

Question #0

Alpha Ciphering

MAΘ National Convention 2007

What is the period of the function

$$f(x) = \cos^4 x - \sin^4 x?$$

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Question #1

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The sum of the solutions to the equation: $x^2 \log 2 + 5x = \log 64 + 5x \log 5$ is an integer **K**. What is the value of **K**?

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$$\sum_{n=6}^{\infty} \frac{4}{n^2 - 8n + 15} = ?$$

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Question #3

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Find the sum of the solutions of

$$\tan x \sin x - 1 - \sin x + \tan x = 0 \text{ over } [0, 2\pi).$$

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Question #4

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Find the area of the quadrilateral whose vertices are the two foci and the endpoints of the minor axis of the following ellipse:

$$3x^2 + 2y^2 - 24x + 12y + 60 = 0$$

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Question #5

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Find the “sum of the limits”:

$$\lim_{x \rightarrow 3} \frac{3 - \sqrt{x+6}}{3-x} + \lim_{x \rightarrow 0} \frac{\frac{1}{x+4} - \frac{1}{4}}{x}$$

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Question #6

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$$\text{Matrix } A = \begin{pmatrix} 1 & 3 & -2 \\ 2 & 2 & 1 \\ -1 & 1 & 4 \end{pmatrix}.$$

What is the sum of the entries in the third row of A^{-1} ?

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Question #7

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5,9,19,35,... is a quadratic sequence that can be expressed in the form

$$a_n = An^2 + Bn + C \text{ for } n = 1, 2, \dots:$$

What is the value of $A - B + C$?

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Question #9

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Question #10

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