1. In how many points does the line $x + y = 2$ intersect the circle $x^2 + y^2 = 2$? **Ans: One**

2. What is the largest four-digit prime number less than 2010? **Ans: 2003**.

3. How many five-letter “words” (any strings of five characters from the English alphabet) strictly alternate between vowels and consonants (one example is “mimes”)? (You may leave your answer in factored form; consider the letter $y$ to be a consonant.) **Ans: $26 \cdot 105^2$** (other forms possible)

4. What is the highest power of 2 that divides 100! (without remainder)? **Ans: 97 (or $2^{97}$)**

5. Put the following mathematicians in order according to their year of birth, starting with the first born: A. Emmy Noether, B. Leonhard Euler, C. John Nash, D. Archimedes. (use the indicated letters) **Ans: D B A C**

6. Solve for $x$: $2x^3 - 3x^2 - 8x = 3$. **Ans: -1, -1/2, 3**

7. How many vertical asymptotes does the graph of $y = \tan(\sec x)$ have in the interval $[0, \frac{\pi}{2})$? **Ans: An infinite number**

8. Put the following events in order from the least likely to the most likely (use the indicated letters):

   E: Rolling four fair six-sided dice and getting a sum of 5.
   F: 10 fair two-sided coins landing “heads”
   G: Choosing a palindrome (a number that reads the same backwards and forwards) at random from among all seven-digit numbers

   **Ans: F G E**

9. The area of a circle inscribed in an equilateral triangle is 1 sq. ft. What is the perimeter of the triangle? **Ans: $\frac{6\sqrt{3}}{\sqrt{\pi}}$** (other forms possible)

10. Which of the following is the negation of the statement “For every $x$ there is a $y$ such that if $x$ has property $P$ then $y$ has property $Q$”? (Circle the letter of your answer.)

    A. There is an $x$ such that for every $y$, $x$ has property $P$ and $y$ does not have property $Q$
    B. For every $x$ there is no $y$ such that $x$ has property $P$ and $y$ has property $Q$
    C. There is an $x$ such that for every $y$, if $x$ does not have property $P$ then $y$ does not have property $Q$

    **Ans: A**

Thank you for participating.