

**FAIRFIELD COUNTY MATH LEAGUE (FCML)
2013-2014**

Match 3 Round 1
Arithmetic: Scientific
Notation and Bases

1.) 3

2.) 1220_6

3.) -1

1.) Find all possible values of the digit d such that $dd4_8$ is a multiple of 5.

2.) Divide the number 220_9 by the number 220_3 , multiply the result by 220_4 and give your answer in base 6.

3.) Find all integer values of k such that this expression gives a number between 1 and 10:

$$\frac{(2 \times 10^{-3})^k (3 \times 10^3)}{(9 \times 10^{-2k})^2}$$

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Match 3 Round 2
Algebra: Word Problems

1.) 150

2.) 6.5

3.) 43

1.) Buford has a collection of nickels and dimes with a total value of \$10.00. Rufus has the same number of nickels as Buford has dimes, and the same number of dimes as Buford has nickels, but his collection is worth \$12.50. How many coins does each person have?

2.) Jesse James robs a bank at 9:00 AM and escapes toward the west at 10 miles per hour. The sheriff's office is 2 miles east of the bank. Sheriff Wyatt Earp gets the word in his office at 9:05 AM and begins his pursuit of Jesse James, traveling toward the west at 15 miles per hour. How many miles does Jesse James travel before he gets caught?

3.) When Grant graduated from West Point, Lincoln's age was 8 less than twice Grant's age. Lee graduated from West Point 14 years earlier than Grant. When Lee graduated from West Point, Lincoln's age was 46 less than three times Lee's age. Lee was born 15 years before Grant. If Lincoln was born in 1809, how old was Grant when Lincoln died in 1865?

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Match 3 Round 3
Geometry: Polygons

1.) 157.5

2.) 3

3.) 6, 12

1.) A convex decagon has exactly two interior angles that are right angles. The remaining 8 interior angles are all congruent to each other. What is the degree measure of one of the 8 congruent the interior angles?

2.) How many convex n -gons from $n=4$ through $n=12$ have a number of diagonals that is a multiple of 5?

3.) Ten times the number of sides of a regular convex polygon is equal to the positive difference between the degree measures of one of its interior angles and one of its exterior angles. What are the possible values for the number of sides of the polygon?

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Match 3 Round 4
Algebra 2: Functions and
Inverses

1.) $g(x) = \frac{x^2}{4} - x - 3$

2.) $\frac{x - 52}{27}$

3.) $x > 1$ or $x \leq 0$

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.) The graph of $y = g^{-1}(x)$ is a parabola with vertex at $(-4, 2)$ that passes through the points $(0, 6)$ and $(0, -2)$. Find $g(x)$ in terms of x . Give your answer in the form $g(x) = ax^2 + bx + c$ for constants a , b , and c .

2.) If $f(x) = 3x + 4$, find $f^{-1}(f^{-1}(f^{-1}(x)))$.

3.) $k(5x) = \frac{x^2}{x^2 - 25}$. What is the domain of $k^{-1}(x)$?

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Match 3 Round 5
Advanced Math:
Exponents and Logarithms

1.) 64

2.) 7

3.) $\pm \sqrt{15}$

1.) If $\log_8 a = x$, and $\log_2 b = y$, what is the product of a and b if $1.5x + 0.5y = 3$? (Give a simplified decimal number.)

2.) Solve for all possible values of x: $\log_6 (0.5x + 0.5) + \log_6 (x + 2) = 2$

3.) If you use the approximation $\log_{10} 2 = 0.3$, find all possible values of x such that

$$\log_2(x + 5) - \log_4(x + 4) = \frac{5}{3}$$

FAIRFIELD COUNTY MATH LEAGUE (FCML)

2012-2013¹³¹⁴

Match 3 Round 6
Discrete Math: Matrices

1.) $x = -\frac{1}{3}$ $y = -\frac{4}{3}$

2.) -9600

3.) -1

1 point: Give the values of x and y that make the following true:

$$\begin{bmatrix} 5 & x \\ 2 & y \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 3 & 6 \end{bmatrix} = \begin{bmatrix} 19 & -7 \\ 4 & -10 \end{bmatrix}$$

2 points: If A is the matrix $\begin{bmatrix} 5 & 4 \\ 6 & 5 \end{bmatrix}$ and B is the matrix $\begin{bmatrix} 5 & -4 \\ -6 & 5 \end{bmatrix}$

give the determinant of the matrix represented by $AB^{-1} - BA^{-1}$.

3 points: Give the sum of the nine entries that make up the inverse of the matrix

$$\begin{bmatrix} 2 & 0 & 1 \\ \frac{1}{5} & 1 & 0 \\ 1 & 5 & 1 \end{bmatrix}$$

**FAIRFIELD COUNTY MATH LEAGUE (FCML) 2013-2014 Match 3
TmRound**

- 1.) A. 8
- 2.) $\frac{48}{13}$ hours
- 3.) $\sqrt{2}, 16$
- 4.) $\begin{bmatrix} 4 & -3 \\ -2 & 1 \end{bmatrix}$
- 5.) $3, \frac{29}{4}$
- 6.) 6, 6, 13 or 4, 9, 12 or 6, 8, 12

1.) In the hexadecimal (base 16) system, A=10, B=11, C=12, D=13, E=14, and F=15.

Express in hexadecimal: $\frac{(271_{16} \cdot x10^{-7})}{(19_{16} \cdot x10^{-4})^2} + \frac{(1A4_{16} \cdot x10^{-6})}{(54_{16} \cdot x10^{-5})}$

2.) Tommy, Ray, and Dougie are painters. If Tommy and Ray work together to paint the garage, the job takes 4 hours. If Ray and Dougie work together to paint the garage, the job takes 6 hours. If Tommy and Dougie work together to paint the garage, the job takes 8 hours. How many hours would the job take if all three painters worked together?

3.) Solve for all possible values of x:

$$(\log_4(x^2))^2 + 2 = \frac{9}{\log_x 4}$$

4.) If $ABA = \begin{bmatrix} 22 & -54 \\ -36 & 88 \end{bmatrix}$ and $A = \begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix}$, find the 2x2 matrix B.

5.) $f(x)=x^2+4x-36$ and $g(x)=2x-5$. Find all values of x such that $f(g(x)) - g(f(x))=g^{-1}(x)$.

6.) Three convex polygons A, B, and C have N_A , N_B , and N_C sides respectively. If the total number of diagonals of the three polygons is 83, what are all possible combinations of the three numbers N_A , N_B , and N_C (order does not matter)? Express your answers as N_A, N_B, N_C separated by the word "or".