Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 1

Let $f(\theta) = 2\cos^2(\theta)\sin(\theta)$.

Give the value of the element of

$$\left\{ f(\pi),\ f\left(\frac{2\pi}{3}\right),\ f\left(\frac{5\pi}{4}\right),\ f\left(\frac{\pi}{6}\right) \right\}$$

that is the least. (Your answer must be the **value** – that means no f.)

Answer:

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Answer:

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 # 2

Two of the roots of the third-degree polynomial function $p(x) = ax^3 + bx^2 + cx + d$ are $(i - 2)$ and 5. The value $p(x)$ approaches ∞ as x approaches $-\infty$. If all coefficients are relatively prime integers, then find $\frac{a+b+c}{d}$.

Answer:

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Answer:

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 # 3

In triangle ABC, $AB = 12$, $BC = 10$, and $\sec^2(B) = \frac{8}{5}$. Find the area of the triangle.

Answer:

Hustle
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 # 4

If $a = \log 2$, $b = \log 3$, and $c = (\ln 10)$ then express $(\ln 6)$ in terms of a, b, and c in such a way that a, b, and c are the only irrational numbers in your answer.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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 # 5

The population (P) of my Sea Monkey tank perfectly obeys the equation $P(t) = \frac{36}{1+3e^{-6t}}$. Of course, the thought of partially formed Sea Monkeys is disgusting, so the population is always rounded to the nearest integer. Find the product of the least and greatest number of Sea Monkeys that you might find in my tank when $t \geq 0$.

Answer:

Hustle
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#6

Let the following three vectors be defined:
$\vec{W} = \langle -3,2,5 \rangle$, $\vec{X} = \langle 1,4,-2 \rangle$, $\vec{Y} = \langle -10,5,2 \rangle$.
Find $\left(\vec{W} \times \vec{X}\right) \bullet \vec{Y}$

Answer:

Hustle
PreCalculus/Calculus
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Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 7

Determine the eccentricity of the ellipse defined by the polar equation $2r\cos\theta = 24 - 3r$

Answer:

Hustle
PreCalculus/Calculus
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 # 8

Let M be a complex number selected at random from the set of all complex numbers with absolute values less than 4. What is the probability that M has an absolute value greater than 3?

Answer:

Hustle
PreCalculus/Calculus
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 # 9

Evaluate: $$\lim_{x \to 0.\overline{6}} \left(\frac{27x^3 - 8}{21x^2 + 10x - 16} \right)$$

Answer:

Hustle
PreCalculus/Calculus
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Answer:

Hustle
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Mu Alpha Theta 2006

 # 10

Find the greatest real value of x that satisfies the equation $5x^4 + 4x^2 = 1$.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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 # 11

In triangle DEF, $EF = 2$, $m\angle D = \frac{\pi}{2}$, and $m\angle E = \frac{\pi}{12}$. Find DE.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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In triangle DEF, $EF = 2$, $m\angle D = \frac{\pi}{2}$, and $m\angle E = \frac{\pi}{12}$. Find DE.

Answer:

Hustle
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Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 12

A circle with five times the area of the unit circle's area is centered at the polar point $\left(2\sqrt{2}, -45^\circ\right)$. When the circle's equation is expressed in the form $x^2 + Bx + y^2 + Dy + E = 0$, evaluate $B + DE$.

Answer:

Hustle
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 # 12

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 # 13

Let $f\left(x-\dfrac{\pi}{6}\right)=4\sin(3x+0.5\pi)$ and $g(x)=f\left(|x|+\dfrac{\pi}{3}\right)$. Evaluate $g\left(\dfrac{4\pi}{3}\right)$.

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Answer:

Hustle
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Mu Alpha Theta 2006

 # 14

Express 20.27° in DMS (degrees, minutes, seconds) form.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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Answer:

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#15

Find the angle (in radians) on the interval $[0,2\pi)$ that is coterminal with the angle in standard position measuring -2006°.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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 # 16

A wheel with a 6-foot radius rolls along a dusty road. The wheel makes 31 complete revolutions every two minutes. Find the wheel's linear speed, in **yards per hour.**

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 16

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#17

Consider a magical world with a magical elf who lives forever and has the magical ability to draw hexagons of any size. He has decided to do nothing but to draw a single regular hexagon for each number in the sequence 16 , 8, 4, 2, … in such a way that each hexagon has a perimeter equal to its corresponding number. Find the total area of all these hexagons.

Answer:

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Answer:

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PreCalculus/Calculus
Mu Alpha Theta 2006

 # 18

Find $P^{-1}(5)$, if $P(x)=\dfrac{3x-1}{2x+3}$.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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Answer:

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Mu Alpha Theta 2006

 # 19 Consider the following table of values (f is not necessarily continuous over any interval):

x	0.5	2	3	4
$f(x)$	-10	-2	2	-3

Let $A = f(-2)$ if it is given that f is even.
Let $B = f(-3)$ if it is given that f is odd.
Let $C = g(-2)$, if $g(x) = f^{-1}\left(-|x|\right)$ and f is a one-to-one function.

Find $A + 4B - 5C$.

Answer:

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 # 20

The vectors $<k,3>$ and $<-1,4>$ are orthogonal.

The vectors $<-2,m>$ and $<7,5>$ are parallel.

Evaluate $\dfrac{k}{m}$.

Answer:

Hustle
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#21

Let $f(\theta) = \tan\theta$. Evaluate $f''\left(\frac{\pi}{4}\right)$.

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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Answer:

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 # 22

Evaluate: $$\lim_{h\to 0}\frac{\frac{1}{4+2h}-\frac{1}{4}}{h}$$

Answer:

Hustle
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Mu Alpha Theta 2006

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Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 23

Evaluate: $\lim_{x \to 0} \frac{\tan x}{x}$

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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Evaluate: $\lim_{x \to 0} \frac{\tan x}{x}$

Answer:

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Evaluate: $\lim_{x \to 0} \frac{\tan x}{x}$

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

 # 24

Evaluate: $\int_{-1}^{3} \left(2x^2+1\right)dx$

Answer:

Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

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Evaluate: $\int_{-1}^{3} \left(2x^2+1\right)dx$

Answer:

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Answer:

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#25
Triangle ABC is growing continuously over time, but in such a way that *AB* always equals *BC*. At one particular instant, *AB* is increasing at the rate of 2 m/sec, and $m\angle B$ is increasing at the rate of 0.2 radians/sec. If $AB = 10$ and $m\angle B = \frac{\pi}{6}$ at the same instant, then how fast is the triangle's area increasing at that instant (in square meters per second)?

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Hustle
PreCalculus/Calculus
Mu Alpha Theta 2006

#25
Triangle ABC is growing continuously over time, but in such a way that *AB* always equals *BC*. At one particular instant, *AB* is increasing at the rate of 2 m/sec, and $m\angle B$ is increasing at the rate of 0.2 radians/sec. If $AB = 10$ and $m\angle B = \frac{\pi}{6}$ at the same instant, then how fast is the triangle's area increasing at that instant (in square meters per second)?

Answer: