# Question #0
Seat 1 – Theta

Solve for $x$: $2x + 5 = 11$

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# Question #0
Seat 2 – Alpha

Evaluate $\cos\frac{\pi}{A}$.

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# Question #0
Seat 3 – Mu

Given that $f(x) = 4x^2 + 3x + 2$, find the value of $f'(B)$.

# Question #1
## Seat 1 – Theta

Evaluate $(\log_2 16)(\log_{49} 7) + (\log_5 1331)(\log_{11} 625)$.

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# Question #1
## Seat 2 – Alpha

Find the positive difference between the zeros of $f(x) = x^2 - Ax - 72$.

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# Question #1
## Seat 3 – Mu

A particle moves along the $x$-axis so that its position at any time $t \geq 0$ is $x(t) = \frac{1}{12}t^3 + \frac{1}{4}t^2 + \ln t$, where $t$ is measured in seconds.

What is the acceleration, in units per second squared, of the particle at $t = B$?

# Question #2
## Seat 1 – Theta

The focus of the parabola with equation $y^2 - 20x - 4y + 304 = 0$ has coordinates $(p, q)$. What is the value of $(2p + 5q)$?



# Question #2
## Seat 2 – Alpha

An ellipse with center at $(1, A)$ has a horizontal major axis of length $A$, and an area of $100\pi$. The endpoints of the minor axis of the ellipse are $(1, r)$ and $(1, s)$, where $r < s$.

Find the value of $s$.



# Question #2
## Seat 3 – Mu

The area bounded by the graphs of $y = x + k$, $y = 0$, $x = 0$, and $x = k$ is the base of a solid. Cross-sections of the solid perpendicular to the $x$-axis are squares. The volume of the solid is $B$.

Given that $k > 0$, find the value of $k^3$.

# Question #3
Seat 1 – Theta

Find the base-10 number which is equivalent to the base-6 number $12.3_6$.

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# Question #3
Seat 2 – Alpha

The row-2, column-2 entry of matrix $X^{-1}X^T$ is $A$. If $X = \begin{bmatrix} 1 & 2 \\ 3 & k \end{bmatrix}$, then what is the value of $k$?

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# Question #3
Seat 3 – Mu

It is given that $\frac{dy}{dx} = x^2 - x^4$ and that $y = B$ when $x = 2$. What is the value of $y$ when $x = 1$?

# Question #4
## Seat 1 – Mu

The values of twice-differentiable functions $f$, $g$, and their first and second derivatives are shown in the table for selected values of $x$.

| $x$ | $f$ | $f'$ | $f''$ | $g$ | $g'$ | $g''$ |
|---|---|---|---|---|---|---|
| 2 | $-4$ | 8 | $-1$ | 3 | 10 | $-5$ |
| 3 | 7 | $-20$ | $-9$ | 2 | 6 | 4 |

Evaluate $\frac{d}{dx}\Big(f\big(g(x)\big)\Big) + \frac{d^2}{dx^2}\big(x^2\, g(x)\big)$ where $x = 3$.

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# Question #4
## Seat 2 – Theta

Find the total number of positive integer factors of $||\lfloor A \rfloor||$, where $\lfloor A \rfloor$ represents the greatest integer value of $A$.

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# Question #4
## Seat 3 – Alpha

Find the sum of the digits of the base-10 representation of $\left|\left|\left(1 + i\sqrt{3}\right)^B\right|\right|$, where $i = \sqrt{-1}$ and where $\lfloor k \rfloor$ represents the greatest integer function of $k$.

# Question #5
Seat 1 – Mu

Given $f(x) = x^2 + \sqrt[3]{x}$ with domain $x \geq 0$, let $L$ be the line tangent to the graph of $f$ at the point where $x = 1$. Using $L$, find the $y$-value that represents an approximation to the function $f$ where its exact $y$-value is 66.

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# Question #5
Seat 2 – Theta

A regular $\lfloor A \rfloor$-gon has exterior angles (one at each vertex) whose degree measures form an arithmetic sequence with a common difference of 1. The smallest exterior angle has a measure of $k°$.

Find the value of $k$.

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# Question #5
Seat 3 – Alpha

Determine the number of $x$-intercepts of the graph of $y = \sin Bx$ on the interval $0 \leq x \leq 2\pi$.

# Question #6
## Seat 1 – Mu

The region bounded by the graphs of $= \frac{1}{\sqrt{1-x^2}}$, $y = 2 - x$, $x = 0$, and $x = \frac{1}{2}$ has an area of $P + Q\pi$ for rational numbers $P$ and $Q$. Find the value of $P + Q$.

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# Question #6
## Seat 2 – Theta

The value of $x$ such that $\frac{x}{1+\frac{x}{1+\frac{x}{1+\cdots}}} = |A|$ can be written as a positive fraction $\frac{P}{Q}$, where $P$ and $Q$ are relatively prime positive integers. Find the value of $P + Q$.

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# Question #6
## Seat 3 – Alpha

Let $k$ be the sum of the digits of the base-10 representation of $B$.

Find the value of $\sin\left(\frac{k\pi}{3}\right) + \sin\left(\frac{B\pi}{3}\right)$.

# Question #7
## Seat 1 – Alpha

Evaluate $\lim_{x\to\infty} \frac{3x+2+2\sin}{x}$.

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# Question #7
## Seat 2 – Mu

The right-sided Riemann sum approximation of $\int_1^A (x \ln x)dx$ using two equal subdivisions is equal to $\ln k$ for some positive integer $k$. What is the value of $k$?

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# Question #7
## Seat 3 – Theta

Let $s$ equal the sum of the digits of the base-10 representation of $B$.

An infinite geometric sequence has first term $s$ and sum $B$. Find the common ratio of the sequence.

# Question #8
## Seat 1 – Alpha

Given vectors $\mathbf{v} = 2\mathbf{i} - 5\mathbf{j} + 4\mathbf{k}$ and $\mathbf{w} = 7\mathbf{i} - 6\mathbf{j} - 9\mathbf{k}$:

If $\mathbf{v} \times \mathbf{w} = p\mathbf{i} + q\mathbf{j} + r\mathbf{k}$ for scalars $p, q, r$, then find the value of $(\mathbf{v} \cdot \mathbf{w}) + p - q - r$.

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# Question #8
## Seat 2 – Mu

Given the function $f(x) = A\sqrt{x}$ with domain $[0, A]$:

Find the value of $c$ in the interval $(0, A)$ that satisfies the conclusion of the Mean Value Theorem for the function $f$ on the interval $[0, A]$.

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# Question #8
## Seat 3 – Theta

Find the sum of the coefficients of the first $(B^2 - 1)$ terms of the expansion of $(Bx - 1)^6$.

# Question #9
## Seat 1 – Alpha

Find the number of positive integral divisors of the constant term of the expansion of

$$\left(x^2+\frac{2}{x}\right)^6$$

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# Question #9
## Seat 2 – Mu

A particle moves along the $x$ −axis so that at any time $t \geq 0$, with $t$ measured in seconds, its velocity $v$ in units per second is given by $v(t)=\left(t-\frac{A}{10}\right)\left(t-\frac{A}{5}\right)$. Find the total distance traveled by the particle from $t=0$ to $t=\frac{A}{4}$.

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# Question #9
## Seat 3 – Theta

The slope of a line through the points $(1,B)$ and $(B,k)$ is equal to $B$. Find the value of $k$.