2009 Theta Ciphering

0. Find the number of permutations of the word Tennessee.

1. Find the equation of the line that is perpendicular to the line $y = 3x - 2$ and has the same x – intercept as the line $3x - 2y = 5$.

2. Simplify: $(1 + i)^{2009} + (1 - i)^{2009}$.

3. Find the points of intersection of: $y = 3x^2 - 4x - 10$ and $2x - y = 1$.

4. Solve: $\frac{\log_2 |(x+2)|}{\log_2 |(2x+3)|} = 2$

5. A chemist has 2 solutions of acid; one is a 35% and the second is 44% acid. If he mixes the 2 solutions together to form a 40% acid solution how much of the 44% acid must he add to make a 240 ml solution?

6. What is the largest prime number that will always divide a 6-digit number of the form *ababab*, where a and b are positive integers.

7. Find the ordered pair (a, b) if: $2a + (3b + 1)i - (3b + 2) - 4ai = 3 - 3i$. (note: $i = \sqrt{-1}$)

8. Find the area of the rectangle formed by the points of intersection of $x^2 + y^2 = 16$ and $25x^2 + 4y^2 = 100$.

9. $f(x) = 4x - 3$; $g(f(x)) = 4x^2 - 5$; Find: $g(3)$.

10. Find the value of the <u>determinant</u> of the product of: $\begin{bmatrix} 1 & -2 \\ 3 & -3 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 4 & 0 \\ 0 & 2 & -4 \end{bmatrix}$