Competition A – Algebra 2 – Individual Contest
     Team Make-up:  maximum 6 students; juniors, sophomores or freshmen, or students enrolled in
         Algebra II
     Questions:  20
     Time:  50 minutes
     Format:  Individual competition
     All battery operated calculators permitted, including CAS-type
     Answers must be legible
     Answers must be **exact** unless otherwise indicated in the question
     Scoring:  Correct answers worth 2 points each; 40 points possible per team member
     Team Score:  The top 4 scores count toward the team score; 5th and 6th scores are used for tie-breaking
         Maximum 160 points per team

Sample Regional Questions

1. For all real numbers $x$, $2f(x) + f(6-x) = x^2$. Find the value of $f(3)$.

   **Answer:**  3

2. Determine the largest real value for $x$ such that $\sqrt{5x^4} = 30$. Express your answer as a decimal rounded to the nearest hundredth.

   **Answer:**  3.66

3. Determine the exact sum of all distinct values of $x$ such that $\begin{vmatrix} -2x & 3x \\ -16 & x^2 \end{vmatrix} = 64$.

   **Answer:**  0

4. Let $w$ be the symbol for the digit twelve in a base system. Let $k$ be a positive integer that is a number base. Let $x$ represent a base 10 number such that $x = 16_k$ and $x^3 = 281w_k$ (where $w$ is the units digit of the number). Determine the value of $k$. Express your answer in base ten.

   **Answer:**  17 or $17_{10}$ or $17_{\text{ten}}$

5. Let $k$ be the numeric value of the area of the region enclosed by $|2x-1| + |y+3| = 8$. Determine the value of $k$.

   **Answer:**  64

6. The circle $x^2 + y^2 = 25$ is intersected by the line $y = x-1$ at points $A$ and $B$. Determine the exact length of $\overline{AB}$.

   **Answer:**  $7\sqrt{2}$

7. Given $x^2 + \dfrac{1}{x^2} = 3$. The largest solution for x in this equation can be written in the reduced

and simplified radical form $\dfrac{k + w\sqrt{p}}{q}$ where $k$, $w$, $p$, and $q$ are integers. Determine the

sum $(k + w + p + q)$.

**Answer:** 9

8. Carly has 369 markers. Out of these, 130 are black, 100 are blue, and the others are neither blue nor black. She chooses two markers at random. Find the probability that one of the two is black and the other is neither blue nor black. Write your answer as a decimal rounded to the nearest thousandth.

**Answer:** 0.266 or .266

9. $n = 2016!$ has $k$ trailing zeros when expanded and written as an integer. (Trailing zeros are the zeros to the right of the last non-zero digit in the integer representation read from left to right.) Determine the value of $k$.

**Answer:** 502

10. A conic represented by $x^2 - 9y^2 + 36y - 72 = 0$ has a major axis of length $k$ and a minor axis of length $w$. Determine the sum $(k + w)$.

**Answer:** 16