



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHS AND PHYSICS

## UNIVERSITY EXAMINATION FOR:

UPGRADING MATHS

AMA 1003 CALCULUS

## END OF SEMESTER EXAMINATION

DECEMBER SERIES

TIME: 2HRS

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of 5 questions. **Answer Question One And Any Other Two Questions**

**Do not write on the question paper.**

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### QUESTION ONE (30MKS)

- a)  $L_1$  is a straight line that passes through (4, 2) and is normal to a line  $L_2$  which passes through points  $Q(2, 1)$  and has a gradient equal to -0.5 find the equations of the two lines [4mks]
- b) Determine the inverse of  $f(x)$  given that  $f(x) = \frac{4-x}{2-x}$  [4mks]
- c) What is the gradient and y-intercept of the line  $3x = 2y - 4$  [4mks]
- d) Determine the equation of a straight line through point  $A(4, -2)$  and is parallel to line  $y = -0.5x$  [4mks]
- e) Determine the maximum value of  $y$  if  $y = -0.02x^3 + 30x^2 + 20$  [7mks]

f) Evaluate i)  $\int_0^1 (2x + 4) dx$  [3mks]

ii)  $\int_4^9 x^{0.5} dx$  [3mks]

### QUESTION TWO

- a. Determine the equation of perpendicular line to the curve  $y = 2x^2 + 2x$  at  $x = 1$  [6mks]
- b. Given that the  $q = x^3 - 0.5x^2 + 100$ ; determine the coordinates of the turning points [8mks]
- c. Find  $g \circ f$  given  $f(x) = 2x + 1$  and  $g(x) = 3x^2 + 2$  hence find  $g \circ f(0)$  [6mks]

### QUESTION THREE

- a) Determine the value of  $x$  where the gradient of the curve  $y = -12x - x^3 + 8$  is equal to zero [4mks]
- b) Use Simpson rule to estimate  $\int_2^6 x^2 dx$  with  $n = 4$  and hence determine the error in the approximation [8mks],
- c) Find i)  $h \circ h(x)$  given that  $h(x) = 2x + 4$  [4mks]  
ii.  $h \circ h(2)$
- d) differentiate  $y = x^2 + 2x$  from first principals [4mks]

### QUESTION FOUR

- a. A straight line passes through points A(2, 2) B(4, 6) and C(k, 4) find the value of k [5mks]
- b. Find the area under the curve  $y = 3x^2$  between  $x = 2$  to  $x = 4$  and the x-axis by  
i. Integration method [3mks]  
ii. Simpson rule with  $n=4$  [8mks]
- c. Find the values of  $x$  and  $y$  where the gradient of the curve  $y = \frac{1}{3}x^3 - 4x$  is equal to 5 [5mks]

- d. Determine the turning point to the curve  $y = 0.01x^2 - 0.16x + 10$ . Is point a minima or maxima? [6mks]

### QUESTION FIVE

- a) Find the second derivatives of the following curves at  $x = 0$

i.  $y = 3 + 2x^2 + 10x$  [3mks]

ii.  $y = \sin x$  [2mks]

iii.  $2y = 2x^2 + 3x + 4$  [5mks]

- b) Find the area under the curve  $y = 6x^2$  between  $x = -2$  and  $x = 2$  and x-axis [5mks]

c) evaluate  $\lim_{x \rightarrow 4} \left[ \frac{x^2 - 16}{x - 4} \right]$  at  $x = 1$  [5mks]

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