

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2014-2015

Match 3 Round 1
Arithmetic: Scientific
Notation and Bases

1.) _____

2.) _____

3.) _____

1.) In the famous equation $E=mc^2$, find E if $m=1.67 \times 10^{-27}$, c is 3×10^8 .
Express your answer in scientific notation. (Assume these are exact numbers, so that significant figures are not an issue)

2.) Multiply the number 121_7 by the number 121_4 and divide your answer by 121_3 . Give your answer in base 8.

3.) If d can be any of the base 6 digits 0,1,2,3,4, or 5, find all values of d such that

$\frac{5d3_6 - 3d5_6}{3d1d_6}$ is between 10^{-1} and 10^{-2} .

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2014-2015

Match 3 Round 2
Algebra: Word Problems

1.) _____

2.) _____

3.) _____

1.) Tickets for the theater cost \$75.00 for an orchestra seat and \$52.50 for a seat in the mezzanine. If 500 tickets were sold and the total revenue was for the evening was \$29625, how many orchestra seats were sold?

2.) One train leaves Bridgeport at 9:30 heading east at 60 mph. Another train leaves Norwalk at 9:36 and heads west at 50 mph. If Norwalk is 10 miles west of Bridgeport, at what time will the two trains be 104 miles apart?

3.) If Moe and Larry work together to mow the lawn, the job takes 40 minutes. If Larry and Curly work together to mow the lawn, the job takes 50 minutes. If Moe and Curly work together to mow the lawn, the job takes 60 minutes. How many minutes would it take to mow the lawn if all 3 men worked together?

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2014-2015

Match 3 Round 3
Geometry: Polygons

1.) _____

2.) _____

3.) _____

1.) The number of diagonals of a regular n -gon is 170. What is the degree measure of each of its interior angles?

2.) The exterior angle at vertex A of a convex n -gon measures 20 degrees. All of the other exterior angles are congruent, and the interior angles associated with these angles are each 15 degrees greater than the interior angle at vertex A . How many diagonals does the n -gon have?

3.) The sum of the number of diagonals of a convex polygon and 151 times the number of its sides is equal to the numerical value in degrees of the sum of its interior angles. What are all possible values for the number of sides of the polygon?

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2014-2015

Match 3 Round 4
Algebra 2: Functions and
Inverses

1.) _____

2.) _____

3.) _____

Note: In this round the notation f^{-1} refers to the inverse relation to the function f . The relation f^{-1} is not necessarily a function.

1.) $h(x) = 5x - 3$. Find all values of x such that $h^{-1}(x) = h(x)$.

2.) If $f(x) = 2x + 3$ and $g(x) = 3x + 2$, find $f^{-1}(g(f(g^{-1}(x))))$.

3.) $k(2x) = \frac{16x^3}{8x^3 - 2x}$. Find the domain of $k^{-1}(x)$. Express your answer using interval notation or as an inequality in terms of x .

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2014-2015

Match 3 Round 5
Advanced Math:
Exponents and Logarithms

1.) _____

2.) _____

3.) _____

1.) If $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$, and $\log_{10} 7 = 0.8451$, find $\log_{10} \left(\frac{60}{7}\right)$

2.) Find all possible values of z if $\log_2(z) = y$ and $(5^{y^2-3y})(25^{y-4}) = (0.04)^{y-6}$

3.) Find all values of x such that $\log_2(x^2) + \log_x(16) = 6$.

**FAIRFIELD COUNTY MATH LEAGUE (FCML)
2014-2015**

Match 3 Round 6
Discrete Math: Matrices

1.) _____

2.) _____

$$B = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

3.) _____

1.) Give the sum of the six entries of the matrix product:

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & -2 & -1 & 3 \\ 2 & 0 & 1 & -2 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & -1 \\ -2 & 0 \\ 0 & 3 \end{bmatrix}$$

2.) Find all values of k such that the determinants of the matrices

$$\begin{bmatrix} 2 & k+4 \\ k & 4 \end{bmatrix} \text{ and } \begin{bmatrix} 3 & 6 \\ 2 & k+2 \end{bmatrix} \text{ sum to } -4.$$

3.) If $ABA = \begin{bmatrix} 20 & -40 \\ -26 & 54 \end{bmatrix}$ and $A = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$, write the 2x2

matrix B . Express your entries as integers or decimals or reduced fractions.
Do not leave any coefficients outside the matrix.

FAIRFIELD COUNTY MATH LEAGUE 2014-15 Match 3 Team Round

Note: The inverse of a function or relation is not necessarily a function.

- 1.) _____₁₆ 4.) _____
- 2.) _____ 5.) _____
- 3.) _____ 6.) _____

1.) In the hexadecimal (base 16) system, A=10, B=11, C=12, D=13, E=14, and F=15. A three digit number is given in hexadecimal. If you reverse the order of the digits, the new number is FF_{16} greater than the original number. The sum of the digits is $2C_{16}$. Find the original hexadecimal number.

- 2.) If $A=2 \times 10^{-4}$, $B=3 \times 10^6$, and $C=5 \times 10^{-8}$, express $\frac{ABC}{6 + B^2}$ in scientific notation.
- 3.) A decagon has interior angles of 10 distinct measures. If you arrange the angle measurements from smallest to largest, each angle beyond the first measures 7 degrees more than the previous angle. What is the degree measure of the largest angle of the decagon?

- 4.) $f^{-1}(x) = \frac{1}{2}x + 3$ and $g^{-1}(x) = \frac{-1}{3}x + 4$. The product of $f(x)$ and $g(x)$ is a parabola $h(x)$. Find the vertex of $h^{-1}(x)$.

5.) Find all values of x such that $8^{\log_2(x+3)} - x(9^{\log_3(x+4)}) = 107$

6.) The digits 1 through 9 appear in this matrix exactly once, and it forms a "magic square", such that the sum of the numbers in all rows, columns, and the two main diagonals is 15. Place the digits 1 through 6 in the correct positions so that it is a magic square, and write the determinant of this matrix in the answer spot.

$$\begin{vmatrix} 8 & - & - \\ - & - & 7 \\ - & 9 & - \end{vmatrix}$$