2010 Mu Alpha Theta National Convention – Relay Test

QUESTION 0

Theta

Solve for x: $4x - 5 = 23$

Alpha

Evaluate $\dfrac{A!}{5!}$

Calculus

Find $\displaystyle\int_{1}^{2} Bx\ dx$

QUESTION 1

Theta

Let $f(x) = 4x^2 + 7x + 5$. If S is the sum of the roots of $f(x)$, and P is the product of the roots of $f(x)$, find the value of $(S + P)^2$.

Alpha

Let $f(x) = \dfrac{1}{A}\cos(A\pi x) + 2010$. If M is the amplitude of the graph of $f(x)$, and P is the period of the graph of $f(x)$, then find the value of MP.

Calculus

What is the volume of the resulting solid formed when the region bounded by $y = x^B$, $x = 1$ and $y = 0$ is revolved about the $x-$axis?

QUESTION 2

Theta

What is the value of $r+s+tu$ if

$$\begin{bmatrix} -1 & 4 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 2 & 1 \\ 3 & 7 \end{bmatrix} \cdot \begin{bmatrix} 8 & -5 \\ -4 & -10 \end{bmatrix} = \begin{bmatrix} r & s \\ t & u \end{bmatrix} ?$$

Alpha

Consider the digits of A as the form of a number that is ALREADY in base-9. When A is changed to a base-10 number, what is the largest digit of the base-10 number?

Calculus

A sphere's radius is increasing at a rate of B feet per second. What is the instantaneous rate of change of its volume, in cubic feet per second, at the instant that the radius is 5 feet?

QUESTION 3

Theta

What is the length of the major axis of the ellipse with equation
$x^2 + 2y^2 + 6x + 8y - 4 = 0$?

Alpha

In $\triangle PQR$, $m\angle Q = 90°$, $PQ = \sqrt{35}$, and $PR = A$. What is the value of $\tan P$?

Calculus

Find $f'(32)$ if $f(x) = x^2 + x^{\left(\frac{B}{\sqrt{35}} + \frac{6}{5}\right)}$.

QUESTION 4

Calculus

If $x^2 + xy + \dfrac{3}{2}y^2 = 9$, then find the value of $\dfrac{dy}{dx}$ at the point $(1,2)$.

Theta

What is the sum of the series $A + A^2 + A^3 + A^4 + \ldots$?

Alpha

What quadratic polynomial function, in the form $f(x) = x^2 + px + q$, has leading coefficient 1 and exactly two roots which are 9 and $22B$?

QUESTION 5

Calculus

If $\displaystyle\int_2^8 \ln x \, dx$ is approximated using a right-hand Riemann sum with 3 subintervals of equal length, and the approximation is equal to $\ln P^2$, what is the value of P?

Theta

A special deck of A cards has 12 jokers, and the remaining cards are split evenly among 3 different suits. If 2 cards are drawn at random without replacement, what is the probability that the second card is of the same suit as the first card? Note: Jokers are not part of any suit. If two jokers are drawn, they are not considered "same suit."

Alpha

If the probability of an event occurring is B, what are the odds it does not occur?

QUESTION 6

Calculus

If $\dfrac{dy}{dx} = \dfrac{2x}{y}$, and $x = 1$ when $y = 0$, then the particular solution is $y^2 = P(x)$, where $P(x)$ is what second-degree polynomial?

Theta

Given $f(x) = A$. If $(0, w)$ is the vertex, and $(\pm p, 0)$ are the $x-$intercepts (where $p > 0$), what is the value of $p - w$?

Alpha

If $\cos\phi = \dfrac{3}{5}$, $0 < \phi < \dfrac{\pi}{2}$, and $\sin\gamma = \dfrac{B}{7}$, $0 < \gamma < \dfrac{\pi}{2}$, what is the value of $\sin(\phi + \gamma)$?

QUESTION 7

Alpha

What is the area of a triangle with two sides of length 8 and 10 and the included angle of $60°$?

Calculus

The region bounded by $y = 0$, $y = x^{1/2}$, $x = \sqrt{2}$, and $x = A$ is the base of a solid. Each cross section perpendicular to the $x-$axis is a square. What is the volume of the solid?

Theta

B_{10} is what base-5 number?

QUESTION 8

Alpha

What is the second-smallest positive solution to $\tan 6x = 1$?

Calculus

If $y = \sin x \tan x$, find $y'(6A)$.

Theta

Simplify $\dfrac{8}{\dfrac{3}{2} + \dfrac{B}{3}}$.

QUESTION 9

Alpha

The hyperbola with equation $x^2 - y^2 - 8x + 10y - 58 = 0$ has asymptotes with y-intercepts $(0, a)$ and $(0, b)$, where $a > b$. What is the value of a?

Calculus

Evaluate $\lim\limits_{x \to A} \dfrac{x^2 - 100}{x - 10}$

Theta

If $\sqrt{B + \sqrt{B + \sqrt{B + \ldots}}} = \dfrac{1 + \sqrt{Q}}{2}$, then what is the value of Q?