Linear Algebra
MAS4105 *6137*

Prereq-A

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A1: On your own sheets of paper, please write (**double-spaced**) a proof of the following, in complete English sentences. *Do* ***not*** *restate the problem.*

Let $L(n) := [5^{[2^n]}] - 1$. By induction on k, prove that $\forall k \in \mathbb{N}$: $L(k)$ is a multiple of 3.

A2: Show no work. *NOTE*: The **inverse-fnc** of g, often written as g^{-1}, is *different* from the **reciprocal fnc** $1/g$. E.g, suppose g is invertible with $g(-2) = 3$ and $g(3) = 8$: Then $g^{-1}(3) = -2$, yet $[1/g](3) \stackrel{\text{def}}{=} 1/g(3) = 1/8$.

Write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed.

___ a $\left[\sqrt{2}^{\sqrt{27}}\right]^{\sqrt{3}} =$ _____. $\log_8(4) =$ _____.

___ b Line $y = [M \cdot x] + B$ owns points **(3, -1)** and **(-3, 17)**. Hence $M =$ _____ and $B =$ _____.

___ c Quadratic $15x^2 + 23x + 6 = [Ax - \alpha] \cdot [Bx - \beta]$, for numbers $A =$ ____, $\alpha =$ ____; $B =$ ____, $\beta =$ ____.

___ d Below, f and g are differentiable fncs with

$$f(2) = 3, \quad f(3) = 5, \quad f'(2) = 19, \quad f'(3) = 17,$$
$$g(2) = 11, \quad g(3) = 13, \quad g'(2) = \tfrac{1}{2}, \quad g'(3) = 7,$$
$$f(5) = 43, \quad g(5) = 23, \quad f'(5) = 41, \quad g'(5) = 29\,.$$

Define the composition $C := g \circ f$. Then $C(2) =$ _____; $C'(2) =$ _____.

Please write each answer as a product of numbers; **do not** multiply out. [*Hint:* The Chain rule.]

___ e Let $y = f(x) := [7 + \sqrt[3]{2x}]/5$. Its inverse-function is $f^{-1}(y) =$ _____.

___ f Let $g(x) := x^3 + x$. Then $g^{-1}(10) =$ _____ and $[g^{-1}]'(10) =$ _____.

___ g Compute the sum of this geometric series: $\sum_{k=5}^{\infty} [-1]^k \cdot [1/3]^{2k} =$ _____.

__ h Matrix-product $\left[\begin{smallmatrix} b \\ c \end{smallmatrix}\right] \cdot [\,x\ y\,] =$ _____.

A3: Math-Greek alphabet: Please write the **two** missing data of lowercase/uppercase/name. Eg:

"iota: α: B: ." You fill in: ι I A *alpha* β *beta*.

Γ: _____ Δ: _____ Υ: _____

ν: _____ ζ: _____ μ: _____

sigma xi omega lambda

End of Prereq-A

A1:	___ ___	60pts
A2:	___ ___ ___	145pts
A3:	___ ___	20pts
Total:	___ ___ ___	225pts

Please PRINT your Name

_____

HONOR CODE: *"I have neither requested nor received help on this exam other than from my professor."*

Signature: _____