#0 Alpha Ciphering
MAΘ National Convention 2016

Find the sum of the integer values of x for which $4x^4 + 16x^3 - 7x^2 - 28x = 0$.

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If $\sin\frac{p}{9}$ and $\cos\frac{p}{9}$ are the roots of $x^2 - bx + c = 0$, find b in terms of c.

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#2 Alpha Ciphering
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The domain of $y=\log_{3x-2}\left(\dfrac{x^2-x-2}{x^2-x-6}\right)$ can be written in the form $\left(A,B\right)\text{È}\left(C,D\right)\text{È}\left(E,\text{¥}\right)$. Find the value of $A+B+C+D+E$, written as an improper fraction.

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#3 Alpha Ciphering
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Find the sum of the elements in the third column of A^{-1} if $A = \begin{bmatrix} 5 & -3 & 2 \\ 2 & 4 & -3 \\ 4 & -2 & 5 \end{bmatrix}$. Write your answer as a fraction.

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Find the smallest root of
$250x^3 - 1075x^2 + 645x - 54 = 0$, given that its roots are in geometric progression.

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#5 Alpha Ciphering
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A biologist is studying patterns of male (M) and female (F) children in families. A family type is designated by a code. For example, FMM denotes a family of three children of which the oldest is a female and the other two are males. (Note that FMM, MFM, and MMF are different types.) How many family types are there among families with at least one but not more than seven children?

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#7 Alpha Ciphering
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Simplify, where $i = \sqrt{-1}$:

$$(1+i)^2 + (1+i)^3 + (1+i)^4 + (1+i)^5 +$$
$$(1-i)^2 + (1-i)^3 + (1-i)^4 + (1-i)^5.$$

#7 Alpha Ciphering
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#8 Alpha Ciphering
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Evaluate: $\sum_{n=1}^{\infty} \frac{4}{n^2+4n+3}$. Write your answer as an improper fraction.

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#10 Alpha Ciphering
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Seven friends are sitting in a theater on a row with only seven seats. After intermission, they return to the same row but choose their seats randomly. What is the probability that neither of the people siting in the two aisle seats was previously sitting in the aisle seat? Express your answer as a fraction.

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#11 Alpha Ciphering
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When the solutions to $x^3 - 64 = 0$ are graphed and connected on the complex (Argand) plane, a triangle is formed. Find the area enclosed by this triangle.

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#12 Alpha Ciphering
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