

1999 MU ALPHA THETA NATIONALS
GATLINBURG SCHOOL BOWL
ALPHA DIVISION
QUESTION # 1

In a right triangle, the length of the median to the hypotenuse is 5 units. The longer leg is twice the length of the shorter leg. The shorter leg has a length in units of what?

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QUESTION # 3

For what value(s) of x is the following statement true? $\log_8 5 \cdot \log_{25} 4 + \log_x 4 = \log_2 \sqrt[3]{x}$

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QUESTION # 2

Let $\langle x \rangle$ equal the sum of all positive odd integers less than or equal to x , for positive even integers x . Find the numerical value of $\langle\langle 12 \rangle\rangle + \langle\langle 16 \rangle\rangle$

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QUESTION # 4

For what positive value(s) of k will $(2 + ki)^3$ be a real number?

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QUESTION # 5

Find all x such that $12x^4 + 44x^3 - 3x^2 - 99x - 54 = 0$.

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QUESTION # 7

Quadrilateral ABCD is a rhombus with A having coordinates $(-4, -2)$ and C having coordinates $(2, 2)$. If side AD is contained in the line $y = -8x - 34$, then find the coordinates of D.

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QUESTION # 6

A table consist of 2 columns and 50 rows. The left hand column contains the numbers from 1 through 50. The right hand column contains, in each row, the number of positive integer divisors (factors) of the corresponding integer in the left hand column. What will be the largest number in the right hand column?

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QUESTION # 8

If the number of sides of a regular polygon is increased by 4, the resulting regular polygon will have an interior angle that is three degrees less than the measure of an interior angle of the original polygon. How many sides does the original polygon have?

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QUESTION 9A

A side of an equilateral triangle is 20 inches. The midpoints of its sides are joined to form an inscribed equilateral triangle. If this process is continued without end, find the product of the sum of the perimeters of the triangles and the sum of the areas of the triangles.

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QUESTION 9B

Find the difference $b - a$, if two positive numbers, a and b , are in sequence 4, a , b , 12. The first three numbers of this sequence form a geometric sequence and the last three numbers form an arithmetic sequence.

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QUESTION 10A

Find the sum of ALL solutions to the equation $2 \tan x - 4 \sin x \cos x = 0$ for $0^\circ \leq x \leq 360^\circ$.

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QUESTION 10B

Find the sum of the only 30° - 45° - 60° multiples which satisfy the following equation:
 $\tan^4 x - 5 \tan^2 x + 4 = 0$ if $0^\circ \leq x \leq 180^\circ$

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QUESTION 11A

Find the ratio, in lowest terms, of the volume of a right circular cone to the volume of a right circular cylinder if this cone has been inscribed in this cylinder.

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QUESTION 11B

Find the volume, in cubic units, of a right circular cone if this right circular cone whose base radius is 12 units has been inscribed in a sphere of radius 13.

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QUESTION 11C

Find the volume, in cubic units, of a square pyramid which has been inscribed in a right circular cylinder whose base radius is 4 units and height is 9 units.

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QUESTION 11D

Find the smallest integral value for the radius of a right circular cylinder which satisfies the following. Given a right circular cylinder such that the volume, in cubic units, has the same numerical value as its total surface area, in square units.

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QUESTION 12A

Find $a + b$, if the center of the circle $x^2 + y^2 + ax + by + 2 = 0$ is at $(4, -8)$.

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QUESTION 12B

Find the product of the coordinates x and y , if the point (x, y) is the point of intersection of the graph $|y - 1| = |x + 1|$ which forms the shape of an X.

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QUESTION 12C

Find the number of degrees formed at point P if the lines $3x - 4y + 8 = 0$ and $8x + 6y - 4 = 0$ intersects at P.

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QUESTION 12D

Find the value of k so that the graph of $f(x - k)$ will be symmetric to the y -axis and $f(x) = 3x^2 + 4x + 5$