

1996 Hoover High School Math Tournament
Algebra II Ciphering

- 1.1 Find the equation in slope-intercept form of the perpendicular bisector of the line segment with endpoints (4,-3) and (8, 11)

ANS: $y = \frac{-2}{7}x + \frac{40}{7}$

- 1.2 Given : $g(x) = x-3$ and $h(x) = \sqrt{x}$, find $h(h(h(h(h(g(h(g(19))))))))$
ANS: 1

- 1.3 $(x+2y)+(3x+4y)i = 3+5i$. Find $2x+y$
ANS: 0

- 1.4 Simplify: $\frac{x^{-6} + y^{-6}}{x^{-2} + y^{-2}}$
ANS: $\frac{x^4 - x^2y^2 + y^4}{x^4y^4}$

- 1.5 Evaluate: $\sum_{n=1}^{\infty} 4\left(\frac{4}{3}\right)^{n-1}$
ANS: No Sum

- 2.1 Find the solution set of the system : $\frac{2x+y}{x-y} = \frac{3}{4}$ and $\frac{x}{y} = -2$

ANS: \emptyset

- 2.2 What is the determinant of the 4x4 matrix:
$$\begin{bmatrix} 1 & 0 & 2 & -1 \\ 0 & 1 & 1 & 3 \\ 3 & 4 & 0 & 0 \\ -2 & 5 & -3 & 2 \end{bmatrix}$$

ANS: 114

- 2.3 What is the remainder when $x^{101} - 39x^{98} + 45x^{37} + 3$ is divided by $x+1$?
ANS: -82

- 2.4 Give all solutions for x : $(3x^2 + 12x + 11)^2 - (3x^2 + 12x + 11) - 2 = 0$

ANS: -3,-2,-1

- 2.5 Give the sum of the x -coordinates of the vertex and the focus of the graph given by $8x = y^2 - 6y + 33$
ANS: 8

3.1 A certain printer can print 1000 pages in 4 hours. Another printer takes 6 hours to print the same number of pages. If the two machines work together, how long will it take to print 1000 pages?

ANS: 2 hours and 24 minutes or $2\frac{2}{5}$ hours

3.2 Simplify: $\frac{8-2i}{3-5i}$
ANS: $1+i$

3.3 What is the constant term in the expansion of $\left(x + 2x^{\frac{-3}{5}}\right)^8$

ANS: 1792

3.4 How many different ways can you arrange the letters in the word EXAMINATION?
ANS: 4,989,600

3.5 The solution to the equation $3^{x-3} = 2^x$ is $\log_a b$. Find $\sqrt[4]{b}$,
ANS: 9

4.1 In an arithmetic series, $a_{10} = 79$ and the sum of the first ten terms is 430. What is the value of a_1 ?
ANS: 7

4.2 An urn contains 4 red marbles and 6 blue marbles. If 4 marbles are drawn at random from the urn, what is the probability that 2 of the marbles will be red and 2 of them will be blue?
ANS: $\frac{3}{7}$

4.3 $x^{\sqrt{2}} = 4$ Solve for x.
ANS: $\sqrt{2}$

4.4 Y varies jointly as X, A, and B, and inversely as the square of Z and the square root of W. When $X=2$, $A=3$, $B=4$, $Z=\frac{1}{2}$, and $W=16$, $y=8$. Find W when $X=8$, $A=9$, $B=10$, $Z=4$, and $Y=3$.
ANS: 25

4.5 What is the area of the figure described by the equation $36x^2 + 49y^2 = 1764$?
ANS: 42π

ALT Solve for y: $\log(2y-3) + \log(6x+2) = \log\left(4x - \frac{2}{3}\right) + \log(3y)$
ANS: $y=3x+1$

ALT If $F(x,y,z) = \frac{5(x^2 + y^2 + z^2) - xy + z - 2}{xyz}$, find $F(12,16,21)$
ANS 1