#0 Alpha Ciphering
MAΘ National Convention 2011

Evaluate:

$$\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \cdot \ldots \cdot \cos 179^\circ$$

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$$\sum_{n=1}^{2011} ni^n$$

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#3 Alpha Ciphering
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Jeff has an unfair coin. If this unfair coin is flipped a total of 6 times, it is equally likely for the result of these 6 flips to contain exactly 4 heads as it is for the result to contain exactly 3 tails. What is the probability of flipping tails if Jeff's unfair coin is flipped once? Assume each of the probabilities of flipping a head and flipping a tail are nonzero.

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The graph of $y=\dfrac{x-2}{\sqrt{x+7}-3}$ has a removable discontinuity, or hole, at the ordered pair where $x=2$. What is the y-coordinate of this ordered pair?

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#5 Alpha Ciphering
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Find the length of a tangent segment from the point $(3,4)$ to the circle with equation $x^2+4x+y^2+8y+12=0$.

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#6 Alpha Ciphering
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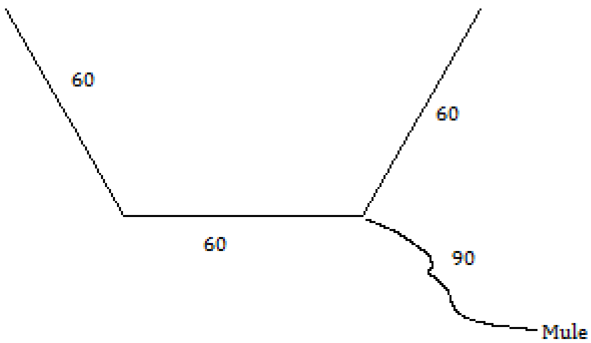
A farmer is in the process of making a regular hexagonal corral with side of length 60 feet. When he is exactly halfway complete, he tethers his mule to one of the corner posts as shown in the diagram with a rope 90 feet long. How much area does the mule have to roam? Assume there are no obstructions other than the 3 pieces of completed fence.



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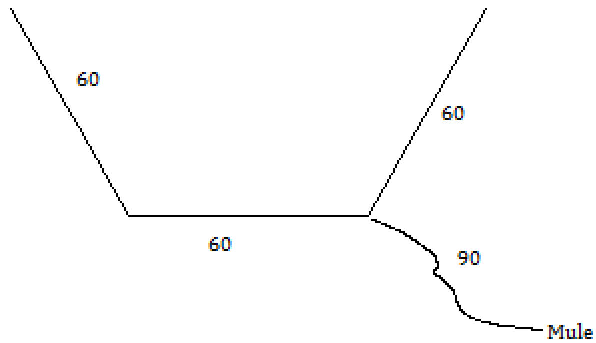

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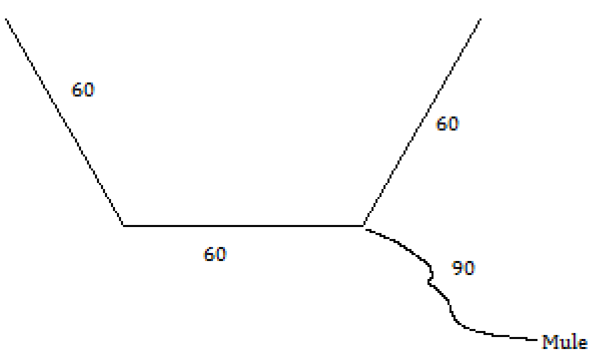

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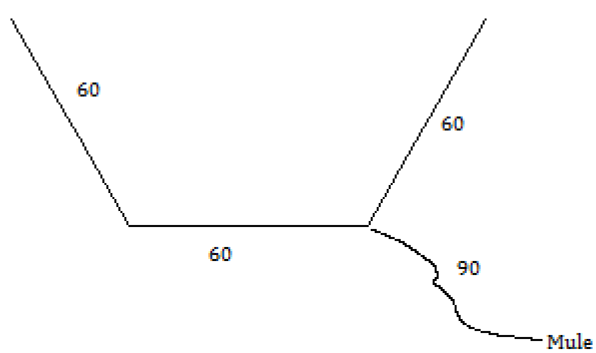

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Solve for x:

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#8 Alpha Ciphering
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Solve the inequality and express the answer in interval notation:

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When the positive integral factors of 432 are listed in ascending order, what is the 17th number in the list?

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#11 Alpha Ciphering
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Find the value of $A-2B-C$, where A, B, and C are integers satisfying the equation

$$\frac{2x^2+3x-2}{x^3+3x^2+3x+1}=\frac{A}{x+1}+\frac{B}{(x+1)^2}+\frac{C}{(x+1)^3}.$$

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26 cards showing A, B, C,…, X, Y, Z are shuffled, then dealt and revealed to form a sequence of 26 letters. What is the probability that either the sequence "WIN" or the sequence "FAIL" appear somewhere in this sequence?

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When 2011! is converted to base 12, in how many consecutive zeros does this base 12 number end?

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