#0 Alpha Bowl
MAΘ National Convention 2018

$A = \sum_{n=91}^{179} \sin\left(n^\circ\right)$

$B = \sum_{n=91}^{179} \cos\left(n^\circ\right)$

Find the value of $\frac{A}{B}$.

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Find the value of $\frac{A}{B}$.

#1 Alpha Bowl
MAΘ National Convention 2018

The oblique asymptote for the function $y = \frac{3x^3 - 17x^2 + x + 15}{2x^2 + 9x + 3}$ can be written in the form $y = Ax + B$, where A and B are real numbers.

The non-linear asymptote for the function $y = \frac{6x^5 + 2x^3 - 13x^2 + 9x - 8}{3x^3 + 4x^2 - 8x - 4}$ can be written in the form $y = Cx^2 + Dx + E$, where C, D, and E are real numbers.

Find the numerical value of $A + 2B + C + D + 3E$.

#1 Alpha Bowl
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Find the numerical value of $A + 2B + C + D + 3E$.

#2 Alpha Bowl
MAΘ National Convention 2018

Find the domain of the function $g(x)=\sqrt{\frac{3x^2+4x-4}{5x^2+16x+12}}$, written in interval notation.

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#3 Alpha Bowl
MAΘ National Convention 2018

Given that $\alpha = \cos^{-1}\frac{3}{5}$, $\beta = \pi + \cos^{-1}\left(-\frac{5}{13}\right)$, and $\gamma = \frac{\pi}{2} + \cos^{-1}\left(-\frac{15}{17}\right)$, find the value of $\cos(\alpha+\beta+\gamma)$.

#3 Alpha Bowl
MAΘ National Convention 2018

Given that $\alpha = \cos^{-1}\frac{3}{5}$, $\beta = \pi + \cos^{-1}\left(-\frac{5}{13}\right)$, and $\gamma = \frac{\pi}{2} + \cos^{-1}\left(-\frac{15}{17}\right)$, find the value of $\cos(\alpha+\beta+\gamma)$.

#4 Alpha Bowl
MAΘ National Convention 2018

$A = \sum_{i=7}^{18} \left(i^2 \right)$

$B = \sum_{i=1}^{100} \left(\left(2i - 1 \right)^3 \right)$

Find the remainder when B is divided by A.

#4 Alpha Bowl
MAΘ National Convention 2018

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Find the remainder when B is divided by A.

#5 Alpha Bowl
MAΘ National Convention 2018

Let *A* be the greater solution of the equation $9^x - 3^{x+2} + 18 = 0$.

Let *B* be the greatest absolute value of the roots of the polynomial $f(x) = x^4 + 4x^3 + 4x^2 - 4x - 5$.

Let $C = \lim_{h \to 0} \frac{f(1+h) - f(1)}{h}$, where $f(x) = 3x^2 - 5x + 1$.

Find the value of $\left(B \cdot \frac{(C+B)^2 + (C-B)^2}{(C+B)^2 - (C-B)^2} \right)^A$.

#5 Alpha Bowl
MAΘ National Convention 2018

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#6 Alpha Bowl
MAΘ National Convention 2018

In twelve years of teaching AP Calculus BC, I had 173 students take the AP exam, with scores of the following: 106 5s, 32 4s, 22 3s, 5 2s, and 8 1s. Let *A*, *B*, and *C* be the mean, median, and mode, respectively, of these scores on the exam, all rounded to the nearest hundredth.

In twelve years of teaching AP Calculus AB, I had 482 students take the AP exam, with scores of the following: 104 5s, 125 4s, 120 3s, 62 2s, and 71 1s. Let *D*, *E*, and *F* be the mean, median, and mode, respectively, of these scores on the exam, all rounded to the nearest hundredth.

Find the largest positive prime integral divisor of $100(A+B+C+D+E+F)$.

#6 Alpha Bowl
MAΘ National Convention 2018

In twelve years of teaching AP Calculus BC, I had 173 students take the AP exam, with scores of the following: 106 5s, 32 4s, 22 3s, 5 2s, and 8 1s. Let *A*, *B*, and *C* be the mean, median, and mode, respectively, of these scores on the exam, all rounded to the nearest hundredth.

In twelve years of teaching AP Calculus AB, I had 482 students take the AP exam, with scores of the following: 104 5s, 125 4s, 120 3s, 62 2s, and 71 1s. Let *D*, *E*, and *F* be the mean, median, and mode, respectively, of these scores on the exam, all rounded to the nearest hundredth.

Find the largest positive prime integral divisor of $100(A+B+C+D+E+F)$.

#7 Alpha Bowl
MAΘ National Convention 2018

A committee is to be formed, composed of exactly two males and exactly four females. The committee must contain at least two faculty members and at least two students. If four male and three female faculty members apply for the committee, and if two male and three female students apply for the committee, how many distinct committees can be formed using these applicants? Two committees are distinct if one committee contains a member that the other does not. Additionally, each person is either male or female, and each person is either a faculty member or a student.

#7 Alpha Bowl
MAΘ National Convention 2018

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#8 Alpha Bowl
MAΘ National Convention 2018

Find the area enclosed by the graph of the polar equation $r + \frac{163}{r} = 16\cos\theta + 20\sin\theta$.

#8 Alpha Bowl
MAΘ National Convention 2018

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#9 Alpha Bowl
MAΘ National Convention 2018

Suppose Pythagorean triples are given as ordered triples (a,b,c), where the first two coordinates represent the leg lengths, while the third coordinate represents the hypotenuse length. If (a,b,c) is a Pythagorean triple written in this way, then $(Da-2b+2c,2a+Eb+2c,2a-2b+Fc)$ is also a Pythagorean triple written in this way, where *D*, *E*, and *F* are non-zero integers. Find the value of the product $D\cdot E\cdot F$.

#9 Alpha Bowl
MAΘ National Convention 2018

Suppose Pythagorean triples are given as ordered triples (a,b,c), where the first two coordinates represent the leg lengths, while the third coordinate represents the hypotenuse length. If (a,b,c) is a Pythagorean triple written in this way, then $(Da-2b+2c,2a+Eb+2c,2a-2b+Fc)$ is also a Pythagorean triple written in this way, where *D*, *E*, and *F* are non-zero integers. Find the value of the product $D\cdot E\cdot F$.

#10 Alpha Bowl
MAΘ National Convention 2018

Suppose that *A*, *B*, and *C* are the solutions to the polynomial equation $x^3+5x^2-11x-9=0$. Find the numerical value of $A^2(B+C)+B^2(A+C)+C^2(A+B)$.

#10 Alpha Bowl
MAΘ National Convention 2018

Suppose that *A*, *B*, and *C* are the solutions to the polynomial equation $x^3+5x^2-11x-9=0$. Find the numerical value of $A^2(B+C)+B^2(A+C)+C^2(A+B)$.

#11 Alpha Bowl
MAΘ National Convention 2018

Suppose that *f* is a polynomial of degree 2018 such that $f(n)=\frac{1}{n-1}$ for all integers *n* satisfying $2\le n\le 2020$. Find the value of $f(2022)-f(2021)$.

#11 Alpha Bowl
MAΘ National Convention 2018

Suppose that *f* is a polynomial of degree 2018 such that $f(n)=\frac{1}{n-1}$ for all integers *n* satisfying $2\le n\le 2020$. Find the value of $f(2022)-f(2021)$.

#12 Alpha Bowl
MAΘ National Convention 2018

Find the remainder when $\sum_{n=1}^{10}\left(n^n\right)$ is divided by 100.

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#13 Alpha Bowl
MAΘ National Convention 2018

The sixth grade at Mu Alpha Theta Middle School consists of 190 right-handed students and 24 left-handed students. Among these students, there are seven times as many right-handed females as left-handed females, and there are nine times as many right-handed males as left-handed males. What is the probability, written as a decimal rounded to the nearest thousandth, that a right-handed student selected randomly from the sixth grade at Mu Alpha Theta Middle School is female? Assume each sixth grade student at Mu Alpha Theta Middle School is 1) either male or female, and 2) either left- or right-handed.

#13 Alpha Bowl
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#14 Alpha Bowl
MAΘ National Convention 2018

Four cars are numbered 1, 2, 3, and 4, and they are to be parked in garages numbered 1, 2, 3, and 4, with one car per garage. Let *A* be the number of distinct ways in which the cars may be parked so that no car is parked in a garage with the same number, and let *B* be the number of distinct ways in which the cars may be parked so that exactly one car is parked in a garage with the same number. Find the sum of the positive integral divisors of $A \cdot B + A + B + 19$.

#14 Alpha Bowl
MAΘ National Convention 2018

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