

WMML
Meet #1
Nov. 9, 2021

Name _____

School _____

Arithmetic and Number Theory

1) How much, in dollars, is 2,021,000 % of a penny?

1. _____

2) Starting with 1, at most how many consecutive positive integers can be added before the sum exceeds 2021?

2. _____

3) Find two numbers whose product is 1,000,000 such that neither number contains a zero.

3. _____

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Algebra 1

1) Solve the following equation for x :

$$|4x - 5| = 2x + 1$$

1. _____

2) For what values of n is $n^{-3} = \left(\frac{1}{n}\right)^5$?

2. _____

3) Bryan has a part-time job delivering packages. He is paid a flat rate of \$9.50 per hour. Caleb works at a competitor that pays its employees \$2 per hour plus \$3 per delivery. How many deliveries would Caleb have to make in 40 hours to earn the same pay as Bryan for a 40 hour work week?

3. _____

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Geometry

1) How many pipes with inside diameter 1 inch are needed to carry the same amount of water as one pipe with inside diameter 10 inches?

1. _____

2) The length of each side of a triangle is increased by 2,000%. By what percent does the area of the triangle increase?

2. _____

3) An equilateral triangle has perimeter P and area A . If $A = 2\sqrt{3}P$, then what is the side length of the triangle?

3. _____

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Algebra 2

1) The vertex of the parabola $y = x^2 - 16x + k$ is on the x -axis.
What is the value of k ?

1. _____

2) Years ago Jack purchased shares of Tesla for a total of \$3,000.
The value of his investment grew by 350% and he wants to give the
shares to his 4 children in the ratio of 3:3:2:2. How much money is
the smallest gift worth?

2. _____

3) If $(x - 3y)^3(x + 3y)^3$ is written as a polynomial in x and y , what
is the sum of its coefficients?

3. _____

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Trigonometry and Complex Numbers

1) Solve for all x where $0 \leq x < 2\pi$.

$$\sin(x - \pi) = \cot\left(\frac{\pi}{6}\right) - 2 \cos\left(\frac{\pi}{6}\right)$$

1. _____

2) Simplify $(i^{2021} + i^{2022} + i^{2023} + i^{2024})^{2021}$.

2. _____

3) Find all possible values of $\angle PQR$ if $PQ = 12$, $QR = 4\sqrt{3}$,
and the area of $\triangle PQR$ is $12\sqrt{6}$.

3. _____

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Precalculus

1) What is the slope of the line that goes through the point $(-3,2)$ and the intersection of the lines $y = 2x + 1$ and $3x + y = 11$?

1. _____

2) The natural numbers from 1 to 2021 are placed into a bag. If one number is drawn randomly from the bag, what is the probability that it is not a multiple of 2 or 3?

2. _____

3) Find the value of k such that the graphs of $(x + 2)^2 + (y - 5)^2 = k$ and $(x - 4)^2 + (y - 1)^2 = k$ have only one point of intersection.

3. _____

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Team Round

1. Starting from right, how many zeros are there before the first non-zero digit after expanding the factorial expression $2021!$?

1. _____

2. How many numbers x in the set $\{1, 2, 3, \dots, 2021\}$ are there such that $x^2 + x^3$ equals the square of an integer?

2. _____

3. Given the regular decagon $ABCDEFGHIJ$, find the measure of $\angle HIA$.

3. _____

4. Three whole numbers, when added together two at a time, have sums of 1202, 2223, and 3021. Determine the value of the largest of the original three numbers.

4. _____

5. If $(\sin(x) - \cos(x))^2 = a^2$, express $\frac{\sin(2x)}{1-a}$ in simplest form in terms of a .

5. _____

6. Let $\mathbf{v} = \begin{pmatrix} 4\sqrt{3} \\ 4 \end{pmatrix}$ and $\mathbf{w} = \begin{pmatrix} 1 \\ \sqrt{3} \end{pmatrix}$ be vectors. Find the projection of \mathbf{v} onto \mathbf{w} .

6. _____