3, 2)$ is the diameter.
11) Suppose \((x_1, 0), (x_2, 0),\) and \((0, y)\) are the intercepts of the rational function

\[ r(x) = \frac{x^2 + (a-b)x - ab}{cx^2 + dx + e}. \]

Find the value of \(x_1 + x_2 + y.\)
12) What is the area of the region described by 
\[(x - 3)^2 + (y - 4)^2 \leq 7?\]
13) Find the sum of the product of the zeros of each function.

\[ p(x) = x^2 - 4x + 13 \]
\[ q(x) = x^2 + 8x + 15 \]

Are you ready?
14) An object is dropped from a height of 400 feet. Assuming that there is no air resistance, how long does it take to reach the ground?

Are you ready?
15) Find the area of the solution to this system:

\[ y - x \leq 1 \quad y + x \leq 1 \]
\[ y + 1 \geq x \quad 3 \geq x + y \]

**Answers**

1) \(-8x^{3/2} + 20x^{7/6}\)
2) \(\ln \sqrt{\frac{(x+3)(x-3)}{(x-17)}}\)
3) \(-\frac{11}{4} - \frac{3}{2}i\)
4) \([3,4]\)
5) 8
6) 1,771,559
7) \(x = 2\sqrt{3}\)
8) 4
9) 1
10) \(x^2 + (y + 1)^2 = 18\)
11) \(\frac{be-ae-ab}{e}\)
12) \(A = 7\pi\)
13) 28
14) 5
15) Infinite