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: $26*105^2$** (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 $\left[0, \frac{\pi}{2}\right)$?

   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:** $\dfrac{6\sqrt{3}}{\sqrt{\pi}}$ (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.