## Algebra 2 Ciphering - Hoover High School Math Tournament - February 22, 2003

1-1. Given: $f(f(x))=4 x+9$. Find the positive slope of $f(x)$, given that $f(x)$ is a linear function.

Ans: 2

1-2. Solve: $\begin{aligned} & 15 x-6 y=12 \\ & 7 y-10 x=-3\end{aligned}$
Ans: $\left(\frac{22}{15}, \frac{5}{3}\right)$
1-3. Find $x: \quad x^{2}-9=\left|\begin{array}{ccc}6 & 9 x & 12 \\ 2 x & 0 & 3 \\ 4 & 6 x & 8\end{array}\right|$
Ans: $\pm 3$

1-4. If the solution to $\frac{\left(x^{2}+8 x-105\right)(x-7)}{x-2} \leq 0$ is
Ans: -13
the inequality $a \leq x<b$, find $a+b$.
1-5. A drawer contains 6 blue, 5 green, 10 yellow, and 20 white socks. What is the minimum number of socks one would have to draw to be sure of getting a matching pair? Ans: 5

2-1. $A=\left[\begin{array}{cccc}16 & 15 & 14 & 24 \\ 6 & 5 & 11 & 17 \\ 12 & 16 & 15 & 12 \\ 10 & 13 & 17 & 19\end{array}\right]-\left[\begin{array}{cccc}15 & 21 & 8 & 22 \\ 9 & 6 & 10 & 17 \\ 21 & 12 & 15 & 12 \\ 5 & 13 & 17 & 19\end{array}\right]$. Find the determinant of A. Ans: 40
2-2. Evaluate: $\binom{5}{3} P_{2}$
Ans: 90

2-3. Evaluate: $\frac{1}{\log _{2} 576}+\frac{1}{\log _{3} 576}+\frac{1}{\log _{4} 576}$
Ans: $\frac{1}{2}$

2-4. Given: $5 x^{2}-8 x+2=0$. If $\mathrm{s}=$ sum of the roots, $\mathrm{p}=$ product of the roots, $\mathrm{d}=$ discriminant, find $s+p+d$.

Ans: 26
2-5. Find the distance from the vertex to the focus of the parabola with equation:
$4 x^{2}-12 x-y+13=0$.
Ans: $\frac{1}{16}$

3-1. Find the product of the imaginary roots of $x^{4}-4 x^{3}+12 x^{2}-36 x+27=0$ Ans: 9

3-2. How many distinct arrangements can be made with the letters of the word MATIKAINEN?

3-3. Adam, Bonnie, Henry and Michelle go to the movies. Bonnie wants to sit next to Henry and Adam doesn't want to sit next to Michelle. How many ways can they fill a four seat row with these conditions?

Ans: 4
3-4. Solve: $\sqrt{x-\sqrt{x-4}}=2$.
Ans: 4 OR 5

3-5. If the center of the circle $2 x^{2}+2 y^{2}-8 x+4 y-12=0$ is $(h, k)$ and the radius is $r$, find $h-k-r^{2}$

Ans: -8

4-1. Find the $54^{\text {th }}$ term of the sequence $20,17,14,11 \ldots$
Ans: -139
4-2. Evaluate $\sum_{k=1}^{5} 2(3)^{k-1}$
Ans: 242

4-3. Simplify: $\frac{2}{1+i}+\frac{5}{2-i}$
Ans: 3

4-4. Find the constant term in the expansion of $\left(3 x^{2}+\frac{1}{x}\right)^{9}$
Ans: 2268

4-5. Solve for matrix $X:\left[\begin{array}{ll}2 & 5 \\ 1 & 2\end{array}\right] X=\left[\begin{array}{cc}14 & 6 \\ 4 & 0\end{array}\right]$ Ans: $\left[\begin{array}{cc}-8 & -12 \\ 6 & 6\end{array}\right]$

E-1. Solve for $x: 1+\frac{1+x}{1+\frac{1+x}{1+\frac{1+x}{1+\frac{1+x}{1+\frac{1+x}{1+\ldots}}}}}=3$
Ans: 5

E-2. Simplify: $\frac{\left(\frac{w^{12} x^{7} y^{21} z^{2}}{w^{20} y^{2}}\right)^{3}}{\left(\frac{x^{10} z^{3}}{y^{3} w^{12}}\right)^{2}}$
Ans: $x y^{63}$

E-3. Solve for $x: 2^{x^{x^{x}}}=8$
Ans: $\sqrt[3]{3}$

E-4. Given: $\begin{aligned} & \log _{x} 256=x \\ & 8 \log _{y} 2=y\end{aligned}$, find $x+y$
Ans: 8

