

1999 MU ALPHA THETA NATIONALS
TENNESSEE STATE BOWL
THETA DIVISION
QUESTION # 1

The largest number of consecutive zero place holders that would appear in the product of 11625000 and 102120000 is what?

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QUESTION # 3

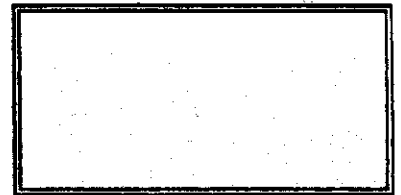
If $\log_2 X + \log_4 X - \log_8 X = 7$, then X equals what?

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QUESTION # 2

Three vertices of a regular hexagon are chosen at random. What is the probability that an isosceles triangle will be formed by connecting these three vertices.

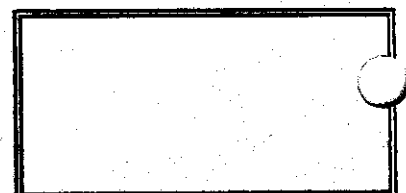
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QUESTION # 4

If $P(x + 2) = x^3 + 9x^2 + 26x + 23$, then $P(x - 2)$ is what?

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QUESTION # 5

One side of a triangle is 4 inches longer than another side. The ray bisecting the angle between these two sides divides the third side into 3 inch and 4 inch segment. Find the perimeter, in inches, of the triangle.

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QUESTION # 7

Find the area of the triangle formed using the centers of the following conic sections.
 $X^2 + Y^2 - 4X - 10Y + 25 = 0$; $3X^2 + 4Y^2 - 24X + 8Y + 40 = 0$; $3X^2 - 2Y^2 + 36X - 8Y + 94 = 0$

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QUESTION # 6

A RUNSUM is a sequence of consecutive positive integers. Three is the smallest RUNSUM of two consecutive integers. ($1 + 2$). Nine is the first number that has two different RUNSUMS: ($2 + 3 + 4$ and $4 + 5$). Fifteen is the first number that has three RUNSUMS: ($1 + 2 + 3 + 4 + 5$ and $7 + 8$ and $4 + 5 + 6$) What is the smallest number with four different RUNSUMS?

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QUESTION # 8

For a given line, the sum of the x and y-intercepts is $6\frac{1}{3}$ and the product is 10. Find all possible value for the slope of this line.

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QUESTION 9A

Find all rational zeros of $f(x) = 4x^3 - 12x^2 - 19x + 12$

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QUESTION 9B

Find the area bounded by the functions $f(x) = -\frac{2}{3}(x+4)^2 + 3$ and $f(x) = -3$

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QUESTION 10A

Solve for x over the Real Numbers: $8^{\frac{1}{6}} + x^{\frac{1}{3}} = \frac{7}{3 - \sqrt{2}}$

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QUESTION 10B

Find the positive value of m such that $P(m, 2m)$ is 5 units from the line $12x + 5y = 1$.

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QUESTION 11A

Find $g(4)$ if $g(x-1) = x^2 + 2$

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QUESTION 11B

Find $g^{-1}(4)$ if $g(x) = x^3 - 4$

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QUESTION 11C

Find $f^{-1}(g(h(5)))$ if $f(x) = x - 1$, $g(x) = 3x$, and $h(x) = \frac{5}{x}$

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QUESTION 11D

Find the value of A if the point $(3, 2)$ lies on the graph of the inverse of $f(x) = 2x^2 + x + A$

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QUESTION 12A

Given $f = \{(0, -3), (2, 5), (-1, 1), (4, 2)\}$, $g = \{(-1, 2), (1, 4), (4, 3), (0, -1)\}$, and $h = \{(4, 2), (1, 0), (-3, 4), (3, -1)\}$, find $f(g(h(x)))$.

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QUESTION 12B

Solve for all values of x : $2^x + 2^x + 2^x + 2^x = 2^{x^2}$

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QUESTION 12C

In the expansion of $(2x + c)^8$, for some non-zero value of the constant c , the fourth and fifth terms have the same numerical coefficient. Find the value of c .

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QUESTION 12D

Find the smallest positive integer which has exactly 27 distinct positive integral factors.