

## FAIRFIELD COUNTY MATH LEAGUE 2019-2020

Match 3 Round 1 Arithmetic: Scientific Notation and Bases
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1.) \_\_\_\_\_

2.) \_\_\_\_\_

3.) \_\_\_\_\_

1.)\_ Find all digits D such that  $DD1_5$  represents a prime number.

2.) Simplify and express your answer in scientific notation:

$$\frac{(40 * 10^6)^4 * (50 * 10^{-4})^3}{(1250 * 10^4)^2 * (\frac{1}{8} * 10^{-2})^{-5}}$$

3.) In the hexadecimal (base 16) system, A=10, B=11, C=12, D=13, E=14, and F=15. Find the two numbers that solve the equation  $x^2 - px + q = 0$  where  $p=14.A_{16}$  and  $q = C.8_{16}$ . Express your answers in hexadecimal.

# FAIRFIELD COUNTY MATH LEAGUE 2019-2020

Match 3 Round 2  
Algebra: Word Problems

1.) \_\_\_\_\_

2.) \_\_\_\_\_ hours

3.) \_\_\_\_\_ miles

1.) Daisy has a collection of dimes and quarters that have a value of \$6.80. She has 9 more quarters than she has dimes. How many coins does she have altogether?

2) ~~3)~~ Buford and Rufus are math teachers. Rufus can correct the same pile of papers in 1.5 hours more than Buford. Buford takes the stack of papers and begins grading. One hour later, Rufus comes along and helps him until the grading is completed. Rufus works for two hours. How long would it take Buford to grade the papers working alone?

3.)\_ A hawk leaves the train station and flies west at  $H$  mph for 2 hours. A train then departs and travels east at  $T$  mph, while the hawk continues to fly west at the same speed. After the train has been traveling for one hour, the hawk turns around and flies east at a speed that is 5 mph faster than its westbound speed, while the train continues east at  $T$  mph. The time for the hawk to turn around is negligible. The train's eastbound speed is twice the hawk's eastbound speed. After 10 minutes of flying east, the hawk and the train are the same distance from the station but in opposite directions. How far is each object from the train station?

## FAIRFIELD COUNTY MATH LEAGUE 2019-2020

Match 3 Round 3  
Geometry: Polygons

1.) \_\_\_\_\_

2.) \_\_\_\_\_

3.) \_\_\_\_\_

1.) The number of diagonals of an N-sided convex polygon is 405. Find N.

2) The exterior angle of an N-sided regular polygon is an integer but not a multiple of 3. Find all values of N for which this is true if  $N \leq 100$ .

3) A regular octagon has apothem of length 8 cm. Find the positive numerical difference between its perimeter in cm and its area in  $\text{cm}^2$  given

$$\tan(67.5^\circ) = 1 + \sqrt{2}$$

**FAIRFIELD COUNTY MATH LEAGUE 2019-2020**

Match 3 Round 4  
Algebra 2: Functions and  
Inverses

Note: The inverse of a function  
is not necessarily itself  
a function

1.) \_\_\_\_\_

2). Domain: \_\_\_\_\_

Range: \_\_\_\_\_

3.) \_\_\_\_\_

1.)  $f(x) = 2x + 5$  and  $g(x) = 3x - 2$ . Find  $g^{-1}(f^{-1}(x))$

2.) Give the domain and range of  $y = \frac{\sqrt{x+3}}{2-x}$ . If you use interval notation, use union and/or intersection if necessary.

3)  $h(x+1) = x^2 - x - 1$  Give the coordinates of the vertex of the relation  
 $y = h^{-1}(x)$ .

# FAIRFIELD COUNTY MATH LEAGUE 2019-2020

Match 3 Round 5  
Advanced Math:  
Exponents and Logarithms

1.) \_\_\_\_\_

2.) \_\_\_\_\_

3.) \_\_\_\_\_

1.) If  $x = 8^{b+4}$  and  $y = 32^{3b-2}$ , what is  $\log_2(xy)$  in terms of  $b$ ?

2.) Solve for  $x$ . You may use a fractional exponent in your answer.

$$\log_3 x + \log_{27}(x^2) = 1$$

3.) If  $z = \log_5(y)$ , solve for  $y$ :  $\frac{(125)^{z+2}}{(0.04)^{z-3}} = (25)^{z^2+1}$  Express your answer(s) in radical form if necessary.

# FAIRFIELD COUNTY MATH LEAGUE 2019-2020

Match 3 Round 6

Discrete Math: Matrices

1) \_\_\_\_\_

2) \_\_\_\_\_

3.) \_\_\_\_\_

1)

$$C = \begin{bmatrix} 5 & 1 & -1 \\ 2 & -3 & 4 \end{bmatrix}, D = \begin{bmatrix} -2 & 3 \\ -4 & -5 \\ 6 & -6 \end{bmatrix}$$

Find  $CD$ .

2) Find all values of  $k$  such that

$$\begin{vmatrix} k+4 & 2 & 4 \\ k+2 & 3 & 0 \\ 2 & k & 1 \end{vmatrix} = -7$$

3.)

$$A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix}$$

Find the determinant of  $(AB)^{-1} + B^{-1}A^{-1}$ .

**FAIRFIELD COUNTY MATH LEAGUE 2019-20 Match 3 Team Round**

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

1.) \_\_\_\_\_

4.)  $a=$  \_\_\_\_\_  $b=$  \_\_\_\_\_

2.) \_\_\_\_\_

5.) \_\_\_\_\_

3.) \_\_\_\_\_

6.) \_\_\_\_\_

1.) You have M ml of a solution of acid and water that is one-ninth acid. If you add N ml of acid, the solution is 20% acid. If you then add P additional ml of acid, the solution is 50% acid. If you then add 80 additional ml of acid, the solution is 60% acid. Find M+N+P.

2.) In the duodecimal (base 12) system, A=10 and B=11. All numbers in the following matrix equation are in duodecimal. Find all values of d such that

$$\begin{bmatrix} d-41 & 12d+42 \\ -2 & d \end{bmatrix} \begin{bmatrix} A & B \\ 1 & 2 \end{bmatrix} = -76$$

Express your answers in duodecimal.

3.) The sum of the interior angles of an N-gon is 90 less than 35 times the number of its diagonals. Find N.

4.)  $f(x) = 9^{2x+1}$ ,  $g(x) = \log_{27}(2x)$ . If  $y = f(g(x))$  is expressed as  $y = ax^b$  for some numbers a and b where  $x > 0$ , find a and b. Express any radicals in simplest radical form.

5. The amount of electricity used in 1 year in the United States is  $4 \times 10^{12}$  kw-hr. 1 kw-hr is equal to  $3.6 \times 10^5$  joules. The rate at which solar radiation hits the earth is  $1.1 \times 10^3$  watts/square meter. 1 joule = 1 watt/second. Solar collectors are about 20% efficient in converting solar radiation to electricity. There are about  $3.1 \times 10^7$  seconds in one year. The area in square meters that would need to be covered by solar collectors at the current rate of usage and efficiency is  $M \times 10^n$  for some values of M and n. Approximate n to the nearest whole number.

6. Solve for x:

$$\log_6(2x-10) - \log_{36}(x-2) = \frac{1}{2}$$