

WMML
Meet #2
Nov. 13, 2018

Name _____

School _____

Arithmetic and Number Theory

1) When n is divided by 5, the remainder is 1. What is the remainder when $3n$ is divided by 5?

1. _____

2) What is the units digit of $7^{42} + 42^7$?

2. _____

3) The number 3456 is currently a base 10 number, what is this number in base 7?

3. _____

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Algebra 1

1) If $j^k = 5$, then what is the value of $j^{2k} + j^{3k} + j^{4k}$?

1. _____

2) The solution to the equation $40x^3 = 625$ can be written in the form $\frac{a}{b}$ where a and b are relatively prime. What is the value of $(ab)^3$?

2. _____

3) A boat travelled 3360 miles across the ocean from Boston to Spain. If the boat had travelled 10 mph faster, it would have made it to Spain 56 hours sooner. How fast was the boat travelling in miles per hour?

3. _____

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Geometry

1) How many scalene triangles have all sides that are integer length and a perimeter less than 10?

1. _____

2) In parallelogram $ABCD$ it is known that $\angle A = 3x + 20^\circ$ and $\angle C = 40 - x^\circ$. What is the measure of $\angle B + \angle D$?

2. _____

3) Given that $ABCD \cdots L$ is a regular dodecagon, find the length AD if $AB = 4$.

3. _____

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Algebra 2

1) Find all x such that $x^2 + x - 30 \geq 0$ and $\frac{6}{x} > 0$.

1. _____

2) Find a constant c such that there is no remainder when $x^3 + cx^2 + 4x - 21$ is divided by $x - 3$.

2. _____

3) What is $\frac{\sqrt{2}}{5-\sqrt{2}-\sqrt{3}}$ when its denominator is rationalized?

3. _____

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Trigonometry and Complex Numbers

1) What is the value of $\tan(2910^\circ)$?

1. _____

2) In isosceles triangle ABC , we are given that $AB = AC = 4$ and $\angle C = 75^\circ$. Find the area of $\triangle ABC$.

2. _____

3) Find all complex numbers z such that

$$|z - 1| = |z + 3| = |z - i|.$$

3. _____

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Precalculus

1) Given $a_0 = 1$, $a_1 = 3$, and the general relation $a_n^2 - a_{n-1}a_{n+1} = (-1)^n$ for $n \geq 1$, find a_3 .

1. _____

2) Evaluate the expression $\log_6 2 + \log_6 27 + \log_6 4$.

2. _____

3) If the line $y = mx + 1$ intersects the ellipse $x^2 + 4y^2 = 1$ exactly once, then find m^2 .

3. _____

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Team Round

1) A store sold 72 decks of cards for \$ $a67.9b$. If every deck cost the same price, then what is the value of $a + b$?
(a and b are both digits between 0 and 9)

1) _____

2) When there is no wind, a plane travelling at a constant rate can cover a round-trip from A to B and back in 10 hours. If the wind blows from A towards B at k km/hr, it adds 25 minutes to the round trip. If A and B are 1000 km apart, then find k .

2) _____

3) A plane intersects a sphere, forming a circle. Find the radius of the circle if the radius of the sphere is 8 and the center of the sphere is 5 units from the plane.

3) _____

4) If $\begin{vmatrix} W & X \\ Y & Z \end{vmatrix} = 4$, then find $\begin{vmatrix} 4W & 4X \\ 4Y & 4Z \end{vmatrix}$.

4) _____

5) If $\sin(x) = \cos(2x)$ and $0 \leq x \leq \pi/2$, then find x .

5) _____

6) A parabola $y = ax^2 + bx + c$ has its vertex at $(4,2)$. If $(2,0)$ is on the parabola, then find abc .

6) _____