

2022 Grissom Math Tournament

Comprehensive : 3 – 4 – 5 Team Contest

Sample Round

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1. Evaluate: $2(16 - 9)^2 - 111/3$	2. How many multiples of 5 are there between 144 and 961?
3. Given a cube with edge = 11 inches, let A = the number of cubic inches in the volume of the cube and B = the number of square inches in the surface area of the same cube, what is the value of A – B?	4. Solve for x: $\frac{x+3}{4} - \frac{x+1}{5} = 2$
5. How many distinct arrangements are there of the letters in the word: ALGEBRA ?	

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Round 1

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Round 1

Round 1:

1. Solve for x : $\log_7(5x + 8) - \log_7(2x - 3) = 2$	2. What is the sum of the next two terms in the harmonic series: $1 + \frac{2}{3} + \frac{1}{2} + \frac{2}{5} + \frac{1}{3} + \frac{2}{7} + \dots$?
3. If $f(2\theta) = \frac{(\sec \theta \csc \theta - 2 \tan \theta)}{2}$, and $f(\theta)$ is a single trig function, find $f(\theta)$.	4. What is the area inside an Easter egg with equations: $\begin{cases} x^2 + y^2 = 16 & \text{when } x \leq 0 \\ \frac{x^2}{36} + \frac{y^2}{16} = 1 & \text{when } x > 0 \end{cases}$
5. Solve the system for (x, y, z) : $\frac{3}{x} - \frac{2}{y+3} + 5z = 3$ $\frac{5}{x} + \frac{4}{y+3} + 17z = 16$ $\frac{6}{x} + \frac{6}{y+3} - 11z = 21$	

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Round 2

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Round 2

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1. Solve for x : $2x^4 - 14x^3 + 8x^2 - 56x = 0$	2. Evaluate: $\sum_{n=1}^{\infty} 24 \left(\frac{2}{3}\right)^{n-3}$
3. Evaluate: $\sec \frac{\pi}{6} + \cot \frac{\pi}{3} + \sin \frac{7\pi}{6} - \tan \frac{5\pi}{4}$	4. Write in $a + bi$ form: $\left(-\frac{1}{2} - \frac{\sqrt{3}}{2}i\right)^4$.
5. On what intervals is the graph of $f(x) = \frac{(x^2-1)(x^2+x-12)}{(x^2-4x+4)(x+3)}$ above the x-axis?	

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Round 3

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1. Evaluate: $\begin{vmatrix} 2 & 5 & 7 \\ 6 & -2 & 3 \\ 4 & 1 & 8 \end{vmatrix}$	2. Evaluate: $\lim_{x \rightarrow -\infty} \frac{17x^4 - 14x^5 + 26x^2}{16x^5 + 23x^3 + 2022}$
3. $\sum_{n=4}^{\infty} \left(\frac{1}{n-1} - \frac{1}{n+3} \right)$	4. Use power reduction formulas to write as a single power of cosine: $4 \cos^2 x - \sin^4 x$
5. How many points of intersection do the graphs of $r = 2 \sec \theta$ and $r = 3 + 5 \cos \theta$ have on $\theta \in [0, 2\pi)$?	

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Round 4

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1. Solve for x: $\log_x 3 + \log_x(x + 6) = 2$	2. Evaluate: $\tan\left(\cos^{-1}\left(\frac{3}{5}\right) + \sin^{-1}\left(-\frac{7}{25}\right)\right)$
3. Solve for a: $2^{3a+2} - 37 \cdot 2^{2a} + 41 \cdot 2^a - 2^3 = 0$	4. Evaluate: $\lim_{x \rightarrow 9} \frac{x^2 - 81}{\sqrt{x} - 3}$
5. Given $A = \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix}$, $B = [4 \quad 3 \quad -2]$, $C = [7]$, and $D = \begin{bmatrix} 1 & 0 & 2 \\ 5 & 2 & 3 \\ 7 & 3 & 4 \end{bmatrix}$, find the sum of the elements in matrices M and N if $M = A \cdot B + D$ and $N = B \cdot A + C$.	

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